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Modelling written language production in English: A Bayesian model of spelling

Helen Mason BSocSc. B.Psych (Hons), MAPS

James Cook University

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Statement of the Contribution of Others

The research presented in this thesis was designed by the author with supervision. My supervisors, Nicole Thomas, David Cottrell, and Deborah Graham provided ongoing feedback on writing. Colin Lemmon wrote the code for the computer program and with Carrie Lui developed the user interface with funding from a small research grant from James Cook University. Colin Lemmon also contributed Figure 6, Figure 7, and Figure 8, and feedback for Chapter 2 and Appendix 1. Daniel Keane assisted with script writing for r statistics.

Helen Mason

01/07/2019

Date

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Abstract

In English, word production (i.e., spelling) is more complex than word recognition (i.e., reading) as the relationship between graphemes and phonemes is not equally distributed. Despite this known complexity, models of spelling are largely descriptive and less sophisticated than models of reading. Furthermore, current models of spelling do not adequately explain how spelling information is learned and managed. Intriguingly, Bayesian reading models have facilitated research and development in recent years. Given the complex relationship between reading and spelling, I developed a Bayesian computational model of spelling to address these limitations.

Operational validity was assessed both theoretically (i.e., conceptual and predictive validity) and empirically (i.e., data, event, and predictive validity). The model was designed to behave like a human speller based on what is currently known about spelling. The Bayesian spelling model simulates a dictation task and makes spelling decisions based on 10 parameters that are analogous to human spelling decisions. The model was trained with Queensland spelling lists based on National curriculum guidelines for grades 1 to 7, which provides data validity, and was tested with words from a computerised NAPLAN dictation task from grades 3, 5, 7, and 9 students, providing event validity.

Predictive validity was examined by comparing the Bayesian spelling model responses with the NAPLAN student data. Accuracy and error data for students and for all parameters were calculated and transformed into density distributions to overcome sample size limitations, and skewed data in relation to letter frequencies. Independent-samples Bayesian *t*-tests compared the distributions of the model with the distributions of students for each testing grade.

Results for grades 3 and 5 supported my hypotheses, showing positive evidence that there was no difference between the distributions of data from students and the distributions from expected model parameters. Although results for grades 7 and 9 supported my hypotheses for error only, accuracy data were still in alignment with the predictions of current spelling models and with Australian curriculum guidelines.

My findings validate the model as spelling behaviour is effectively reproduced (i.e., empirical validation) and data are congruent with existing literature (i.e., theoretical validation). Furthermore, the progression of learning through parameter decisions aligns with known learning processes. These findings provide robust evidence that Bayesian decision making can be used to model spelling behaviour and that my model can reproduce the learning process of spelling.

My model provides ample research opportunities, including investigation of early phonological learning and later morphological strategies. I suggest that further model development consider the ability to examine contractions and differentiate between homophones. Future research with the Bayesian spelling model feasibly provides a means of experimentally examining educational strategies and spelling disorders and could have implications for natural language processing. Most importantly, it is hoped that future research with the Bayesian model of spelling will highlight the important role of spelling and spelling education in everyday life.

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Chapter One: A Review of Spelling

A common English spelling rule that students learn at school is “I before E, except after C” (Cunningham, 2017; Education Department of Western Australia, 2002; Samara, Singh, & Wonnacott, 2019). This rule is believed to guide students when spelling the common vowel sound; ‘ee’, which is represented in International Phonetic Language (IPA) as /i:/. In this example, /i:/ is a vowel digraph - vowels blended together to form a single sound - created by combining the letters ‘e’ and ‘i’, such as in the word ‘receive’. However, there are numerous ‘weird’ exceptions to this rule.

A statistician recently demonstrated that in a study of over 35,000 words, the “I before E except after C” rule is valid only 25% of the time, despite it being one of the most well-known and commonly taught spelling rules (Cunningham, 2017). A revision by Merriam-Webster expanded the rule to include the rule exceptions, leading to the less than catchy:

I before e, except after c. Or when sounded as 'a' as in 'neighbor' and 'weigh'. Unless the 'c' is part of a 'sh' sound as in 'glacier'. Or it appears in comparatives and superlatives like 'fancier'. And also except when the vowels are sounded as 'e' as in 'seize'. Or 'i' as in 'height'. Or also in '-ing' inflections ending in '-e' as in 'cueing'. Or in compound words as in 'albeit'. Or occasionally in technical words with strong etymological links to their parent languages as in 'cuneiform'. Or in other numerous and random exceptions such as 'science', 'forfeit', and 'weird' (“I Before E Except After C,” n.d.)

English is one of the most difficult languages to learn to spell. This difficulty stems not only from rule exceptions, but also irregular consonant and vowel patterns,

and little consistency between pronunciation and spelling (Bontrager, 2015; Treiman, 2017a). Conceptually, the letters of the alphabet should represent speech sounds, which is known as the alphabetic principle (Carroll, 1999). However, in English, this principle has been distorted over time. In fact, the 44 sounds in British English have 205 potential spellings, and this figure is higher for other dialects, such as Australian English (Bontrager, 2015; Cox, 2012; Harley, 2008). Furthermore, the most common sound within English, the schwa (represented as /ə/ in IPA), can be spelled with any one of the five vowels or the letter 'y.' Thus, there are many more ways to spell a pronunciation than there are to pronounce a spelling. Yet somehow individuals learn to spell, and most spell with great accuracy (O'Sullivan, 2000). How individuals achieve this feat is relatively unclear.

For the most part, spelling is closely related to reading, and these processes are traditionally taught together in modern schooling (Education Department of Western Australia, 2002; Hebert & Graham, 2011; Rees, Rivalland, & Education Department of Western Australia, 2002). The general idea is that spelling is the process of reading in reverse. Pairing explicit spelling teaching (e.g., dictation tasks) with learning to read can enhance the learning process (Education Department of Western Australia, 2002; Hebert & Graham, 2011; Treiman, 2017b). Furthermore, the process of word recognition is thought to aid spelling. For example, when an individual is unsure of the spelling of a word, they might make a guess and write it down as a means of checking the spelling. In this case, they are relying on reading to make a decision about spelling (Education Department of Western Australia, 2002; Hebert & Graham, 2011; Treiman, 2017a).

However, the relationship between reading and spelling is not straightforward (Kessler & Treiman, 2003; Marinelli, Romani, Burani, & Zoccolotti, 2015). Whilst

reading and spelling are both forms of written communication, and involve the same units of information, they are very different processes (Marinelli et al., 2015). In its simplest form, reading involves word recognition, whereby a visually presented string of graphemes (i.e., letters and letter combinations) is recognised as a specific string of phonemes (i.e., the sound of a word). On the other hand, spelling is a process of word production, whereby an individual produces the graphemes associated with a given phoneme string (Harley, 2008). The process of production is more complex than recognition, making spelling more difficult than reading (Kessler & Treiman, 2003; Marinelli et al., 2015; Treiman, 2017b).

It is well known that individuals can be superior at reading and inferior at spelling; yet individuals are less commonly superior at spelling and inferior at reading (Ellis, 1994; Harley, 2008; Manolitsis & Georgiou, 2015; O'Sullivan, 2000).

Furthermore, individuals who are considered superior spellers and inferior readers are still accurate readers, they merely read more slowly than average (dysfluency), unlike inferior spellers, who are typically slower than average and also show impaired spelling capacity (Manolitsis & Georgiou, 2015). Indeed, there are numerous examples in the literature of the contribution of spelling skills to reading skills but not vice versa (Beeson, Rising, Kim, & Rapcsak, 2008; Conrad, 2008; Ellis, 1994; Kohnen, Nickels, & Coltheart, 2010; O'Sullivan, 2000; Ouellette, 2010; Ouellette & Sénéchal, 2008a). This paradox has merited limited investigation, therefore less is known about the process of spelling than the process of reading (Levy, 1997; Marinelli et al., 2015). It is this superior reading/inferior spelling paradox that provided the motivation for the current research.

The majority of research examining written communication is concerned with aspects of reading with less attention devoted to processes of spelling (Levy,

1997; Marinelli et al., 2015; Treiman & Boland, 2017). Therefore, models of spelling are less sophisticated than models of reading. For example, whilst statistical learning models have been applied to replicate, investigate, and predict human reading behaviour since the 1980's (Seidenberg & McClelland, 1989), models of spelling are still primarily comprised of diagrams of stages and processes.

Currently, reading models can replicate human behaviour whereas spelling models describe it. This discrepancy in the sophistication of the models leads to a substantial difference in the level of detail and efficiency of the models to explain human behaviour. Furthermore, the predictions that can be made from reading models are more specific than those that can be made from current spelling models. It is the aim of this research to address this discrepancy by determining if the methodologies used to construct models of reading can be used to construct more sophisticated models of spelling. Therefore, the first section of this review provides a brief overview of the historical context of spelling, followed by a detailed examination of how spelling is taught in modern schooling and how teaching aligns with current research. Lastly, models of spelling will be evaluated in order to identify the characteristics that a new model of spelling would need to possess. Current models of reading will then be appraised against these criteria in order to identify the most appropriate strategies to develop a more sophisticated model of spelling.

Spelling is Tough, Although can be Understood Through Thorough Thought

Historically, English has not always been as complex as it is today (Fritz, 2010; Green, 2004; Upward & Davidson, 2011). The early English writing system was a combination of the Roman alphabet, Latin, and the Runic alphabet, thought to have been brought to Britain by Anglo-Saxons in the fifth century. Early English

spelling was relatively consistent, following the alphabetic principle, with predictable relationships between spelling and pronunciation. However, modifications to the writing system occurred between the ninth and eleventh centuries, and although English was the language of common citizens, by the eleventh century it was replaced with French in formal settings, such as court and government (Upward & Davidson, 2011). Thus, French became the written language for court officials and those who documented historical events, which caused lasting changes in English spelling.

The period from the twelfth to the fifteenth century was characterised by further changes to written English (Fritz, 2010; Green, 2004; Upward & Davidson, 2011). With the demise of French dominion over politics, English once again became the official written language in formal as well as informal settings. Early scholars, such as Chaucer, attempted to standardise written English; however, court officials who had previously used French and Latin, had difficulty adjusting to English spelling. Further, the arrival of the printing press thwarted these reform attempts ().

The invention of the printing press in the fifteenth century heralded the mass-production of written language, irrevocably changing how and who could interact with written language (Fritz, 2010; Green, 2004). Ironically, this revolutionary invention contributed towards English becoming one of the most complex written languages, as there were no accepted standardised conventions for English spelling. Printers were paid by the line and often complicated spellings or included extra vowels to increase the number of lines of text or the aesthetic of margins, and thus increase their earnings. At times, the same word was spelled differently on each occasion on the same page. Further, English books were often printed in other countries, such as Belgium and Germany where printers were unfamiliar with the words they were

printing and inadvertently made spelling errors. These corrupted copies were then used to print other copies and to teach written English, thus corrupting English spelling even further ().

Several notable authors since this time have attempted to reduce the number of different spellings and to standardise spelling (Fritz, 2010; Green, 2004; Upward & Davidson, 2011). Unfortunately, this endeavour was most often undertaken with the intention of retaining the most frequently occurring spelling, rather than the most logical spelling. Combined, these factors caused irregularities in spelling and the alphabetic principle that have persisted to this day (Fritz, 2010; Green, 2004; Kessler & Treiman, 2003; Upward & Davidson, 2011).

In modern times there has been a movement to reform English spelling and make it more consistent with the alphabetic principle. The premise of the movement is that the irregularities in English spelling have a hidden social and economic cost in countries where English is the majority language (Bontrager, 2015; Paterson, 2019). Research has shown that learning English requires an average of two and a half years more education, compared to countries where the majority language is more regular (Marinelli et al., 2015; Seymour, Aro, & Erskine, 2003). Proponents of English spelling reform argue that this situation inflates education costs and promotes educational, social, and economic disadvantage (Bontrager, 2015; Paterson, 2019). They argue that because other educational content relies on a level of literacy, a delay in achieving literacy due to the complexities of English language impacts all students, but particularly those that never achieve functional literacy. They argue that in majority English-language countries, adult illiteracy rates are at an average of 23%, which is higher than countries where the majority language is more regular. Further, they argue that despite a multitude of teaching strategies, spelling

and literacy rates have not improved. Rather, this variation in teaching strategies across schools and regions amplifies confusion for students and educators (O'Sullivan, 2000; Paterson, 2019). A thorough discussion of the spelling reform movement (and criticisms, see Kessler & Treiman, 2003) is beyond the scope of this research; however, it demonstrates the complexity of spelling in English and the importance of understanding the learning process in greater detail.

Current spelling Education

Whilst less is known about the learning process of spelling compared to reading, English spelling instruction in Western schools generally follows the process outlined in Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). Stage models will be discussed and critiqued in a later section however, it is important to note that the research evidence regarding specific ages and grades for each stage is mixed, and that Stage models generally do not indicate age or grade milestones. Rather, Stage models, and therefore spelling instruction, should be regarded as a developmental trajectory through three main elements of written language: phonology, orthography, and then morphology. This section will focus on spelling instruction through these elements.

Phonology

In Australia, spelling education begins with phonology; learning the relationships between sounds (phonemes) and letters or letter combinations (graphemes) and using these relationships to spell. That is, students learn that “c says /k/,” “a is for apple,” or “t says /t/,” and use this information to spell the word ‘cat’ (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of

Western Australia, 2002; Harley, 2008; Rees et al., 2002; Treiman, 2017b). Most students are first taught this phonological information, enabling them to sound out words when reading and to decode the spelling of pronunciations (Education Department of Western Australia, 2002; Rees et al., 2002; Treiman, 2017b).

To decode spellings, students are often taught to break words into parts and one of the most common divisions is that of the onset and rime (NSW Department of Education, 2017; Treiman, 1986). The onset is the first syllable of the word and can include one or more letters (NSW Department of Education, 2017). Onsets typically have predictable spelling; thus, spellers are generally highly accurate (Kessler & Treiman, 2003; Treiman, 1986). In contrast, the rime is the latter part of the word and can include final syllables, and letters and letter clusters. Phoneme-grapheme relationships in the rime look more consistent than individual letters and breaking words into their onset and rime can assist spelling (NSW Department of Education, 2017). However, research shows that rimes are typically more irregular in their spelling than the onset, making their spelling less predictable. This reduced predictability means that spellers are more prone to make errors at the end of words compared to the beginning of words (Treiman, 1986).

This disconnect between educational strategies and research evidence highlights one of the main limitations of emphasising phonological strategies for spelling in English; the English writing system does not consistently adhere to the alphabetic principle. Therefore, many words cannot be spelled based solely on the relationship between sounds and letters (Bontrager, 2015; Kessler & Treiman, 2003). High frequency words are particularly known to comprise less consistent spelling than lower frequency words (Taft, 1994). These high frequency words with inconsistent spellings are sometimes taught as 'sight words' in very early Australian

grades to overcome this limitation (Australian Curriculum, Assessment and Reporting Authority, 2019).

Another means of overcoming the limitation of a purely phonological strategy in an inconsistent writing system is to introduce students to the remaining elements of written English: orthography and morphology (Kessler & Treiman, 2003).

Phonology is usually explicitly taught from early pre-schooling until the end of grade two (Department of Education and Training, 2018h-w) and a common strategy for spelling education in Australia is to teach spelling rules (Education Department of Western Australia, 2002). These rules are based on patterns within English and although generally considered within the domain of orthography, many also have phonological or morphological elements (Ouellette, 2010). One such rule related to phonology is termed “when two vowels go walking, the first one does the talking.” This rule is an example of many that have been turned into songs, animated, and uploaded onto streaming services and blogs. These are shared widely and promoted as tools for learning to spell (for an example, see BTLFanatic, 2009).

Despite their popularity, evidence for the usefulness of explicitly teaching rules in English to improve spelling is limited (Bontrager, 2015; Scott, 2000; Stirling, 2011). According to the “two vowels walking” rule, when encountering vowel digraphs (two or more vowels paired together), the first vowel has a long sound, whilst the second vowel is silent. The words ‘receive’ and ‘bean’ are examples of this late phonological, early orthographic rule. Many online blog posts claim to have tested this rule, with rates of efficacy ranging from 36% to 50% (for an example, see Rippel, 2019). They note that this rule is not an effective way to learn to spell as there are too many ‘weird’ exceptions in everyday language (Rippel, 2019; Stirling, 2011).

The spelling of 'weird' is an exception to the "two vowels walking" rule and instead could be explained by a "bossy R," depending on pronunciation. Like the "two vowels walking" rule, the "bossy R" is a late phonological, early orthographic rule (Department of Education and Training, 2018a-c). According to this rule, if a vowel is followed by the letter 'r' in the same syllable, the vowel is influenced by the 'r', creating a different sound. For example, in the word 'bird' the 'i' combines with the 'r' to create the sound /ɜ:/. This sound is only ever spelled with one or more vowels and the letter 'r'. It cannot be created with any other letter combination; thus, the rule could be helpful for learning in this context (Bell, 2004; Department of Education and Training, 2018a-c; Stirling, 2011).

Orthography

Orthography refers to letter patterns within language and the rules that describe these patterns (Cunningham, 2017; Harley, 2008). Although explicit teaching of orthography begins from grade three in Australian schools (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018x-au), aspects of orthography are taught earlier, and continue to be taught until the end of grade seven. Orthographic strategies are related to the second stage of spelling acquisition according to Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985).

Orthographic strategies involve using rules such as the "I before E except after C" rule discussed previously. Another orthographic rule is the "fizzle" rule. According to this rule, the consonants 'f,' 's,' 'z,' 'l,' and 'e' are routinely doubled when they follow a vowel at the end of a one-syllable word (Newman, 2019; Stirling, 2011). For example, the word 'buzz' is spelled with a double 'z' and not a single 'z.'

There are many exceptions to this rule, such as the word 'quiz,' where the final 'z' is not doubled in the usual spelling of the word (Newman, 2019).

The "magic" or "silent E rule, where the "E makes the vowel say its name" is another very common rule that students learn as part of explicit orthographic instruction (Department of Education and Training, 2018a;d;e). The rule refers to the placement of an 'e' at the end of words where there is a prior vowel separated by one or more consonants, such as in the word 'cake,' and describes how the first vowel is pronounced (Kessler & Treiman, 2003). Exceptions to this rule include words that end in a 'v' sound, such as 'love', or 'have' (Bontrager, 2015). Despite its popularity, the "magic E" is less consistently correct than many other rules and thus may be less useful for learning spelling (Scott, 2000; Stirling, 2011).

The rules detailed herein are typically considered to be related to orthography; however, just like English words, rules often do not fit neatly into categories. One means of examining spelling processes and acquisition is to use pseudowords. Pseudowords, also known as nonwords, are created words that follow the rules and structures of English but have no inherent meaning. Researchers can draw conclusions about how spelling information is processed and utilised based on how participants respond to these stimuli (Chliounaki & Bryant, 2007; San Francisco, Mo, Carlo, August & Snow, 2006). They are useful when examining written English as they allow researchers to examine purely phonological, orthographic, or morphological properties, without the interference of other elements. For example, Ouellette (2010) showed that spelling practice contributed to improved reading performance for students in grade 2 in an experiment using orthographically constructed pseudowords. Cassar and Treiman (1997) discovered that students

responded to orthographic properties in the spellings of constructed pseudowords, and that responses were influenced by letter frequency information.

Letter frequency refers to the number of times a letter occurs in language and can be examined from the perspective of either word or position. Each letter has a different frequency of occurrence within words, and this frequency has implications for spelling research and language processing (Norvig, 2012). Further, each letter also has a different frequency in each potential position. Research indicates that spellers are sensitive to letter frequency information and that proficient spellers accurately estimate letter position frequencies (Sedlmeier, Hertwig, & Gigerenzer, 1998).

A related concept is that of N-grams. N-grams are connections between units of language, and like letter frequencies, can be calculated across and within words (Norvig, 2012). For spelling, N-grams of sub-units (e.g., body) and letters can be instructive as they indicate letters and letter combinations that commonly follow one another (Perry & Ziegler, 2004). Recent research has shown that spellers plan their spellings ahead (Treiman & Boland, 2017) and that letters initially selected influence the selection of other letters in a potential spelling (Scaltritti & Balota, 2013). These findings indicate that spellers use nuanced information about letter relationships when making spelling decisions.

Morphology

Morphology refers to patterns based upon meaning; for example, '-ed' is added to the end of a word to denote a verb in the past tense, or an 's' at the end of a word denotes a plural. Morphological knowledge incorporates the structure and meaning of words and word parts such as roots, and affixes such as prefixes and

suffixes. Morphological strategies are largely taught from grade six (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018av-bg), and spelling is not explicitly taught beyond grade seven in Australia (Department of Education and Training, 2018bh).

The age of morphological acquisition is debated in the existing research literature. Nunes, Bryant, and Bindman (1997) found evidence that students begin applying rules related to morphology in early grades, but do not develop morphological understanding, and therefore accuracy, until approximately 10 years of age. This study has been touted as a robust indication for the age of morphological acquisition; however, the students who participated had an average reading age of 11 years and 4 months and were thus more advanced than their biological age of 10 years. More recent research examining morphological awareness using the commonly taught plural nouns rule showed that secondary school students and adults performed more poorly than expected, with few participants scoring above chance. Further, they found a difference in performance between adults based on length of education (Kemp, Mitchell, & Bryant, 2017).

Whilst the plural nouns rule has been useful in a research context, its usefulness in educational settings has been questioned (Bell, 2004; Newman, 2019). This rule involves turning a noun ending in a vowel or an 's,' 'ss,' 'sh,' 'ch,' 'x,' or a 'z' into a plural. In this case, the plural suffix must be spelled '-es' rather than '-s'. In the case of words ending in 'z,' the 'z' is doubled. Thus, quiz becomes 'quizzes,' 'tomato' becomes 'tomatoes,' and 'kiss' becomes 'kisses.' Furthermore, when a noun ends with a 'y' that follows a consonant, such as in the word 'sky,' the 'y' must be changed to an 'i' before adding the '-es.' Unfortunately, there are many exceptions to the

plural nouns rule, particularly for words with a final vowel such as an 'a'. For example, the plural of the word 'banana' is 'bananas' and not 'bananaes.' Exceptions to rules such as this one are used by literacy academics as examples of the inconsistent application of rules in the English writing system (Bontrager, 2015; Newman, 2019; Scott, 2000; Stirling, 2011).

A potentially useful rule, which is explicitly taught in schools, is the doubling rule. This rule, also known as the 1-1-1 rule, is useful when adding a suffix to words that end in a single consonant with a single vowel in front of it, where the last syllable is stressed on pronunciation (Newman, 2019; Stirling, 2011). Suffixes are sub-word units added to the end of words to add information about the word. For words that fulfill these criteria, the single, final consonant is doubled when adding a suffix that begins with a vowel, such as '-ed' or '-ing.' For example, 'hop' becomes 'hopping,' or 'prefer' becomes 'preferred.' Whilst this rule is much more consistently applied than many others, exceptions remain. These include suffixes beginning with a consonant, such as '-ly.' and words ending in the consonants 'h,' 'w,' 'x,' and 'y', which are never doubled in English. Suffixes can be a particularly useful element for teaching as well as researching spelling behaviours.

Like suffixes, prefixes can also be informative for spelling. Prefixes are sub-word units that are added to the beginnings of words to add information about the word (Harley, 2008; Newman, 2019). These predominantly originate from Latin, and each prefix has its own meaning and is consistently spelled in the same way. For example, adding 'inter-' to the beginning of the word adds the meaning 'within', and 'sub' adds the meaning 'below'. There are a finite number of accepted prefixes in English, and as these are spelled consistently, knowing the meaning of the prefix can guide spelling decisions (Newman, 2019; Stirling, 2011).

There are also a finite number of suffixes within English (Harley, 2008; Newman, 2019). These can be further categorised as inflectional or derivational. Inflectional suffixes add information about a word, such as tense, comparison, or number, without changing its grammatical properties. For example, adding '-ing' to the end of a verb indicates that the action occurred in the past, or adding the inflectional suffix '-s' to indicate the word is plural. The word remains a verb or a noun despite the addition of the inflectional suffix.

In contrast, addition of a derivational suffix can change the grammatical properties of a word (Harley, 2008; Newman, 2019). Derivational suffixes indicate parts of speech, including nouns, adjectives, verbs, and adverbs. They are more complex than inflectional suffixes as they can change a word from one category to another, as well as contain their own meaning. For example, the noun 'beauty' becomes the adjective 'beautiful' with addition of the derivational suffix '-ful.' Similarly, the adjective 'hard' becomes the noun 'hardship' with addition of the derivational suffix '-ship,' which refers to a state or quality.

In terms of spelling, these rules and structures within English can lead to a state or quality of hardship for students and educators. Words and word units do not fit neatly into discrete categories or rule systems, and the English writing system does not consistently adhere to the alphabetic principle, creating confusion when students are attempting to decode information (Bontrager, 2015; Scott, 2000; Stirling, 2011). Whilst research demonstrates varying utility in explicitly teaching these known rules and structural components of English (Cunningham, 2017; Stirling, 2011), they can be useful for researching aspects of language.

Morphological properties can be examined using homophones. Homophones are words that sound the same when pronounced but have different spellings and

different meanings (NSW Department of Education, 2017). They are useful for examining morphological aspects of language as a speller must rely on the semantic or syntactic properties of the words to differentiate them (Crepaldi, Morone, Arduino, & Luzatti, 2014; Pacton & Deacon, 2008; Tong, McBride-Chang, Shu & Wong, 2009). For example, researchers may examine the type of word, such as an adjective or a noun, or they may rely on the meaning of the word. Research with homophones suggests that morphological information is learned and utilised later in the process of spelling acquisition, which has been used as evidence to support conventional models of spelling development (Pacton & Deacon, 2008).

Other researchers have used the etymological properties of English to examine spelling acquisition. Silent letters such as the “magic E” have been discussed in the context of orthography but are also considered to be morphological units as they contain etymological meaning (Harley, 2008; Newman, 2019). Silent letters are an unusual occurrence in most languages, yet there are many within written English. Letters can include consonants such as ‘b,’ ‘g,’ ‘k,’ ‘l,’ or ‘n,’ as well as vowels such as the “magic e.” These silent letters can make spelling very difficult (Bell, 2004; Carroll, 1999; NSW Department of Education, 2017). For example, the word ‘knowledge’ comes from the word ‘knowen’ in Middle English, thus we might ‘know’ that the word contains a silent ‘k,’ based on this etymological information (“Knowledge,” n.d.). Research shows that students in lower grades do not use this etymological information when making spelling decisions, whereas spellers in grade seven do (Larkin & Snowling, 2008). However, research examining other aspects of morphology has not been as clear, leading to questions regarding the efficacy of current models of spelling.

Models of Spelling

Popular spelling models include the Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and the Dual Route Cascading (DRC) model (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001). However, these models are either limited to providing mostly descriptive information (Stage models) or are essentially inverted versions of current reading models (DRC model). Further, the DRC model predominantly relates to skilled spelling and provides limited information regarding spelling development. More recently, Treiman and Kessler (2014) proposed the Integration of Multiple Patterns (IMP). The following section will briefly summarise these three spelling models.

Stage Models of Spelling

The Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) are currently the most commonly known models of spelling. According to the initial conceptualisation of this model, which is shown in Figure 1, spelling develops as a progression through three linear stages of learning: phonological, orthographic, and morphological (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985; Treiman, 1993). These stages are aligned with the three main elements of written English; thus, students begin spelling by using phonological relationships, then progress to utilising orthography, such as common letter patterns and grammatical sequences, including the “i before e except after c” rule. Finally, students progress to the morphological stage, and use meaning-based patterns to spell (Larkin & Snowling, 2008). For example, students might learn that because the word ‘magician’ comes from the word ‘magic’ the ‘fən’ sound at the end of the word is spelled ‘cian’ and not ‘tion’ or other letter combinations. According to the Stage

models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), once students have progressed through these stages, they are considered proficient and can make spelling choices using all three as spelling strategies (Treiman, 1993).

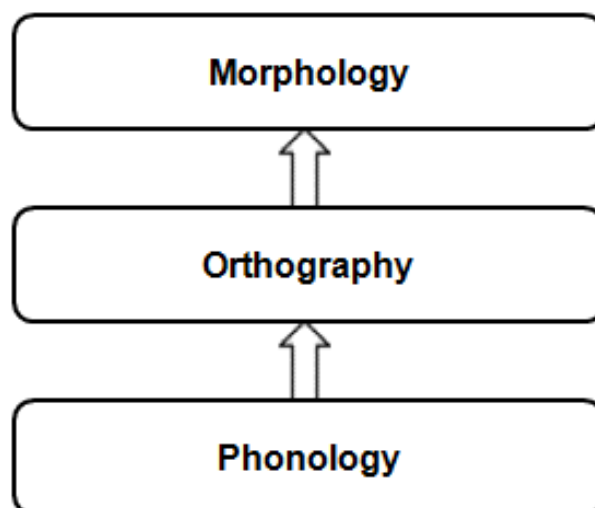


Figure 1. Representation of the Stage model of Spelling (Treiman, 1993).

As the name suggests, Stage models describe a developmental trajectory for spelling acquisition, but most, by design do not specify ages for the stages within this progression (Gentry, 2000; Treiman, 1993). In this way, stages are considered sequences of behaviour rather than milestones to be achieved. A revision by Bear (1991) attempted to define ages and grades to proposed stages of spelling. However, Bear's (1991) defined ages have been contested in the literature as being too prescriptive to be useful (Gentry, 2000). Whilst Bear's (1991) age and stage categories broadly align with current spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), this point could be made of all Stage models. For the purposes of this research, Stage models referred to herein represent the models by Gentry (1982), Henderson (1985), Bear (1991), and Ehri (1992). These models describe a similar developmental trajectory, and relationship to grades

therefore occurs through the common age at which students begin school and thus process of learning to spell.

Traditionally, progress through the spelling stages was thought to be linear, whereby one must master the previous stage before moving onto the next stage. Indeed, research shows that children begin spelling using sound information (phonology) and show early sensitivity to sound patterns (Larkin & Snowling, 2008; Marsh, Freidman, Welch, & Desberg, 1980; Read, 1986; Treiman, 1993). However, other evidence suggests that students learn in a more simultaneous manner, following the same general progression from phonology to orthography then morphology, but with overlap between these stages and the capacity to use all three as spelling strategies (Hayes, Treiman, & Kessler, 2006; Kemp, 2006; McBride-Chang, Wagner, Muse, Chow, & Shu, 2005; Nunes, Bryant, & Bindman, 1997; Treiman & Cassar, 1996).

Research involving a spelling choice and spelling production (dictation) task with participants in grades two, three, five, and at university, showed that all groups performed greater than chance, and that performance improved with age (Hayes, et al., 2006). However, children in grade two picked up on word position-conditioned conventions about the spelling of English consonants. Position-conditioned conventions relate to knowledge of the position and positional relationships of a letter within a word, based on the context of that word. This is a concept thought to be associated with the orthographic stage of spelling, indicating a more advanced level of learning than the predicted phonological stage for a grade two student. According to Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), students in grade two would not yet have the required foundational knowledge to progress to orthographic strategies.

Similarly, Chliounaki & Bryant (2007) employed a longitudinal design to demonstrate early morphological awareness. They asked young children to spell pseudowords on three separate occasions over a two-year period, from grades one to three. The study examined the role of inflection in conveying morphological information, by assessing whether children spelled a spoken pseudoword as a noun (e.g., “preeze”) or a plural noun (e.g., “prees”). Chliounaki and Bryant (2007) found that by the end of the two-year project, the students had successfully learned the rules for spelling the inflections without explicit teaching. According to Stage models, students should not have been able to learn these morphological rules as these are related to advanced stages of spelling acquisition whereas students had only begun learning to spell and thus were in the first, phonological learning stage.

Another experiment examined how accurately students spell final consonant clusters within inflected and uninflected words. Stimuli were created to differentiate between phonological (uninflected) and morphological (inflected) spelling strategies by examining patterns within paired words. It was thought that if students were using a purely sound-based, phonological strategy, then there would be no difference in spelling patterns between these uninflected words and the more morphologically-complex, inflected words. However, results indicated fewer consonant omissions on inflected words, even for grade one students. These findings suggest a greater understanding of morphology than is indicated by the Stage models as presumably children at this age have not progressed through the orthographic stage of learning (Treiman & Cassar, 1996). Further research conducted by Kemp (2006) led to the same conclusion. This evidence prompted some researchers to propose modifications to the Stage models (Kemp, 2006; Treiman & Cassar, 1996).

Rather than a linear progression through stages, some researchers believe that children learn to spell using all available information (Kemp, 2006; O'Sullivan, 2000; Treiman & Cassar, 1996). That is, children simultaneously use phonological, orthographic, and morphological information when making a spelling choice. This proposal allows researchers to explain research evidence, such as that discussed above, using modified Stage models (Hayes, et al., 2006; Kemp, 2006; McBride-Chang, et al., 2005; Treiman & Cassar, 1996). However, these proposed modifications do not overcome one of the main criticisms of Stage models.

Stage models simply describe when certain learning is thought to occur in relation to other learning. In this way, they do not explain how proficient readers arrive at a spelling response, beyond that they use multiple strategies or sources of information; Stage models do not explain how the phonological, orthographic, or morphological information is used to make the spelling choice. Further, it is argued that they emphasise phonology over other elements, making them limited in their ability to create testable hypotheses (Mitchell, Kemp, & Bryant, 2011; Treiman, 2017a).

The Dual Route Cascading Model

The Dual Route Cascading model was developed to explain reading; however, this model was later expanded to incorporate an explanation of the process of spelling (Coltheart, et al., 2001). In this model, shown in Figure 2, the process of spelling is considered analogous to the process of reading in reverse (Bates, Castles, Luciano, Wright, Coltheart, & Martin, 2007; Rapcsak, Henry, Teague, Carnahan, & Beeson, 2007). As suggested by the name, the Dual Route Cascading

model describes two possible routes for the processing of information: a direct and an indirect route (Coltheart, et al., 2001).

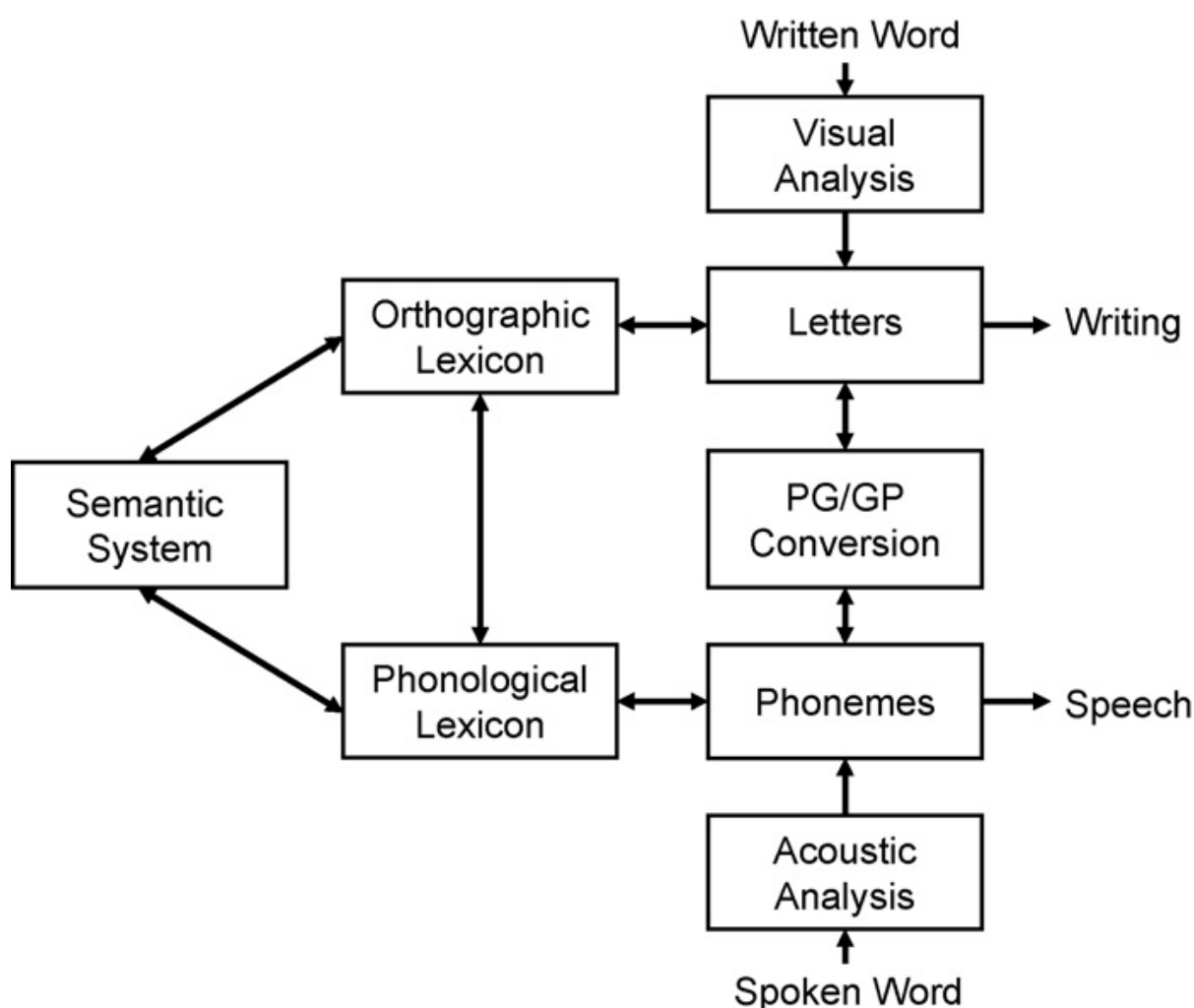


Figure 2. Dual Route Cascaded model of Reading and Spelling (Rapcsak, et al., 2007). PG: phoneme-grapheme, GP: grapheme-phoneme.

The direct route, also referred to as the lexical route, is used once spellers are proficient. It involves direct mapping from phonology (phonological lexicon) and orthography (orthographic lexicon) to the word for spelling. There is evidence that familiar, and thus regular, high frequency words and spellings are processed through the direct route (Coltheart, Curtis, Atkins, & Haller, 1993; Coltheart, et al., 2001; Perry, Ziegler, & Zorzi, 2007). However, the model architecture suggests that words

are stored in long term memory as whole units, and thus a large lexicon becomes very resource heavy (Treiman, 2017a; 2017b).

The indirect route, considered to be non-lexical, involves word retrieval via phoneme-grapheme (PG) conversion rules for spelling, or grapheme-phoneme (GP) conversion rules for reading. These conversion rules allow for decoding of novel (i.e., unfamiliar) words and spellings, to arrive at a response (Coltheart, et al., 2001; Rapcsak, et al., & Beeson, 2007). Research examining the spelling of legal English pseudowords, thought to be processed through the indirect route, provides preliminary support for the DRC model as a model of spelling (Bates, et al., 2007; Perry & Ziegler, 2004; Rapcsak, et al., 2007). However, there is no accounting for words and spellings that are irregular, or exceptions to standard grapheme-phoneme conversion rules, and therefore no explanation of how these exceptions are learned over time and spelled correctly (Perry, et al., 2007). Further, there is limited information as to how this indirect route functions (Treiman, 2017b).

Like Stage models, the capacity for the DRC model to account for the learning process of spelling is limited. It is believed that beginning spellers utilise the indirect route, learning the phoneme-grapheme conversions to decode spellings. Over time, whole words are learned and information about these words and their spellings are retained in the mental lexicon. Once the whole word has been learned, it is accessed through the direct route, explaining the increasing speed and accuracy seen in proficient spellers. However, as discussed previously, this explanation relies on a large, and potentially resource-heavy mental lexicon, and the model has been further criticised for being largely descriptive (Treiman, 2017a; 2017b).

Integration of Multiple Patterns

Integration of Multiple Patterns (IMP) is a framework proposed by Treiman and Kessler in 2014 (cited in Treiman, 2017a; 2017b). IMP incorporates statistical learning; the concept that humans (and other animals) have an innate ability to extract statistical patterns from their experiences and use this information for learning about the objective world. IMP proposes that spellers learn patterns within and between words, both implicitly and explicitly, and utilise this information to make spelling decisions. Like Stage models that incorporate multiple sources of information, these patterns may be related to phonology, orthography, or morphology. The more consistent patterns that exist for a particular word, the easier that word will be to learn to spell. Conversely, when patterns are inconsistent, the word will be more difficult to learn to spell (Treiman, 2017a; 2017b). Indeed, research suggests that students implicitly learn 'rules' such as the "magic e rule" without explicit teaching (Treiman, 2017b). This argument has been used to explain the spellings of novel and infrequent words (Treiman, 2017b), and could also explain the speed with which proficient spellers spell high frequency words.

Although research specifically utilising the IMP framework has been limited, evidence for the role of statistical learning in spelling is growing. Several studies have demonstrated that exposure to text facilitates statistical learning, even without explicit teaching (Samara & Caravolas, 2014; Samara et al., 2019). Recent research showed that pre-phonological spellers utilise these patterns when producing word-like spellings, demonstrating sensitivity to language patterns much earlier than previously thought (Treiman, Cardoso-Martins, Cury Pollo, & Kessler, 2019). Further, statistical learning could explain anomalous research findings, such as that by Chliounaki and Bryant (2003), whereby young children learned spelling rules related

to morphological information over a two-year period, without being taught these advanced rules. Thus, evidence from statistical learning supports the IMP framework as a promising avenue for future spelling research.

Criteria for a Novel Model of Spelling

Whilst current spelling models partially account for human spelling behaviour, and IMP remains an interesting prospect for future research, existing models possess a number of limitations, some which were outlined in the previous section. Importantly, identifying these limitations provides a good set of criteria that novel models should address.

A novel model of spelling needs to provide an explanation of learning and how new information is managed. Although Stage models describe a process of spelling acquisition, there is research that these models cannot explain. Furthermore, Stage models do not explain how spellers arrive at a specific spelling decision, particularly when there is inconsistency. The IMP framework shares this limitation in the context of inconsistent or competing information. The DRC model describes proficient spelling but does not account for developing spellers or the learning process via the indirect route. A novel model of spelling must explain how information is organised and used to make a spelling decision at all levels of ability.

As current spelling models lack predictability, a novel model of spelling needs to be predictive. For example, predictions derived from Stage models are limited to describing developmental stages and cannot be used to make specific predictions of human spelling behaviour, particularly for proficient spellers. Similarly, the DRC model cannot be used to test predictions for developing spellers via the indirect route. Thus, a novel model of spelling must be able to generate testable hypotheses.

Furthermore, spelling models must replicate human behaviour. Despite the complexity of the task, once individuals have learned to spell proficiently, they are typically fast at the task (Ellis, 1994; O'Sullivan, 2000). Whilst the DRC model can explain this phenomenon, the model also assumes a large mental lexicon for proficient spellers, which requires significant resources. This lexicon and use of cognitive resources is counter intuitive. Thus, a spelling model needs to be simple rather than resource heavy, in order to account for the speed and accuracy of spelling by proficient spellers.

In contrast to current spelling models, reading models are significantly more sophisticated and more effective at explaining and predicting reading behaviour. Given the success of reading models in overcoming some of the limitations described above, these models could be useful as a method for developing an improved model of spelling. Reading and spelling are related elements of written communication, and whilst there is some evidence of skill transfer, they are different processes. Thus, a novel model of spelling should utilise the contemporary methodologies for examining reading as an independent model of word production.

Models of Reading

As my aim is to determine whether the strategies used to construct models of reading can be used to construct a novel model of spelling, this section will examine current reading models in detail. There are 3 main classes of reading models that explain human reading behaviour effectively. These models include the Dual Route Cascading model of reading mentioned above (Coltheart, et al., 2001), the Interactive Activation and Competition (IAC) model (McClelland & Rumelhart, 1981), and statistical models, such as the Parallel Distributed Processing (PDP) model

(Seidenberg & McClelland, 1989) and the Bayesian Reader (Norris, 2006). These models differ in their conceptualisation of the reading process.

The Dual Route Cascading Model of Reading

As described previously, the DRC model of reading utilises the same architecture as the DRC model of spelling but in reverse. It has been used to explain automaticity, which is the ability to recognise words and spellings very quickly. For example, this model has been used to explain the Stroop effect (Coltheart, et al., 2001). In this classic experiment, participants were presented with a list of nouns labelling colour, such as the words 'red', 'blue', and 'green', printed in different coloured text. When participants were asked to read the words aloud as quickly as possible, they were very fast and made very few errors. Conversely, participants found the task more difficult when they were asked to state the colour of the text aloud as quickly as possible. They often mistakenly read the word aloud instead of listing the text colour leading to many more errors (MacLeod, 1991). In theory, reading had become an automatic process that mediated by the direct route among proficient readers, and this automaticity interferes with participants' performance in the colour-naming task, which is associated with the indirect route (Coltheart, et al., 2001).

Evidence for the indirect route in reading comes from research involving pseudowords. Using a lexical decision task, Taft (1991) showed that participants take longer to respond to pseudowords compared to high frequency words. Similar to spelling, pseudowords are thought to be processed via the indirect route, via grapheme-phoneme conversion rules, when reading. The indirect route has also

been used to explain the ability of individuals to read pseudowords in a naming task (Taft, 1991).

Although the DRC reading model can explain classic reading research findings (Coltheart, et al., 2001; Taft, 1991), there are some findings that the model cannot explain. Where the model has difficulty is in explaining the reading of novel infrequent or irregular words, such as “yacht” and “choir.” Novel words are previously unencountered, thus they cannot be processed through the direct route. Novel words that also have irregular spellings cannot be decoded through grapheme-phoneme conversions. Similarly, the model has difficulty explaining how individuals produce an accurate spelling of these words (Bates, et al., 2007; Perry, et al., 2007), and there has been limited explanation of how learning occurs.

As described for spelling, the DRC model suggests that learned words are stored in a mental lexicon; therefore, a larger lexicon involves more “storage space” and thus, more resources. The idea of proficiency necessitating more cognitive resources does not align neatly with the phenomenon of automaticity. In contrast, the IAC model and Statistical models of reading better account for learning and developmental processes and also address the issue around resource size.

The Interactive Activation and Competition Model

The IAC model (see Figure 3), is one of the most influential reading models to date (McClelland & Rumelhart, 1981; Taft, 1991). It is a single route model based on the concept of interaction and competition between nodes of activation. These nodes represent identifiable units of information, such as letters and words. In its simplest form, the model consists of three hierarchical levels of processing nodes; a feature level, a complex features level, and a word level (Carroll, 1999; McClelland &

Rumelhart, 1981; Taft, 1991).

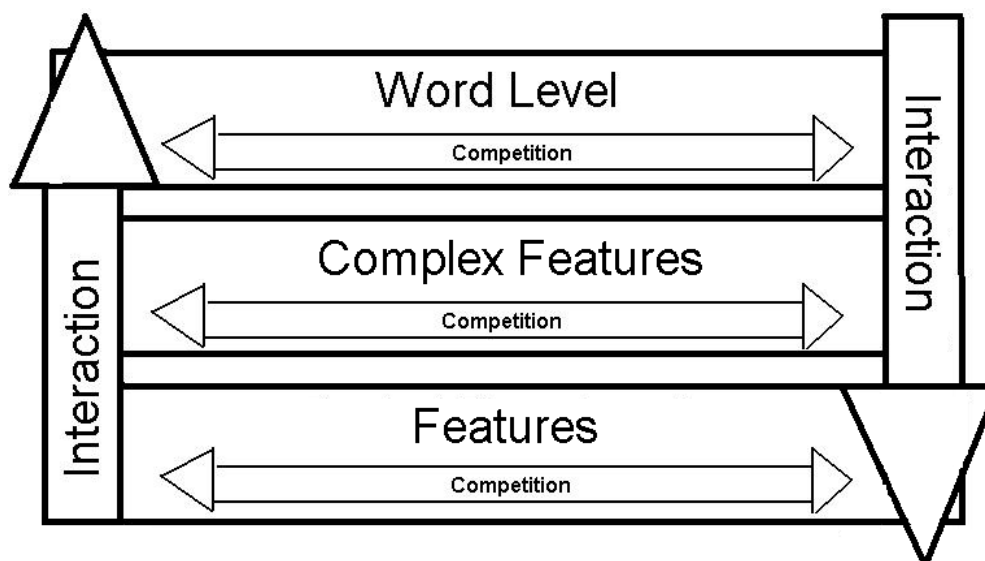


Figure 3. Representation of the Interactive Activation and Competition model of reading.

As the name suggests, interaction and competition are primary features of the model. Interaction occurs between top down and bottom up processes, whereby information derived from the stimulus feeds bi-directionally between the nodes at each level, facilitating activation in nodes that are relevant to the evidence gained from the perceptual system. However, competition also occurs in the form of inhibition of lateral activation between the nodes. As evidence feeds into the nodes from both directions, nodes compete and inhibit other nodes whose activation is weaker, narrowing the range of possible candidates. Thus, the model works swiftly to produce a word, as information about what the stimulus is feeds up and down between levels, whilst information about what the stimulus is not, feeds back and forth within the nodes at each level (Carroll, 1999; McClelland & Rumelhart, 1981; Taft, 1991).

Following studies examining sub-lexical (sub-word) phenomena, Taft (1994) proposed an expansion of the IAC model to incorporate the processing of morphological features and sub-lexical units (phonological and orthographic). The process is the same as that described previously, with the inclusion of phonological and orthographic information nodes at each level, spanning the grapheme/phoneme level, body/rime level, morpheme level, word level, and concept level (See Figure 4). Within this expanded model, connections between nodes remain bi-directional, whereby nodes within levels both influence and are influenced by other nodes.

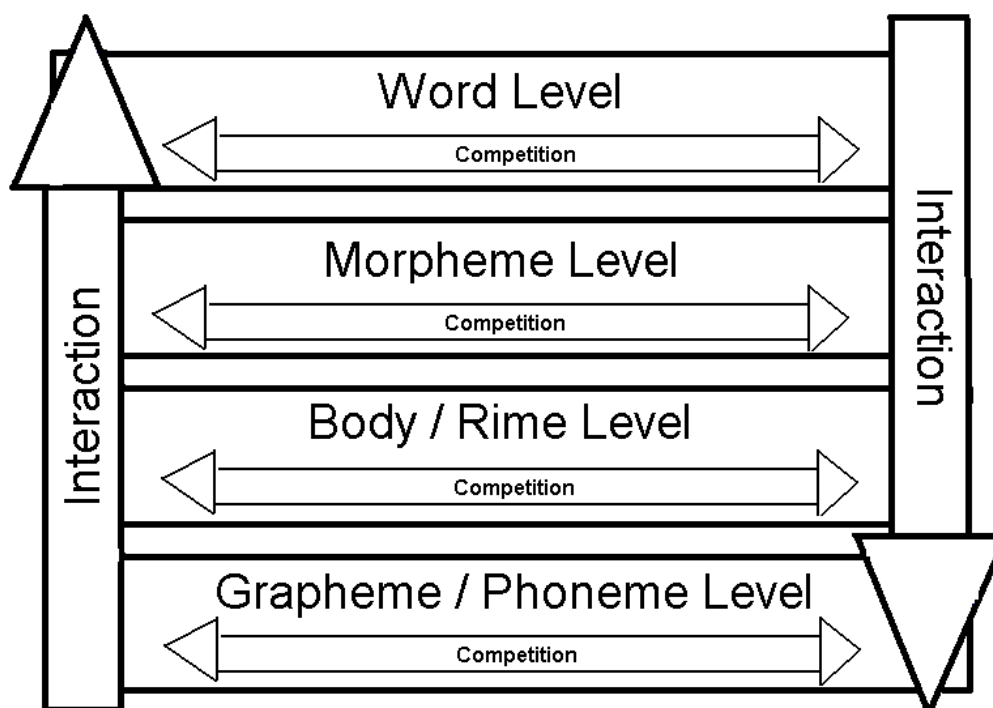


Figure 4. Representation of the Interactive Activation and Competition model of reading developed by Taft (1994).

Like the DRC model, the IAC is able to account for longer reaction times to pseudowords in lexical decision tasks, and to explain the process of reading novel, regular words. Another strength of the IAC model is its ability to account for the processing of sub-lexical information, such as syllables (Taft, 1994; 2001).

Furthermore, as already mentioned, the IAC model is able to explain how learning occurs, and the developmental processes involved in reading (Perry, et al., 2007).

A criticism of the IAC model has been its failure to explain the finer details of the reading choice, particularly when discriminating between similar, irregular, or infrequent words (Taft, 1991). Furthermore, it has been claimed that the IAC model purports to use probabilistic means to derive weightings between nodes; however, there is little discussion of how this process develops in practice. These criticisms have led some researchers to propose more explicitly statistical models of reading.

As the name suggests, statistical models, such as PDP and the Bayesian Reader, utilise statistical methods to explain reading. The PDP simulation employs a learning algorithm to gather information over time and encodes this information as connections between nodes (Seidenberg & McClelland, 1989). The Bayesian Reader model conceptualises reading as a decision-making process and utilises probabilistic equations based upon evidence of prior events (Norris, 2006). Both methods have been useful to examine reading.

The PDP Model

PDP models were among the first Statistical models of reading. These models consist of a network with two layers of connections, between three layers of representational nodes (Seidenberg & McClelland, 1989). The PDP simulation employs a statistical learning algorithm to gather information over time and encodes this information as connections between nodes. These connections are abstract in nature and vary depending on the starting state of the system, and the statistical properties of the language being processed. The architecture of the network can be

seen in Figure 5, and shows the orthographic, hidden, and phonological units as layers of nodes.

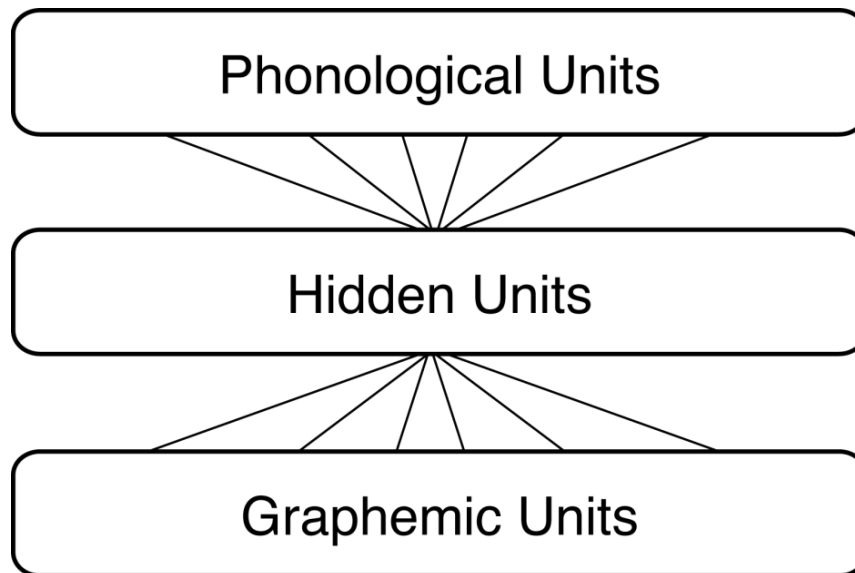


Figure 5. Diagram depicting the process of reading according to the PDP model.

The orthographic and phonological nodes represent information that corresponds to attributes of external events (the spelling and pronunciation of words), whilst the hidden nodes are sub-symbolic and not directly connected to external events (Seidenberg & McClelland, 1989). Information from the word stimulus generates a pattern of activation in orthographic nodes, spreading through the system based upon connection weights between the nodes, to the phonological nodes, where a pronunciation output is constructed from the orthographic input. Connection weights between nodes are mediated by the back-propagation learning algorithm within the hidden nodes.

PDP is a learning model that can 'learn' almost anything, as long as what the model is learning is made up of rules or patterns. These rules/patterns do not need to be consistent or regular, as the model can learn about inconsistencies and

exceptions to rules (Seidenberg & McClelland, 1989). In terms of lexical access, the model learns as a function of the words that the model is exposed to, which has often been a criticism of PDP models (Coltheart, et al., 1993).

In the early stages of learning, the model makes random guesses about which word the stimulus is (Seidenberg & McClelland, 1989). Over a number of trials, the back-propagation learning algorithm adjusts the connection weights between the hidden units and the input orthographic units and output phonological units, based on exposure to words and information about correct and incorrect responses. Over time, information about statistical relationships is accumulated in order to reduce output errors. That is, the model learns based on a trial and error process, and in this way approximates a human reader (Seidenberg & McClelland, 1989). Hidden unit codes differs in any given training of the network, since the initial weights of all connections are random. Thus, the model is often described as sub-symbolic, as it is incorrect to think of the hidden units as coding specific information, such as a syllable. Once the model has learnt a set of relationships, exposure to a stimulus generates a pattern of activation in orthographic units, which in turn activates a set of hidden units in a simple “feed forward” process. These hidden units activate phonological units, leading to the identification and pronunciation of the word being read (Seidenberg & McClelland, 1989).

The PDP model has been shown to accurately replicate human spelling mistakes, such as overgeneralisation, where learning of a new rule sees that rule applied broadly, before being refined to only those cases where it is accurate (Nunes, Bryant, & Bindman, 1997). In addition, PDP models are able to produce accurate pronunciations of legal English pseudowords (Taft, 1991). Whilst the PDP model has been shown to reliably replicate human reading behaviour, the model

takes a considerable amount of time to train for the model to produce accurate responses. Furthermore, as previously mentioned, learning is dependent on the training information that the model is given, which has been a major criticism of PDP models (Borowsky & Besner, 2006; Coltheart, et al., 1993).

The Bayesian Reader

Unlike PDP models that rely on a representative training set to accumulate information about language, the Bayesian Reader utilises information about prior events to make a decision. Similar to PDP, it is a statistical model of language, but rather than encoding information as connections between nodes, the Bayesian Reader model employs probabilistic equations based upon evidence of prior events, to arrive at a word recognition decision (Norris, 2006).

The Bayesian Reader is the most recent model of reading and proposes that when people read, they operate as Bayesian decision makers. That is, readers optimally use the information and resources that are available at that point in time, to make a decision by means of Bayes' theorem (Norris, 2006; Norris & Kinoshita, 2008). Bayes' theorem is a mathematical equation that describes how prior information is combined with new incoming information to arrive at a response. In the case of reading, the decision refers to identifying the word being read (stimulus), and decisions are made based upon knowledge of the previous probability of occurrence of a word (e.g., word frequency and context), and the current information about the stimulus presented, to derive the likelihood that the stimulus presented is a given word (Norris, 2006; Norris & Kinoshita, 2008).

An important part of the model is that decisions are based on the nature of the task, and not on the properties of the stimuli (Norris, 2006; Norris & Kinoshita, 2008).

Relationships between stimuli are accounted for through probability equations (e.g., the probability that b follows a); as the nature of the decision changes, so too does the information within the equation, which can alter the outcome. In this way, the Bayesian Reader model may account for the different patterns of sub-lexical effects demonstrated across languages, as the information within the probability equation changes according to the properties of the language being read (Norris & Kinoshita, 2008).

The Bayesian Reader is effective at replicating human reading behaviour and explaining how readers arrive at a response. Furthermore, research has shown that the model can account for increasing accuracy of reading through experience, and the processing of orthographic information, through the conceptualisation of 'noisy' input. It is suggested that the 'noise' creates uncertainty at output resulting from the conflict between different plausible letter patterns, leading to errors and hesitations (Norris & Kinoshita, 2010; 2012). This explanation could also account for common spelling errors, and it is this possibility that the proposed research intends to explore.

A Novel Model of Spelling

As discussed previously, a novel model of spelling needs to fulfil specific criteria in order to be effective. These criteria include the capacity to replicate, predict, and explain spelling, at all levels of ability and in a manner that does not require significant computational resources. Of the current reading models, the DRC model has also been used to explain spelling behaviour, but the existing model does not fulfil these stated criteria. The IAC and statistical models of reading have not yet been explicitly applied to model spelling; however, statistical models are far more detailed in their explanations and predictive ability than is the IAC model.

In particular, the statistical models of reading (i.e., PDP and the Bayesian Reader) simulate human reading behaviour and are used to derive very specific predictions of human reading behaviour. Further, they potentially align with the IMP model of spelling. These characteristics are proposed to make statistical models an ideal base from which to develop more sophisticated models of spelling behaviour.

Whilst the PDP and Bayesian Reader models can account for much previous research (Norris, 2006; Seidenberg & McClelland, 1989), they are both computationally heavy. As an analogue for a human reader, this computational power would require significant cognitive resources. However, readers do not read words in isolation, and proficient readers can read up to 500 words per minute (Dehaene, 2009). Furthermore, readers read whilst engaging in other tasks, such as driving (e.g., road signs). Therefore, it is unlikely that a behaviour that humans can successfully undertake in a dual task situation would be cognitively resource heavy. A novel model of spelling would also need to overcome this limitation.

The primary difference between the PDP model and the Bayesian Reader is their underlying computations. The PDP model utilises back-propagation, which is a serially iterative process. Learning does not occur without thousands of potential calculations. This process cannot be computationally reduced without affecting learning. Thus, a PDP model is unlikely to fulfil the criteria identified for a novel model of spelling. In contrast, a Bayesian approach can be scaled as it requires only two pieces of information: the prior information and the new information. Whilst the current Bayesian reader is computationally heavy, it is possible that a simplified network could be developed. In addition, unlike the PDP model, a Bayesian approach has no hidden units; the information that is coded in the nodes is known and can be examined. For these reasons, a Bayesian approach appears to be the

most appropriate for a novel model of spelling.

To this end, a Bayesian model of spelling will be constructed according to the criteria identified previously and validated against current spelling theory and research. Further, the model will be validated against human behaviour to assess its capacity to reproduce human spelling behaviour. If the model can be shown to effectively replicate human behaviour, model findings will provide valuable insight into the cognitive processes underlying spelling and written language production. It is anticipated that this could inform educational practices and research examining spelling disorders and dysfunction. Effective communication, particularly written communication, is fundamental to modern life and is a basic skill expected of all individuals (Treiman, 2017a; 2017b).

Chapter Two: Bayesian Spelling

Bayesian probability has been used in many varied applications in the last 15 years, including predicting spatiotemporal information (Wei, Lucey, Morgan, & Sridharan, 2013), visual processing and perception (Rao, 2005; Yuille & Kersten, 2006), memory (Brady, Konkle, & Alvarez, 2009), and even consciousness (Lau, 2007). In all these fields, researchers have demonstrated that humans use Bayesian principles to respond to incoming information. These principles are particularly suited to examining decision making and has been successfully used to examine reading (Norris, 2006; Norris & Kinoshita, 2008; 2010; 2012). As such, a Bayesian approach is an appropriate choice for examining the related language phenomena of spelling.

I developed the Bayesian model of spelling to address the lack of specificity and predictive capacity of conventional spelling models. The model uses Bayesian principles to make decisions about the spellings of words. Whilst Bayesian probability may appear complex, it is simply examining the relationship between two sets of information; patterns that have evolved based on prior experience and the patterns within the new information (Fienberg, 2006; Olshausen, 2004). The combination of these two pieces of information allows a Bayesian decision process to make an informed decision.

In terms of a simulation of spelling, the most appropriate task to reproduce is a dictation task. Dictation tasks are commonly used to assess spelling ability in educational facilities and have been popularised in spelling bees. In a dictation task, a word is read aloud, which exposes the speller to the phonemes (sounds) of the word to be spelled. The task of the speller is to use this information to identify the graphemes (letters) that comprise the written word. In this process, the speller converts phonemes to graphemes by comparing the incoming patterns of phonemes

with what is already learned about the language based on prior exposure. Over time, repeated exposures to the language refines spelling knowledge leading to increasing accuracy in spelling ability. The Bayesian Spelling Model simulates this learning and spelling process.

The Bayesian Model of Spelling

The Bayesian spelling model was written in the Microsoft C# programming language. The model constructs a two-dimensional network of interconnected nodes representing words and letters in the form of phoneme-grapheme pairs. Network learning is initiated using a predetermined set of training stimuli which represent a set of words that map phonemes to graphemes for each word. Spelling is then performed using test stimuli of word sets with each spoken word represented by a phoneme sequence (see Appendix 1 for operation manual).

The Bayesian model of Spelling was tested using Australian English; however, the network can be trained to use any language by defining the appropriate phoneme-grapheme units for that language. The phoneme and grapheme units representing the language are loaded from file on program start-up to set the language prior to training and testing. This study used 47 original phoneme units and 349 associated graphemic units, to produce 349 individual phoneme-grapheme pairs (See Appendix 2). These phoneme-grapheme sets were based on the Australian English protocols characterised by Cox (2012), using characters from the International Phonetic Alphabet (IPA). These units form the basis of the transcription relationships between individual phonemes and graphemes, which are used by the spelling simulator to construct a graphemic response, as shown in *Figure 6*.

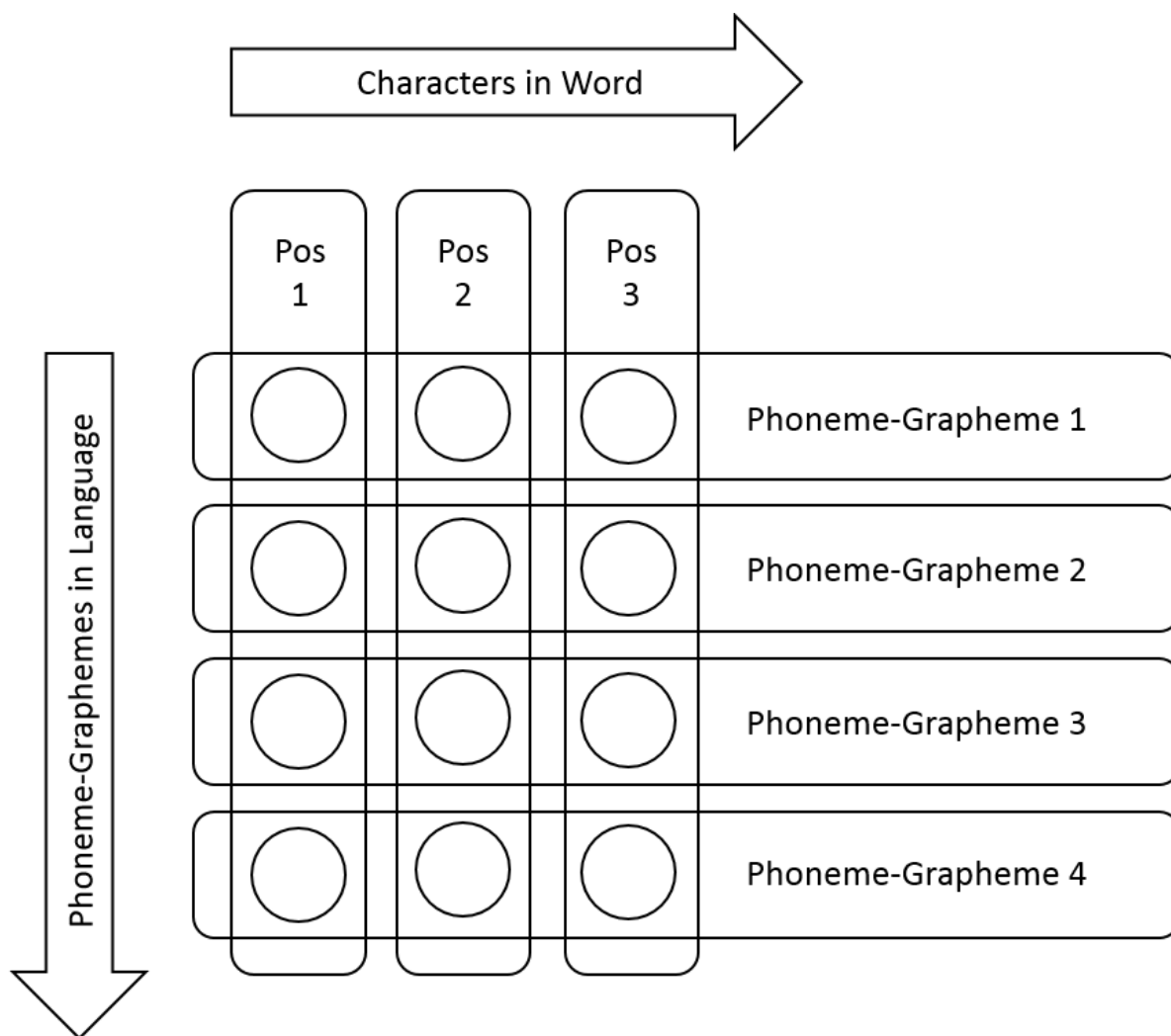


Figure 6. Basic network layout of the Bayesian spelling model.

The spelling simulator uses a fully interconnected network of nodes laid out in a pattern of columns and rows.

- Nodes represent phoneme-grapheme (sound-letter) pairs
- Columns represent the character position in the word
- Rows represent each phoneme in the language phoneme set
- Links represent the weighted connection between nodes (phoneme-grapheme sets) from one position to the next

Each node in the phoneme-grapheme set is connected to every node in the following letter position. After training, these statistical relationships are used to extract the letters (graphemes) that spell a word based on the pattern of sounds in the word represented by the phoneme sequence.

The network provides up to 15 characters which sets the maximum phonemic word length. The number of rows in the network is expanded to match the number of phoneme-grapheme pairs (unique sound and letter combinations) in the language set (see Figure 7). This dimension is set dynamically on start up by reading in the language set configuration file, which contained 349 pairs (creating 349 rows) in this study.





















































Language Mapping	Phoneme - Grapheme Pairs	4 Character Node Layout			
/b/ b, bb /d/ d, dd, ed /f/ f, ff, ph, gh, lf, ft ...	/b/ b /b/ bb /d/ d /d/ dd /d/ ed /d/ ed /f/ f /f/ ff /f/ ph /f/ gh /f/ lf /f/ ft 349 rows				
					
					
					
					
					
					
					
					
					
					
					
					
		349 rows			

Figure 7. Language file, phoneme-grapheme pairs to nodes in model.

Once the nodes are created and the phoneme-grapheme pairs loaded into the nodes, each node is connected by a link to all nodes (349) in the next character position. Figure 8 shows a representation of a network for a 4-phoneme word with 4 of the 349 phoneme-grapheme pairs illustrated. In a 4-character (phoneme) network there would be a total of 1,396 potential nodes.

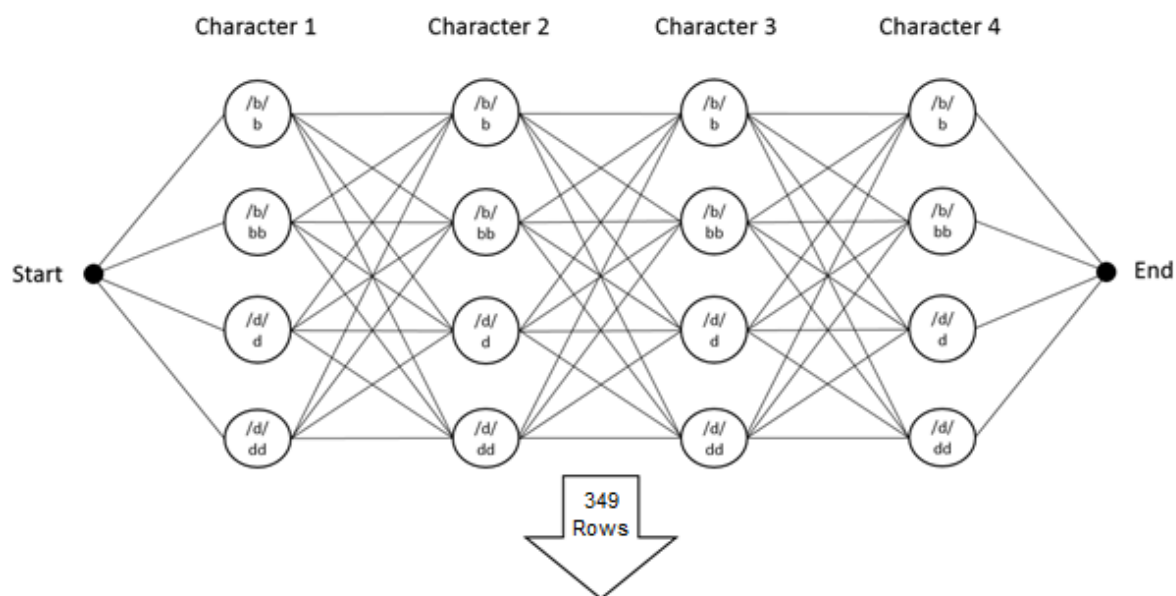


Figure 8. Graphical representation of the architecture of the Bayesian spelling model.

With regards to network size, the model will accommodate shorter words within a longer network, but longer words cannot be processed within a shorter network. For example, the word “aunt” is spelled with 4 letters (graphemes), but has 3 phonemes, /ɑ:/ /n/ /t/; thus, it could be spelled within a network that is 3 columns (or more) in length. However, the 3-grapheme word “box” has 4 phonemes, /b/ /ɒ/ /k/ /s/; therefore, requiring a network at least 4 columns long to be spelled by the model. Figure 9 shows a screenshot of an untrained network with 4 character positions. Note that the display has been flipped 90 degrees to better fit the network to the screen

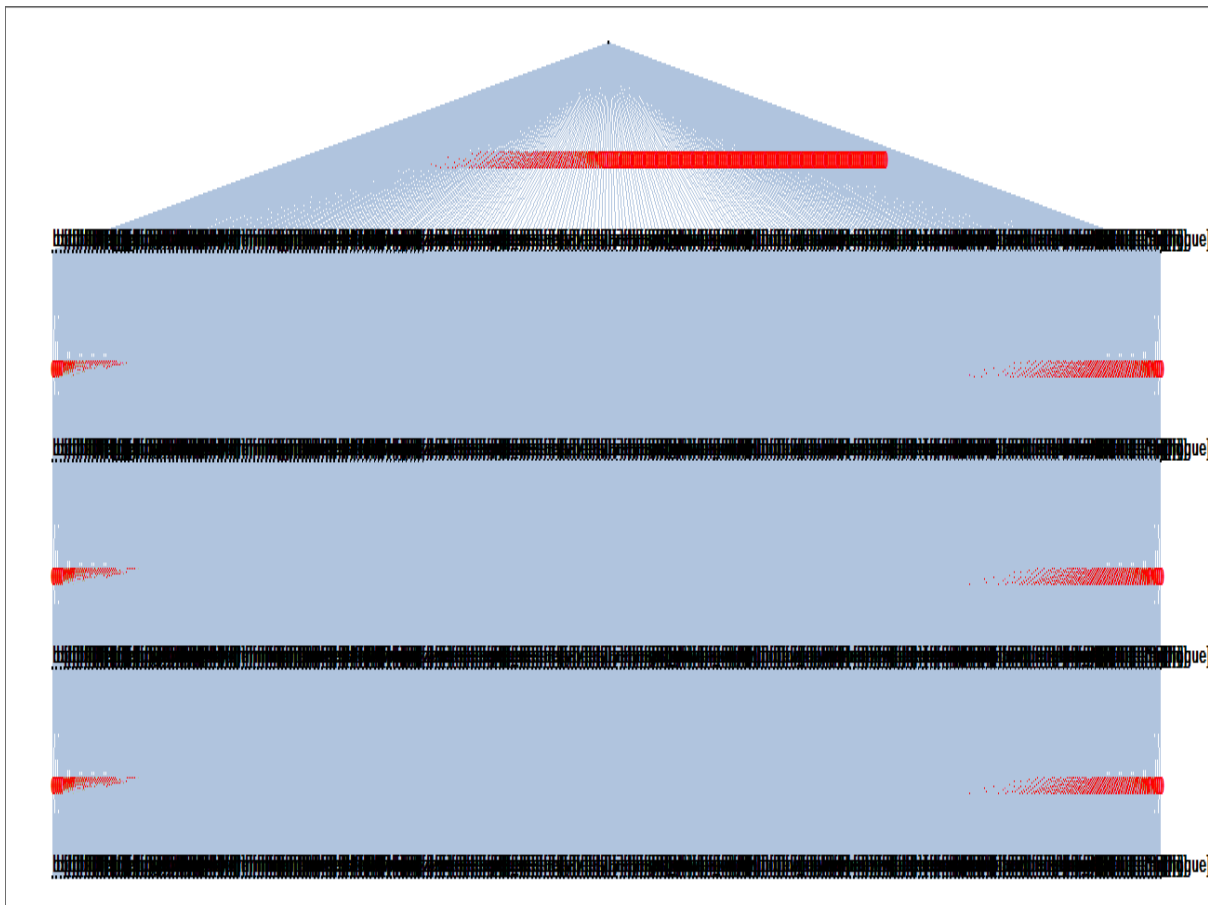


Figure 9. Image of an untrained network with 4 phoneme positions represented by rows and columns of nodes in black. Red sections indicate where frequency information would be displayed once the network has been trained.

Training

Training the Bayesian model is analogous to teaching students at school. Students are taught phoneme and grapheme relationships (i.e., phonology) and learn patterns within language (i.e., orthography and morphology), both explicitly through teaching and implicitly through exposure. Similarly, the model is provided the phoneme-grapheme relationships explicitly, and through the training process (i.e.,

exposure) implicitly learns the statistical relationships and statistical patterns inherent within the set of words provided.

The training process provides a location for each phoneme-grapheme pair in each layer and a link weight into and out from each node. The model calculates the frequencies of phoneme-grapheme pairs in different positions within the words it has been exposed to in the training phase. The number of times one node (i.e., phoneme-grapheme pair) links to another node at the next position is counted, and the sum of this frequency count becomes the link weight value for that connection. In the case of the nodes in the first position, the number of times that a word begins with each phoneme-grapheme pair in that training word list is calculated as the link weight. Similarly, for nodes in the final position, the number of times that a word ends with each phoneme-grapheme pair in that training word list is calculated as the link weight. An example of a trained network with four phoneme positions is shown in Figure 10.

In an untrained network there is a node for each phoneme-grapheme pair in each column and each position, position along with a full set of connections between each node and all nodes in the adjacent columns. However, in a trained network, the number of nodes in each layer depends upon the characteristics of the training set. Through the training process, the model pares back the connections between the layers of the network and nodes for phoneme-grapheme pairs that have a link weight of zero, meaning they are not present within that position within the training set and are removed. Thus, a trained network is more compact than an untrained network (see Figure 9 and Figure 10 for comparison). The resulting trained network is analogous to a relative position map of orthographic relationships for a human speller (Dandurand, Grainger, Dunabeitia, & Granier, 2011).

Testing

After training has been completed, the testing process to assess the spelling efficacy of the model can be conducted. The testing phase simulates a dictation task analogous to those used in testing spelling at school, with the only difference being the exclusion of context information. In a human dictation task, a speller can ask the tester for the target spelling word to be used within a sentence. This allows the speller to differentiate between homonyms - words that sound the same but have different meanings - and to obtain further morphological information. The model does not receive this additional information, meaning its capacity to utilise morphological information is more limited than a human speller. It is unclear if this will impact the efficacy of the model; therefore, model responses to homophones in the testing set will be examined and compared to the responses of students.

The testing process is identical to that of the training mode, except that link weights are not updated with new information. The model arrives at a response output and does not compare this output with the input information; that is, the model does not check for accuracy in the final stage. The model runs through one iteration to arrive at a response and displays all the information used to evaluate the decision. The model makes the final decision using the first parameter in the parameters list, unless the response is tied and the model is unable to make a decision. In this case, the model selects the second parameter in the list, and so on until the model arrives at a response. Researchers can remove parameters and modify their order within the decision making process depending on their research focus. The default order for parameters can be found in Appendix 3.

The resulting output of the testing process provides information for all parameter settings, in order to overcome limitations of current spelling models. That is, all parameter values are provided in the output, and a researcher can examine what information was evaluated, what information was chosen to produce the response, and how the model arrived at that decision, for each word in the testing list. Current models cannot identify why a speller chooses one spelling strategy over another, particularly in the instance of competing information, or when examining inconsistent languages such as English. For example, Stage models describe a general progression of learning through phonological, orthographic, and morphological stages, but do not explain how information is managed or why one strategy is utilised over another, particularly for proficient spellers. The Integration of Multiple Patterns (IMP) model experiences this same problem. Similarly, for the DRC model, it is unclear how the indirect route of phoneme-grapheme conversions

functions in inconsistent languages. By producing this information in the output, the Bayesian spelling model overcomes these major limitations.

Parameters

The Bayesian model of spelling was designed for researchers to examine spelling decisions based on 10 types of decisions, known as parameters. Parameters are the potential methods that the model can use to make a spelling decision. As discussed previously, a novel model of spelling should explain how information is learned and managed but must also address what is already known about human behaviour.

Although spelling is not an automatic process in the way that reading is for proficient readers, proficient spellers still produce word spellings relatively quickly, particularly given the complexity of the task (Ellis, 1994; O'Sullivan, 2000). The speed human of spellers indicates that spelling processes are likely cognitively efficient and therefore spelling models need to be similarly efficient. Thus, one of my goals was to develop the Bayesian spelling model in the most parsimonious manner possible; namely, by taking advantage of the simplicity of calculations involving multiple parameters.

The Bayesian reader is computationally heavy as it calculates all probability equations in order to produce a response. Importantly, the Bayesian spelling model differs in that calculations have been designed to be simpler. The probability of an event is based on the frequency of the event divided by the number of times all events occur, making frequency a fundamental component of the probability calculations. In the case of this spelling model, frequency information is derived from the training phase, and this information is used in the testing process - during

exposure to novel information - to produce a response. The construction of parameters and how they use this frequency information achieves the criteria of efficiency and parsimony, whilst also accounting for how spelling information is learned and managed.

Parameter Calculations

There are 10 parameters in total which can be calculated from either weights or links. Weights are frequency counts from the number of times a connection between a node (phoneme-grapheme pair in a specific position) and a node in the next character position was activated in the training set. The link count parameters are the number of connections between nodes in adjacent columns. Next character node selection can be determined using weights or links in to a node or weights or links out from a node, in addition to an overall sum of weights or links in or out.

Links or weights in are considered feed-forwards processes, whereas links or weights out are feed-backward processes. This set of parameters were designed to provide finer detail for the simulation and exploration of the spelling process when considering specific path options in spelling decisions. In contrast, the sum of links or weight in and out is an overall representation of the role of activation level or interconnectedness of a node within the network. The parameters are used to select the candidate nodes with the highest values according to the selected criteria, which encompass a combination of letter position, frequencies, and n-grams. As research demonstrates that successful spellers use a combination of spelling strategies (O'Sullivan, 2000), parameter 1: *best link weight*, encompasses all three of these criteria.

Parameter 1: Best Link Weight

This parameter compares the link weights for all connecting nodes and selects the node with the highest value connecting link weight. A link weight is the frequency count of the number of times a node (i.e., phoneme-grapheme pair) was represented in the training set in a specific position - letter position frequency. Unlike other parameters that use link weights in calculations, parameter 1 also encompasses N-grams. N-grams are connections to the letters that come before and after them within words (Norvig, 2012) and evidence shows human spellers utilise N-grams and letter relationships when making spelling decisions (Perry & Ziegler, 2004; Scaltritti & Balota, 2013; Sedlmeier, Hertwig, & Gigerenzer, 1998; Treiman & Boland, 2017). Parameter 1 utilises N-grams as it can only select candidate nodes from nodes that are directly connected to it (neighbours).

An example calculation for parameter 1 is shown in Figure 11, which displays a representation of a Bayesian spelling network with 2 columns and 3 nodes. In this example, node X is in position 1 and is seeking to choose a node for the next potential spelling. Nodes A and B, which are in position 2, are both potential candidates. Node A has a connecting link weight of 1, whereas node B has a connecting link weight of 3. Therefore, based on parameter 1, node X would choose node B as the next potential spelling as it is the higher *best link weight* value.

Parameter 2: link weights in. This parameter is the summed value of all link weights in to the candidate node from all other nodes, meaning it is a feed-forwards process. The node with the highest number of total link weights in is selected. In Figure 11, node A has 3 links in and their weights sum to 8 ($2 + 1 + 5 = 8$), whereas node B has 2 links in and their weights sum to 10 ($3 + 7 = 10$). Therefore, node X would choose node B as the next potential spelling based on the *link weights in* parameter.

Parameter 3: link weights out. This parameter is the summed value of all link weights out of the candidate node from all other nodes, making it a feed-backward process. The node with the highest value of total link weights out is selected. In Figure 11, node A has 2 links out and their weights sum to 13 ($10 + 3 = 13$), whereas node B has 3 links out and their weights sum to 5 ($1 + 1 + 3 = 5$). Therefore, node X would choose node A as the next potential spelling based on the *link weights out* parameter.

Parameter 4: total link weights in/out. This parameter is the sum of all link weights in and out of the candidate node from all other nodes and the node with the highest value of total link weights in and out is selected. In Figure 11, node A has a weight sum of 8 for links in and 13 for links out which is a total weight of 21, whereas node B has a weight sum of 10 for links in and 5 for links out, which is a total weight of 15. Node X would choose node A as the next potential spelling based on the *total link weights in/out* parameter.

Number of Links

Parameters can also be calculated based on the number of connections or links to the other candidate nodes, known as N-grams (Norvig, 2013). Parameters 5:

number of links in, 6: number of links out, and 7: total links in/out use the calculation of links and represent the use of predominantly orthographic processing. In this mid-orthographic stage, human spellers develop a relative position map of orthographic relationships and use this map to make spelling decisions (Dandurand et al., 2011) and these parameters are designed to also use this information to make spelling decisions.

Parameter 5: number of links in. This parameter calculates the number of links in to the candidate node from all other nodes, meaning it is a feed-forwards process, and the node with the highest number of links in is selected. In Figure 11, node A has 3 links in, whereas node B has 2 links in. Therefore, node X would choose node A as the next potential spelling based on the *number of links in* parameter.

Parameter 6: number of links out. This parameter calculates the number of links out of the candidate node from all other nodes, making it is a feed-backward process, and the node with the highest number of links out is selected. In Figure 11, node A has 2 links out, whereas node B has 3 links out. Therefore, node X would choose node B as the next potential spelling based on the *number of links out* parameter.

Parameter 7: total links in/out. This parameter calculates the number of links in and out of the candidate node from all other nodes and the node with the highest number of links in and out is selected. In Figure 11, node A has 3 links in and 2 links out, making 5 links overall, whereas node B has 2 links in and 3 links out, which is also 5 links overall. The model would not be able to make a choice for this parameter based on the *total links in/out* calculation and therefore would move to the next parameter in the list to break the tie.

Overall Links

The final method for calculating parameters involves summing the overall number of connections (N-grams) for a column, rather than a node. These parameters allow researchers to examine a phoneme-grapheme pair over all positions rather than a specific position. Parameters 8: overall links in, 9: overall links out, and 10: total links in/out use the calculation of overall connections. These parameters are designed to mimic a human speller, representing the use of a more flexible orthographic system whereby position becomes less important (Dandurand et al., 2011), and the capacity to investigate statistical relationships is based on morphological properties. These parameters represent a late orthographic, early morphological stage of spelling acquisition.

Parameter 8: overall links in. This parameter is the sum of the number of all links in to a column, making it a feed-forwards process. That is, the number of links in to each node in a column is summed and the node in the position under examination that corresponds to the column with the highest number of links in is selected. In Figure 11, node A is in column A, and there are 3 links into node A; therefore, there are 3 links in to column A. Node X and node B are in column B and there are no links in to node X and 2 links in to node B; therefore, there are 2 links in to column B. In this example, node X needs to link to either node A or node B as they are in the next position. Node X would link to node A as there are a greater number of links into column A than there are into column B.

Parameter 9: overall links out. This parameter is the sum of the number of all links out of a column, meaning it is a feedback process. That is, the number of links out from each position in a column is summed and the node in the position

under examination that corresponds to the column with the highest number of links out is selected. In Figure 11, node A is in column A, and there are 2 links out from node A; therefore, there are 2 links out from column A. Node X and node B are in column B and there are 4 links out from node X and 3 links out from node B; therefore, there are 7 links out from column B. Node X would link to node B as there are a greater number of links out from column B than there are from column A.

Parameter 10: overall links in/out. This parameter is the sum of the number of all links in to and out from a column. That is, the number of links in to and out from each position in a column is summed and the node in the position under examination that corresponds to the column with the highest number of links in and out is selected. In Figure 11, node A is in column A, and there are 3 links into node A and 2 links out from node A; therefore, there are a total of 5 links in to and out from column A. Node X and node B are in column B and as there are no links in to node X and 4 links out from node X, and 2 links in to node B and 3 links out from node B; therefore, there are a total of 9 links in to and out from column B. Node X would link to node B as there are a greater number of links in to and out from column B than there are for column A.

Model Validation

The process for assessing a computational model is known as validation. Development of the model was based on information identified in an extensive literature review in order to encompass necessary constructs and operational criteria. This procedure not only ensures face validity, but importantly, ensures that the model is conceptually valid (Carson, 2002; Sargent, 2011).

One of the criticisms of using models to reproduce human behaviour has been that the researcher creates not only the model, but the context for the model's learning. Thus, the researcher constructs the ideal environment for a successful model, but the model may not accurately reflect a real-world context. The current Bayesian spelling model addressed these criticisms by using robust conceptual validity (aspects of which have been discussed throughout this chapter), and by utilising real-world information as testing and training information. Use of this data has the additional advantage of providing data validity (Carson, 2002; Sargent, 2011).

Data validity is one of the most important considerations, both for statistical models and for human spellers and a common descriptive phrase is "rubbish in, rubbish out." Data for computational models must be representative of the data a human completing the task would have access to. In terms of spelling, if a speller is exposed to a narrow range of language, the information derived will be similarly constrained, which affects accuracy. If a speller is exposed to a more representative range of language, the information derived will be similarly representative and accuracy will be greater. As computer models are designed to replicate human behaviour, the stimuli chosen for learning are particularly important (Carson, 2002; Sargent, 2011).

To accurately examine the variables of interest, specific training and testing sets must be created which encapsulate the language characteristics that will be examined. As this research examines the learning process, data must be representative of different levels of spelling ability. Further, it must be representative of the training information that a human speller would be exposed to. The most appropriate analogy is that of educational grades; thus, spelling lists from the

Queensland State School curriculum were used as training sets (Department of Education and Training, 2018a-g). These lists adhere to National curriculum guidelines, are available for all grade levels, and are constructed by letter-pattern and word types (Australian Curriculum, Assessment and Reporting Authority, 2019). Therefore, this list of spelling words is representative of both language and real-world context.

Arguably the most important aspect of model validation is operational validity, which refers to the capacity of the model to operate in the same manner as would be expected in the 'real-world' (Carson, 2002; Sargent, 2011). In terms of this simulation, operational validity refers to efficacy; namely, does the model behave like a human speller? To investigate this question as rigorously as possible, I employed a two-pronged approach: theoretical validation and empirical validation. Theoretical validation refers to whether results align with literature and with existing models. Theoretical validation has been addressed through the design and construction of the model and parameters (i.e., conceptual validity) as well as examining the model in an experimental context.

Empirical validation includes both event validity and predictive validity. Event validity ensures that the model receives the same information and completes the same task as a human (Carson, 2002; Sargent, 2011). As the most common way of assessing human spelling is via a dictation task, the model simulates the same event. All Australian school students sit a National test assessing spelling in grades three, five, seven, and nine; the National Assessment Program – Literacy and Numeracy, known as NAPLAN. In 2008, a computerised dictation task trial was conducted for NAPLAN, and provides an excellent testing set with corresponding human data for comparison for my research (Willet & Gardiner, 2009). Therefore, the

model receives the same training stimuli, and the same task and testing stimuli as a human speller, which provides event validity. Using these stimuli, my research assessed the predictive validity of the model, as a means of demonstrating operational validity (Carson, 2002; Sargent, 2011). Given that humans are not perfect spellers, data were examined in terms of accuracy as well as error.

Grade Three Spelling

According to Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), spellers in grade three would predominantly use phonological information, with the inclusion of some orthographic strategies, to make spelling decisions (Cassar & Treiman, 1997; Hayes, Treiman, & Kessler, 2006). This is because students begin explicit education of spelling, beginning with phonology, in grade one and need time to learn these strategies prior to progressing to orthographic strategies as the second stage of spelling acquisition. As the national spelling curriculum is based upon Stage models, late phonological, early orthographic strategies are reflected in the teaching curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018a-c). The parameters most closely aligned with later phonological and early orthographic strategies are parameters 2, 3, and 4. These parameters involve using phonological mapping and letter position frequencies to make decisions about spellings, making them relevant for grade three spelling.

The differences between the parameters derive from how they are calculated. Parameter 2: *link weights in* is calculated by summing the weights in to each node and is therefore optimised to examine the links to rather than out of each node. Thus, this parameter would not be expected to be effective at the first position. In

comparison, parameter 3: *link weights out* is calculated by summing the weight of links from each node, making it more accurate at the first position; however, this parameter is unlikely to be accurate in the final position. These two parameters likely provide additional information about the direction of the spelling process, but they are not ideal candidate parameters for examining the overall spelling strategy for grade three. Parameter 4: *total link weights in/out* is calculated by summing all the weights into and out of the node; as such, this parameter represents an overall spelling strategy comprising letter position and frequency information. Further, as this parameter is not constrained by letter position limitations, the output for parameter 4 is likely the most similar to the data from grade three students for both accuracy and error.

To test the model's capacity to simulate grade three spelling, words from the Queensland spelling curriculum for grades one to three were used as the training list. This list represents words that spellers in grade three would be expected to know (Department of Education and Training, 2018a-c). Words from the NAPLAN computerised dictation task for grade three students (Willet & Gardiner, 2009) were used as a testing set. Model responses were transformed into density distributions for accuracy and error and compared to those of students to assess the predictive validity of the model for grade three spelling.

Grade Five Spelling

Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) propose that spellers in grade five would predominantly use orthographic strategies to make spelling decisions as this is the second stage of spelling acquisition (Cassar & Treiman, 1997; Chliounaki & Bryant, 2007; Dandurand

et al., 2011; Treiman & Cassar, 1996). Orthographic strategies are reflected in the teaching curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018c-e). In this mid-orthographic stage of learning, students develop a relative position map of orthographic relationships and use this map to make spelling decisions (Dandurand et al., 2011).

The parameters most closely aligned with mid-orthographic strategies and relative orthographic mapping are parameters 5: *number of links in*, 6: *number of links out*, and 7: *total links in/out*, which utilise N-grams and letter position information to make spelling decisions. Parameters 5 and 6 examine the finer process of spelling and might be constrained by letter position limitations. Therefore, parameter 7 is most likely to resemble human spellers for accuracy and error.

To test the model's capacity to simulate grade five level spelling, words from the Queensland spelling curriculum for grades one to five were used as the training list. This list represents words that spellers in grade five would be expected to know (Department of Education and Training, 2018a-e). Words from the NAPLAN computerised dictation task for grade five students (Willet & Gardiner, 2009) were used as a testing set. Model responses were transformed into density distributions for accuracy and error and compared to those of students to assess the predictive validity of the model for grade five spelling.

Grade Seven Spelling

Students of this grade are believed to have the capacity for a flexible orthographic system whereby letter position becomes less important for spelling decisions (Dandurand et al., 2011). Further, there is evidence that students begin applying rules related to morphology before this grade (Nunes, Bryant, & Bindman,

1997). However, these findings, and those assessing the accuracy of spellers in utilising morphological information, have not been found consistently (Kemp et al., 2017). Given the inconsistency in the literature regarding the age of morphological acquisition, hypotheses for this research followed National curriculum guidelines according to spelling instruction (Australian Curriculum, Assessment and Reporting Authority, 2019).

Grade seven is the last year wherein students are explicitly taught spelling (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018e-g). Students complete NAPLAN in term 2 and therefore still have 2 terms of explicit spelling instruction before they are thought to be wholly proficient. From grade six, students are taught orthographic and morphological strategies for spelling. According to Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), morphological strategies represent the final phase of spelling acquisition; therefore, I expected that spellers will utilise late orthographic and morphological strategies to make spelling decisions.

The parameters that use the calculation of late orthographic and morphological strategies, regardless of letter position, are 8: *overall links in*, 9: *overall links out*, and 10: *total links in/out*. These parameters utilise N-grams, but unlike parameters 5, 6, and 7, letter position is not fixed and can be calculated across words to make spelling decisions. As for previous grades, parameters 8 and 9 examine the finer process of spelling and might be constrained by letter position limitations and parameter 10 is most likely to resemble human spelling data for accuracy and error.

To test the model's capacity to simulate grade seven level spelling, words from the Queensland spelling curriculum for grades one to the end of term two of

grade seven were used as the training set (Department of Education and Training, 2018a-g). Due to the timing of NAPLAN, students would not have been trained with the word lists allocated for after the end of term two, so only words to this point were included. Words from the NAPLAN computerised dictation task for grade seven students (Willet & Gardiner, 2009) were used as the testing set. Model responses were transformed into density distributions for accuracy and error and compared to those of students to assess the predictive validity of the model for grade seven spelling.

Grade Nine Spelling

Spelling is not explicitly taught after grade seven, as students are considered proficient spellers at this stage. It has been shown that proficient spellers utilise all types of information to make decisions about spelling (O'Sullivan, 2000); thus, all parameters could be relevant. However, the most likely candidate is parameter 1, as it encompasses frequency information, N-grams, and letter position, which represents the optimal spelling strategy.

To test the model's capacity to simulate proficient spelling, all word lists from the Queensland spelling curriculum, from grades one to seven, were used as the training set (Department of Education and Training, 2018a-g), and words from the NAPLAN computerised dictation task for grade nine students (Willet & Gardiner, 2009) were used as a testing set. Model responses were transformed into density distributions for accuracy and error and compared to those of students to assess the predictive validity of the model for grade nine spelling.

Overall Spelling

I anticipated that the overall spelling process of the model across all grades would replicate the process described by Stage spelling models. Research suggests that spelling acquisition progresses from use of least to most complex strategies and that spelling performance improves with educational level (Graham & Santangelo, 2014; Hayes, Treiman, & Kessler, 2006). Therefore, distributions for parameters most closely resembling the distributions of students would begin with less complex, late phonological, early orthographic parameters and progress to more complex orthographic and morphological parameters. The expected progression begins with parameters calculated by link weights (i.e., 2, 3, 4), specifically parameter 4: *total link weights in/out*, moving to parameters calculating connections dependant on position (i.e., 5, 6, 7), specifically parameter 7: *total links in/out*, followed by parameters calculating the connections independent of position (8, 9, 10), specifically parameter 10: *total links in/out*, and finishing with parameter 1: *best link weight*, which represents the optimal spelling strategy.

Hypotheses

It was anticipated that:

- 1 – the accuracy distribution for parameter 4: *total link weights in/out* would not be different from the accuracy distribution of grade three students
- 2 – the error distribution for parameter 4: *total link weights in/out* would not be different from the error distribution of grade three students
- 3 – the accuracy distribution for parameter 7: *total links in/out* would not be different from the accuracy distribution of grade five students

- 4 – the error distribution for parameter 7: *total links in/out* would not be different from the error distribution of grade five students
- 5 – the accuracy distribution for parameter 1: *total links in/out* would not be different from the accuracy distribution of grade seven students
- 6 – the error distribution for parameter 10: *total links in/out* would not be different from the error distribution of grade seven students
- 7 – the accuracy distribution for parameter 1: *best link weight* would not be different from the accuracy distribution of grade nine students
- 8 – the error distribution for parameter 1: *best link weight* would not be different from the error distribution of grade nine students

Chapter Three: Method

Model

The Bayesian model of spelling simulates a dictation task analogous to the task given to students in an educational setting. In a dictation task, the speller is given the phonemes for a word to be spelled. For a student in a school setting, this involves a tester speaking the word aloud, whereas the model is given the same phonemic information in written form using the International Phonetic Alphabet (IPA). The speller, whether a student or the model, must then provide the graphemic spelling of the word. For example, if the phonemic representation /l/ /aɪ/ /k/ is given, the model and student would be expected to respond with the correct written spelling, “like”.

In order to determine the correct spelling, the model can make decisions based on information from ten parameters (see Appendix 3 for the default parameter list). These parameters are analogous to the types of decisions that human spellers make about spellings (see Chapter two for a detailed description of these parameters). The model was operated according to usual protocol (see Appendix 1 for operating manual) and using the parameters in sequence according to their default order.

Stimuli

The stimuli for the Bayesian model of Spelling consists of three main elements: information about the language, training stimuli, and testing stimuli. Language information in the form of phoneme and grapheme units is loaded prior to training and testing and this information determines the language of the model. In this study, the language was Australian English; however, the model can spell in any

language, depending on the information provided. There were 47 original phoneme units and 349 associated graphemic units (see Appendix 2). These were based on Australian English pronunciation as described by Cox (2012), using characters from IPA. These units form the basis of the transcription relationships between individual graphemes and phonemes, and how the model constructs an output response.

Early piloting of the model identified an issue with two graphemes; “x” and “o” when in the initial position, such as in the word “once.” These graphemes are pronounced with two phonemes, creating an unequal number of phonemes and graphemes which the model was unable to process. For example, the three-letter word “box” becomes four phonemes, /b/ /ɒ/ /k/ /s/. A further example is the three-letter word “one” which also becomes the three phonemes /w/ /ɒ/ /n/, however the phoneme and grapheme relationships are misaligned due to the initial “o.” The correct relationships should be “o” = /w/ /ɒ/, “ne” = /n/, however the model interpreted the relationships as “o” = /w/, “n” = /ɒ/, “e” = /n/. This limitation will be examined in detail in the general discussion, but to manage this issue for the purposes of this study, two extra phonemes were created for the purposes of training the model. The grapheme “x” became the phoneme /x/ and is associated with the graphemes “k,” “ks,” “cs,” and “x.” The grapheme “o” became the phoneme /o/ and is associated with the graphemes “wo” and “o.” These created phonemes were used only as necessary to maintain fidelity with Australian English IPA.

Another issue was identified with the sound “yoo”, commonly used for the grapheme “u” and represented by the phonemes /j/ /u:/. An example of this problem is the word “huge”, which is translated into Australian English IPA as /h/ /j/ /u:/ /dʒ/. Similar to the problem with the initial “o” grapheme, this phoneme was causing the phoneme and grapheme relationships to become misaligned so that “huge” became

“h” = /h/, “u” = /j/, “g” = /u:/, “e” = /dʒ/, instead of “h” = /h/, “u” = /j/ /u:/, “ge” = /dʒ/. To resolve this issue for the purposes of this study, all words containing the /j/ phoneme were reviewed individually, and where it was not possible to maintain the /j/ phoneme, the created phoneme /y/ was used instead. Thus, “huge” became /h/ /y/ /dʒ/ (“h” = /h/, “u” = /y/, “ge” = /dʒ/). The created phoneme /y/ is associated with the graphemes “u,” “you,” “ew,” “iew,” “yu,” “ul,” “eue,” “eau,” “ieu,” “eu,” and “ue” in the training stimuli.

The training stimuli consisted of Queensland curriculum spelling lists (Department of Education and Training, 2018a-g). Students are explicitly taught these words at school in Queensland, based on National curriculum guidelines (Australian Curriculum, Assessment and Reporting Authority, 2019) providing a representative training set for model validation. There were 3595 words in total (see Appendix 4) and these were transcribed into comma-separated, English graphemes (e.g., l,i,ke) and translated into IPA (e.g., /l/ /aɪ/ /k/) using Australian dialect (Cox, 2012). The model is given the phonemes and related graphemes as input in the training phase. All contractions (e.g., can’t) were removed.

The testing stimuli were lists of words from computerised National Assessment Program – Literacy and Numeracy (NAPLAN) dictation task trials for grades three, five, seven, and nine students (Willet & Gardiner, 2009). This testing set is representative because NAPLAN is a national program that tests the literacy and numeracy of students in grades one, three, five, seven, and nine. Spelling is not assessed using a dictation task in grade one therefore this grade was unable to be included in the computerised trial. NAPLAN is based on the national curriculum, which the Queensland curriculum also adheres to, and is conducted annually in Australia during term two of semester one. NAPLAN has a contentious history and

an analysis of the program itself is beyond the scope of this work; however, the program provides an excellent source of data. The range of student responses on this spelling test is well documented, which provides good comparison data to examine the capacity of the model to reproduce human spelling behaviour. There were a total of 100 testing words across the four testing grades (see Appendix 5). These were translated from English into IPA using Australian dialect (Cox, 2012) in the same manner as the training stimuli. In the testing phase the model is only given phonemes as input (e.g., /l/ /aɪ/ /k/) and produces a graphemic response output (e.g., like).

Grade Three Students. The training stimuli consisted of Queensland curriculum spelling lists for grades one (282 words; Department of Education and Training, 2018a), two (390 words; Department of Education and Training, 2018b), and unit one to three of grade three (286 words; Department of Education and Training, 2018c). There were 958 training words in total (see Appendix 4). Only unit one to three of grade three spelling curriculum were included in the training stimuli as NAPLAN is conducted at the end of unit three in grade three. The testing stimuli were a list of 25 words (see Appendix 5) from a computerised NAPLAN dictation task trial of grade three students (Willet & Gardiner, 2009).

Grade Five Students. The training stimuli consisted of Queensland curriculum spelling lists for grades one (282 words; Department of Education and Training, 2018a), two (390 words; Department of Education and Training, 2018b), three (626 words; Department of Education and Training, 2018c), four (646 words; Department of Education and Training, 2018d), and units one to three of grade five (338 words; Department of Education and Training, 2018e). There were 2282 words in total (see Appendix 4). Only units one to three of grade five spelling curriculum

were included in the training stimuli as NAPLAN is conducted at the end of unit three. The testing stimuli were a list of 25 words (see Appendix 5) from a computerised NAPLAN dictation task trial of grade five students (Willet & Gardiner, 2009).

Grade Seven Students. The training stimuli consisted of Queensland curriculum spelling lists for grades one (282 words; Department of Education and Training, 2018a), two (390 words; Department of Education and Training, 2018b), three (626 words; Department of Education and Training, 2018c), four (646 words; Department of Education and Training, 2018d), five (657 words; Department of Education and Training, 2018e), six (664 words; Department of Education and Training, 2018f), and unit one of grade seven (160 words; Department of Education and Training, 2018g). There were 3425 words in total (see Appendix 4). Only unit one of grade seven spelling curriculum were included in the training stimuli as NAPLAN is conducted at the end of unit three. The testing stimuli were a list of 25 words (see Appendix 5) from a computerised NAPLAN dictation task trial of grade seven students (Willet & Gardiner, 2009).

Grade Nine Students. The training stimuli consisted of Queensland curriculum spelling lists for grades one (282 words; Department of Education and Training, 2018a), two (390 words; Department of Education and Training, 2018b), three (626 words; Department of Education and Training, 2018c), four (646 words; Department of Education and Training, 2018d), five (657 words; Department of Education and Training, 2018e), six (664 words; Department of Education and Training, 2018f), and seven (330 words; Department of Education and Training, 2018g). There were 3595 words in total (see Training stimuli by grade). Spelling is only explicitly taught using dictation tasks until the end of grade seven. Curriculum

for grade eight onwards focuses on the application of learned skills. The testing stimuli were a list of 25 words (see Appendix 5) from a computerised NAPLAN dictation task trial of grade nine students (Willet & Gardiner, 2009).

Procedure

The phoneme and grapheme information for Australian English was loaded into the model prior to training. Once this process was completed, training and testing of the model was conducted in accordance with the process outlined in Chapter 2 and Appendix 1. Each NAPLAN testing grade (i.e., three, five, seven, and nine) was trained and tested separately. During the training process, the model was trained with the relevant training stimuli, and the column length was set to the longest phonemic word length contained within that set. For example, if the model was spelling the words /l/ /aɪ/ /k/ (like), /əʊ/ /p/ /ə/ /n/ (open), and /s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/ (swimming), the column length would be set to 6 to accommodate the word with the longest phonemic length (/s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/).

The testing process was conducted using the same stimuli for all parameters, in all phoneme positions. Each parameter was tested sequentially in parameter position one for each NAPLAN grade, retaining the order of parameters according to the default list. At times when the model was unable to decide about a particular phoneme position within a word, the model automatically switched to using the next parameter according to the default list.

Data were exported to Excel in the form of a response to each phoneme position for each word, ensuring parameter labels and all values were retained for the occasions in which the model was unable to decide, based on the selected parameter and so used the next parameter, for that phoneme position. It was

anticipated that when given spelling lists from the Queensland school curriculum and tested with words from the NAPLAN spelling test, model responses would closely resemble student responses when the parameter selected was analogous to the spelling decision strategy that human spellers are believed to use at that grade. Further, it was anticipated that the learning process would be identifiable over time, with parameter changes per grade in accordance with Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) and educational curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019).

Chapter Four: Results

Examination of data from the model for each testing grade showed that all responses, in all phoneme positions, for all words, were legal English possibilities. Therefore, all responses were considered valid and were retained. Data from the students' responses for each testing grade were transformed in the same manner for direct comparison. This transformation rendered eleven groups containing all ten model parameters and the student data, for each testing grade. The number of data points per phoneme position for each group, and for each testing grade, can be seen in Appendix 6.

For each testing grade, the number and position of correct responses were calculated for each group to compare accuracy and the number and position of incorrect responses were calculated to compare error patterns. Accuracy was defined as a correct response for a phoneme position; error was defined as an incorrect response for a phoneme position. These data were smoothed and fitted to Cauchy distributions as spelling is not normally distributed.

Variability in spelling data relates to speller behaviour as well as properties of the language examined, and these are common issues for language researchers (Norvig, 2012; Teller, 2000). Spellers of all levels are known to be more accurate in the beginning of a word than in later positions, thus skewing the data (Treiman, 1986). Additionally, the testing words had different phoneme lengths and thus, there was a large discrepancy between groups for the number of data points per phoneme position. Further, different letters have different frequencies in different positions (Norvig, 2012; Sedlmeier, Hertwig, & Gigerenzer, 1998), making direct comparisons was not appropriate.

Once the data for accuracy and error for each group had been smoothed and fitted, independent-samples Bayesian *t*-tests were conducted to compare the distributions. All data management and analyses were conducted using the tidyverse (Wickham, 2016), reshape2 (Wickham, 2007), ggplot2 (Kassambara, 2016), and BayesFactor (Morey, Rouder, & Jamil, 2015) packages in R Statistics (R Core Team, 2019). See Appendix 7 for R scripts written for analyses and graphical outputs. Further, the spelling errors made by the model parameters and students were collated for each testing grade (see Appendix 8, Appendix 9, Appendix 10, and Appendix 11 for model and student responses to each word in the testing list per grade).

Grade Three Spelling

The accuracy distributions for each group for grade three level spelling can be seen in Figure 12. Independent-samples Bayesian *t*-tests demonstrated there was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the accuracy distributions for parameters 4: total link weights in/out, 5: number of links in, or 7: total links in/out, and the accuracy distribution of the students' data (Table 1). There was no evidence in favour of the null hypothesis for parameters 1: best link weight, 2: link weights in, 3: link weights out, 6: number of links out, 8: overall links in, 9: overall links out, or 10: overall links in/out, indicating that these distributions likely differ from the students.

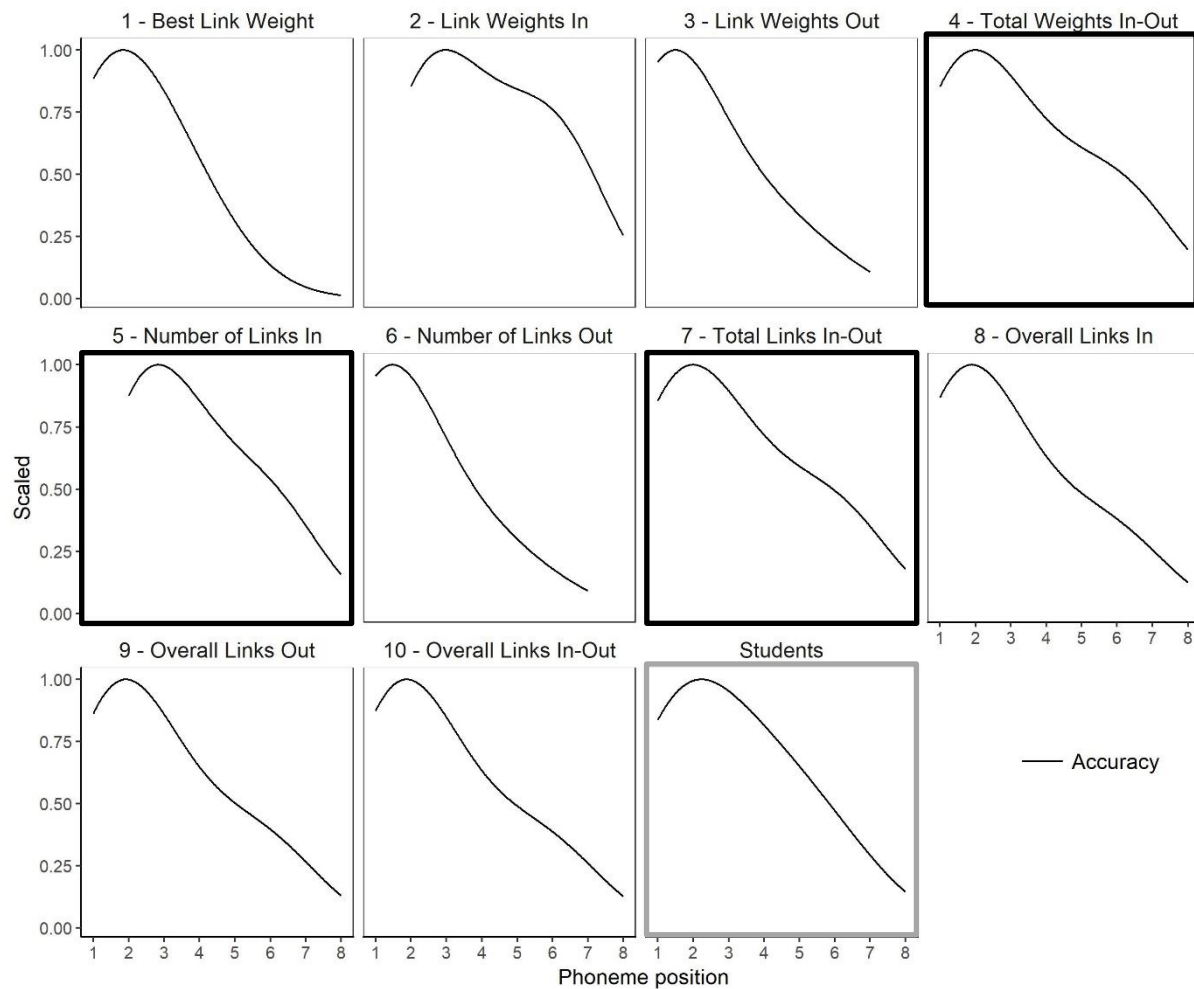


Figure 12. Accuracy distributions for each group at grade three level spelling. Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 1.

Results from the Independent-samples Bayesian t tests comparing the accuracy distributions of groups at grade three level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	bf_{01}	Error
1 - Best Link Weight	8.49263E-18	5.93143E-23
2 - Link Weights In	7.25076E-10	7.5792E-15
3 - Link Weights Out	1.35251E-09	1.43359E-14
4 - Total Weights In & Out	14.22241327	0.000265574
5 - Number of Links In	12.65149551	0.000235472
6 - Number of Links Out	8.20559E-13	7.38295E-18
7 - Total Links In & Out	9.745636313	0.000180058
8 - Overall Links In	0.000366705	5.19606E-09
9 - Overall Links Out	0.003848353	5.77947E-08
10 - Overall Links In & Out	0.000692984	9.97359E-09

The error distributions for each group for grade three level spelling can be seen in Figure 13. There was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the error distributions for parameters 2: link weights in, 4: total link weights in/out, 7: total links in/out, 8: overall links in, 9: overall links out, or 10: overall links in/out and the error distribution of the students' data (Table 2). There was no evidence in favour of the null hypothesis for parameters 1: best link weight, 3: link weights out, 5: number of links in, or 6: number of links out, indicating that these distributions likely differ from the students.

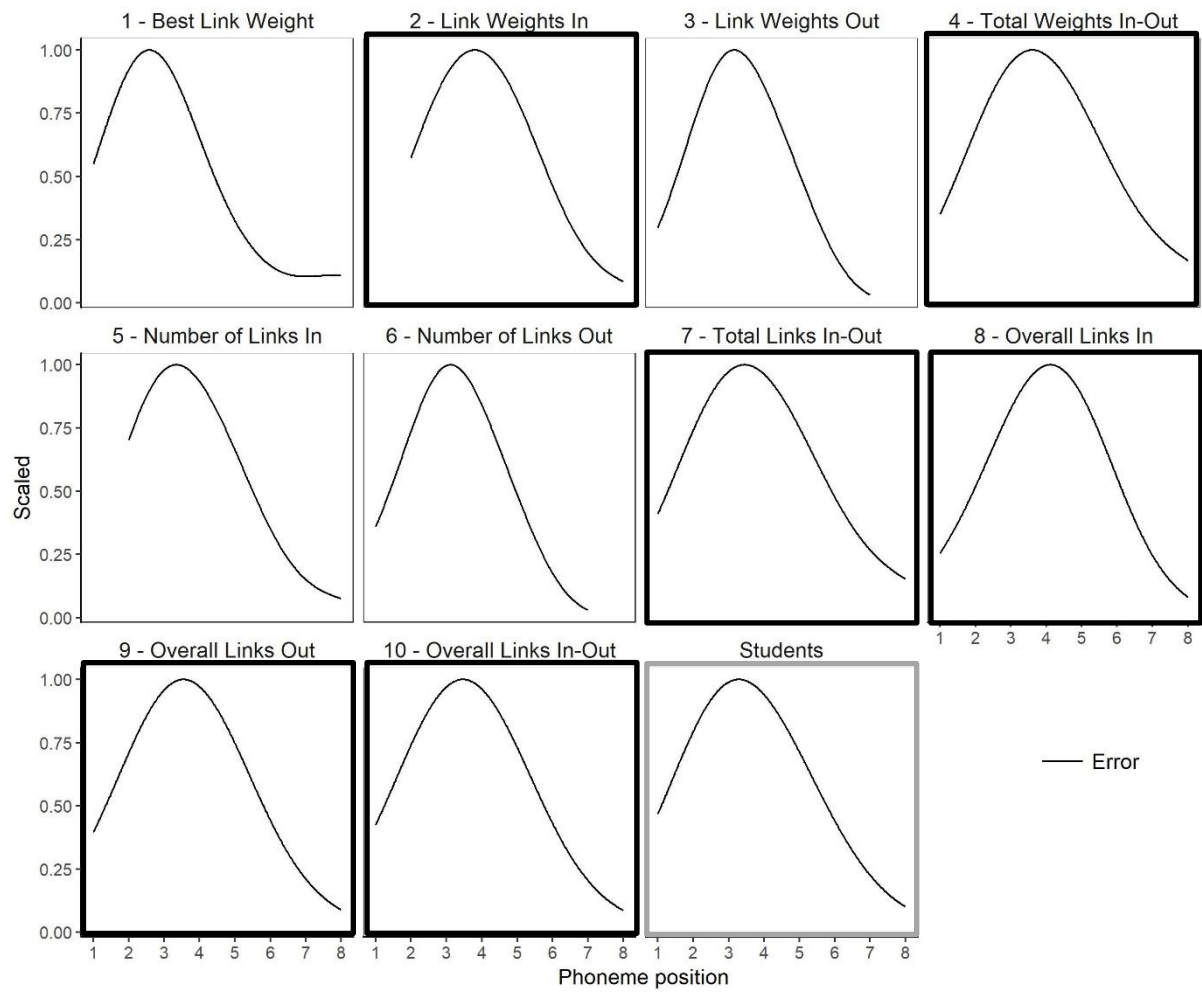


Figure 13. Error distributions for each group at grade three level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 2.

Results from the Independent-samples Bayesian t tests comparing the error distributions of groups at grade three level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	Bf ₀₁	Error
1 - Best Link Weight	2.72273E-09	2.93149E-14
2 - Link Weights In	12.31727149	0.000229071
3 - Link Weights Out	0.202556994	3.36841E-06
4 - Total Weights In & Out	12.40036457	0.00023066
5 - Number of Links In	0.798292171	1.37695E-05
6 - Number of Links Out	0.253271489	4.23668E-06
7 - Total Links In & Out	12.49668089	0.000232502
8 - Overall Links In	3.959297417	7.13418E-05
9 - Overall Links Out	10.07576764	0.000186331
10 - Overall Links In & Out	10.87093499	0.000201464

Table 3 indicates the responses made by the model and students to homophones within the grade three spelling list. See Appendix 8 for a full list of the model and student responses for each word in the grade three testing list.

Table 3.

Responses given by the model and students for homophones within the grade three testing list. The homophones for the word from the spelling list are indicated in brackets.

Word	Students	Model
great	great	grayt
(grate)	grate	greyt
	grat	grat
	graet	
	gat	
	greate	
	grant	
pour	pour	pour
(pore)	pore	por
(poor)	poor	pau
(paw)	por	
	paw	
	powr	
	pure	
	poar	
	powe	
	pare	
	pall	

Grade Five Spelling

The accuracy distributions for each group for grade five level spelling can be seen in Figure 14. Independent-samples Bayesian *t*-tests demonstrated that there was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the accuracy distributions for parameters 2: link weights

in, 4: total link weights in/out, 5: number of links in, or 7: total links in/out, and the accuracy distribution of the students' data (Table 4). There was no evidence in favour of the null hypothesis for parameters 1: best link weight, 3: link weights out, 6: number of links out, 8: overall links in, 9: overall links out, 10: overall links in/out, indicating that these distributions likely differ from the students.

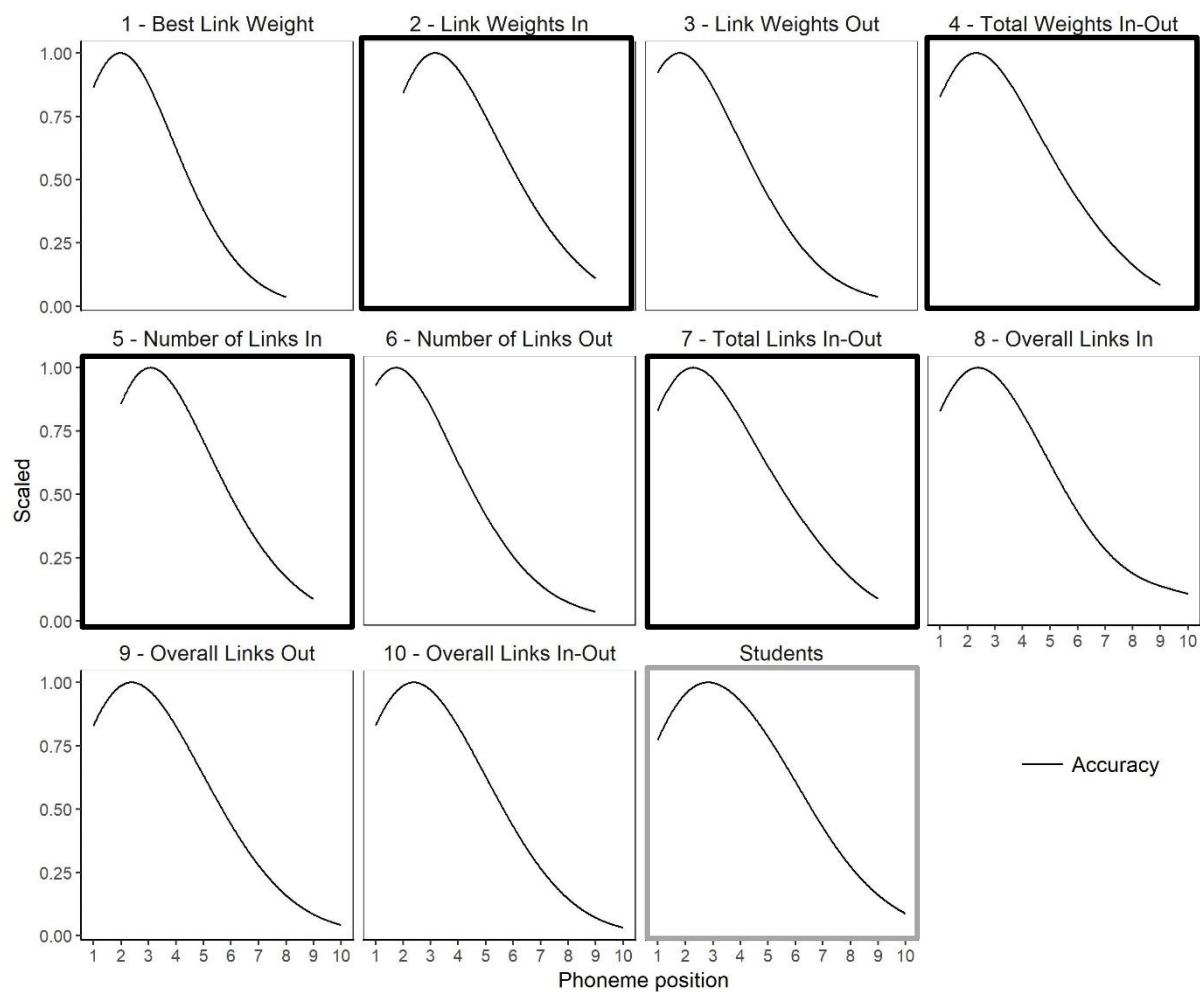


Figure 14. Accuracy distributions for each group at grade five level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 4.

Results from the Independent-samples Bayesian t tests comparing the accuracy distributions of groups at grade five level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	bf_{01}	Error
1 - Best Link Weight	0.000248863	3.49312E-09
2 - Link Weights In	13.09833841	0.000244018
3 - Link Weights Out	9.3061E-08	1.08521E-12
4 - Total Weights In & Out	3.270130955	5.86135E-05
5 - Number of Links In	2.834036586	5.05976E-05
6 - Number of Links Out	5.86184E-09	6.42086E-14
7 - Total Links In & Out	5.35093128	9.72237E-05
8 - Overall Links In	0.021292695	3.33939E-07
9 - Overall Links Out	0.004982197	7.53096E-08
10 - Overall Links In & Out	0.001582067	2.32386E-08

The error distributions for each group for grade five level spelling can be seen in Figure 15. There was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the error distributions for parameters 1: best link weight, 6: number of links out, 7: total links in/out, 8: overall links in, 9: overall links out, or 10: overall links in/out, and the error distribution of the students' data (Table 5). There was some evidence in favour of the null hypothesis for parameter 5: number of links in, but it was not convincing. There was no evidence in favour of the null hypothesis for parameters 2: link weights in, 3: link weights out, or 4: total link weights in/out, indicating that these distributions likely differ from the students.

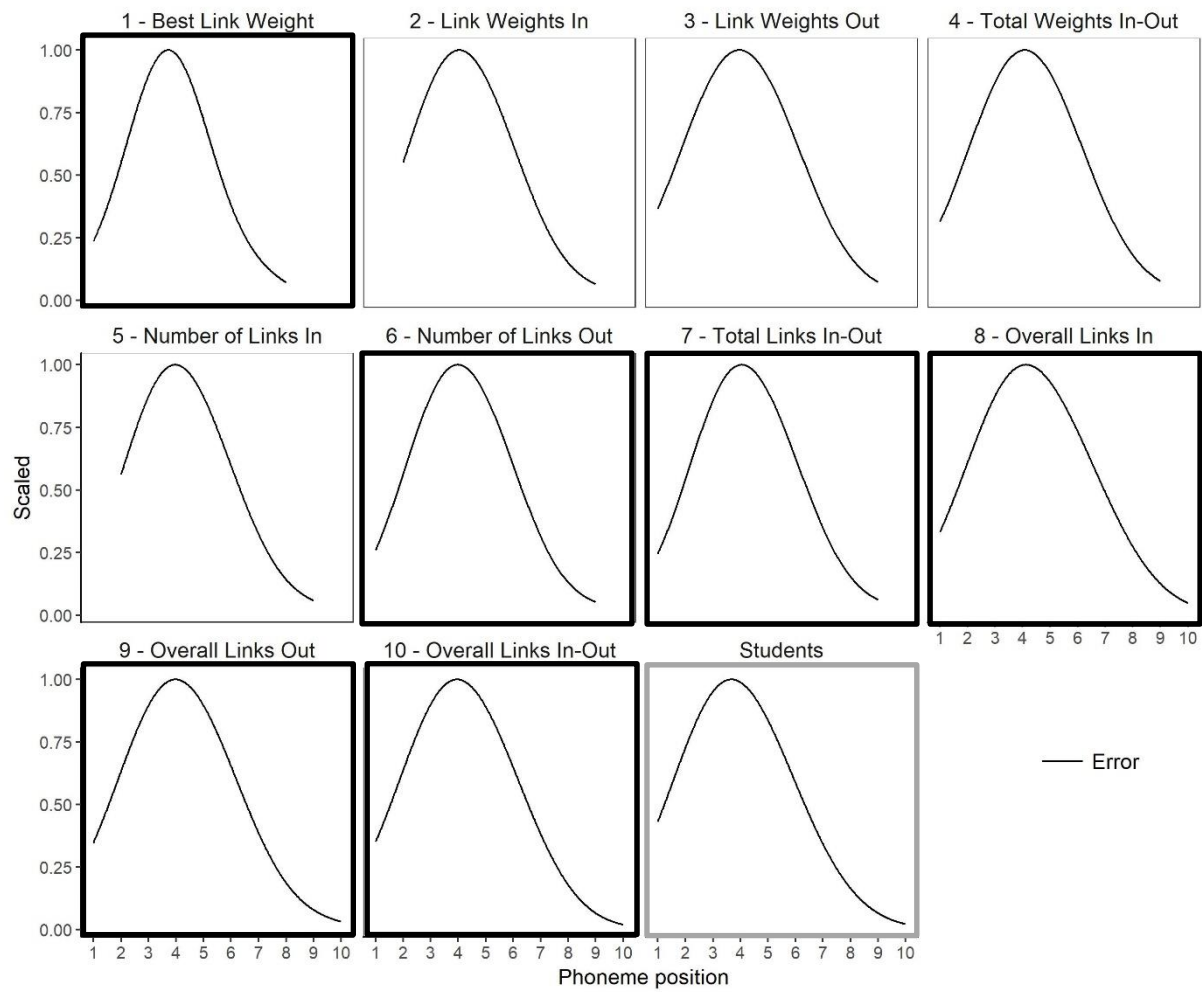


Figure 15. Error distributions for each group at grade five level spelling. Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 5.

Results from the Independent-samples Bayesian t tests comparing the error distributions of groups at grade five level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	bf ₀₁	Error
1 - Best Link Weight	13.19891458*	0.000245944
2 - Link Weights In	0.499247692	8.50357E-06
3 - Link Weights Out	0.12847738	2.11104E-06
4 - Total Weights In & Out	0.321565694	5.4132E-06
5 - Number of Links In	1.181048372	2.05884E-05
6 - Number of Links Out	8.854062544	0.000163147
7 - Total Links In & Out	5.583845698	0.000101576
8 - Overall Links In	2.773771505	4.94923E-05
9 - Overall Links Out	14.15688088	0.000264316
10 - Overall Links In & Out	14.27869499	0.000266655

Table 6 indicates the responses made by the model and students to homophones within the grade five level spelling list. See Appendix 9 for a full list of the model and student responses for each word in the grade five testing list.

Table 6.

Responses given by the model and students for homophones within the grade five testing list. The homophones for the word from the spelling list are indicated in brackets.

Word	Students	Model
great	great	grate
(grate)	grate	grat
	grat	
	graet	
	girte	
	gat	
	geat	
muscle	muscle	musl
(mussel)	musle	
	muscel	
	musel	
	mucle	
	mussle	
	mussel	
	musal	
effects	effects	effects
(affects)	efects	efects
	affects	iffects
	effect	ifects
	efex	
	effets	
	efecs	

Grade Seven Spelling

The accuracy distributions for each group for grade seven level spelling can be seen in Figure 16. Independent-samples Bayesian t-tests demonstrated that there was some evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the accuracy distributions for parameter one and the accuracy distribution of the students' data (Table 7). There was no evidence in favour of the null hypothesis for any other parameter, indicating that these distributions likely differ from the students.

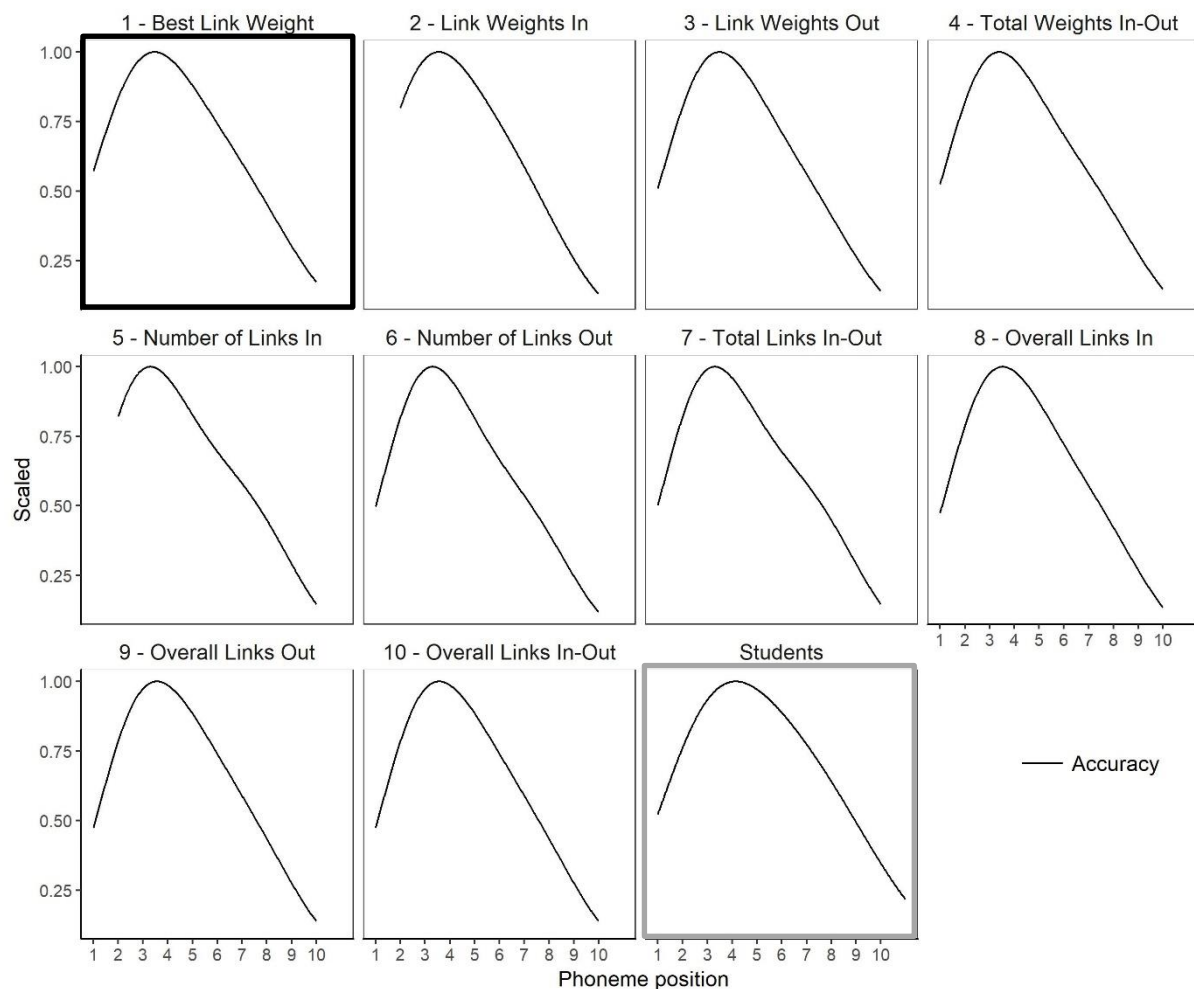


Figure 16. Accuracy distributions for each group at grade seven level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis

are outlined in black and the distribution of students is outlined in grey for comparison.

Table 7.

Results from the Independent-samples Bayesian t tests comparing the accuracy distributions of groups at grade seven level of spelling. Distributions with some evidence for the null hypothesis are indicated in bold.

Parameter	bf_{01}	Error
1 - Best Link Weight	1.330784877	2.32738E-05
2 - Link Weights In	0.097223712	1.58589E-06
3 - Link Weights Out	0.007473378	1.14126E-07
4 - Total Weights In & Out	0.011518424	1.77838E-07
5 - Number of Links In	0.022113099	3.47142E-07
6 - Number of Links Out	5.22737E-05	7.06618E-10
7 - Total Links In & Out	0.015265436	2.37385E-07
8 - Overall Links In	0.007995148	1.22303E-07
9 - Overall Links Out	0.045423324	7.26415E-07
10 - Overall Links In & Out	0.045423324	7.26415E-07

The error distributions for each group for grade seven level spelling can be seen in Figure 17. There was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the error distributions for parameter 2: link weights in, 4: total link weights in/out, 5: number of links in, 7: total links in/out, 8: overall links in, 9: overall links out, or 10: overall links in/out, and the error distribution of the students' data (Table 8). There was no evidence in favour of the null hypothesis for parameters 1: best link weight, 3: link weights out, or 6: number of links out, indicating that these distributions likely differ from the students.

There were no homophones in the grade seven testing list. See Appendix 10 for a full list of the model and student responses for each word in the grade seven testing list.

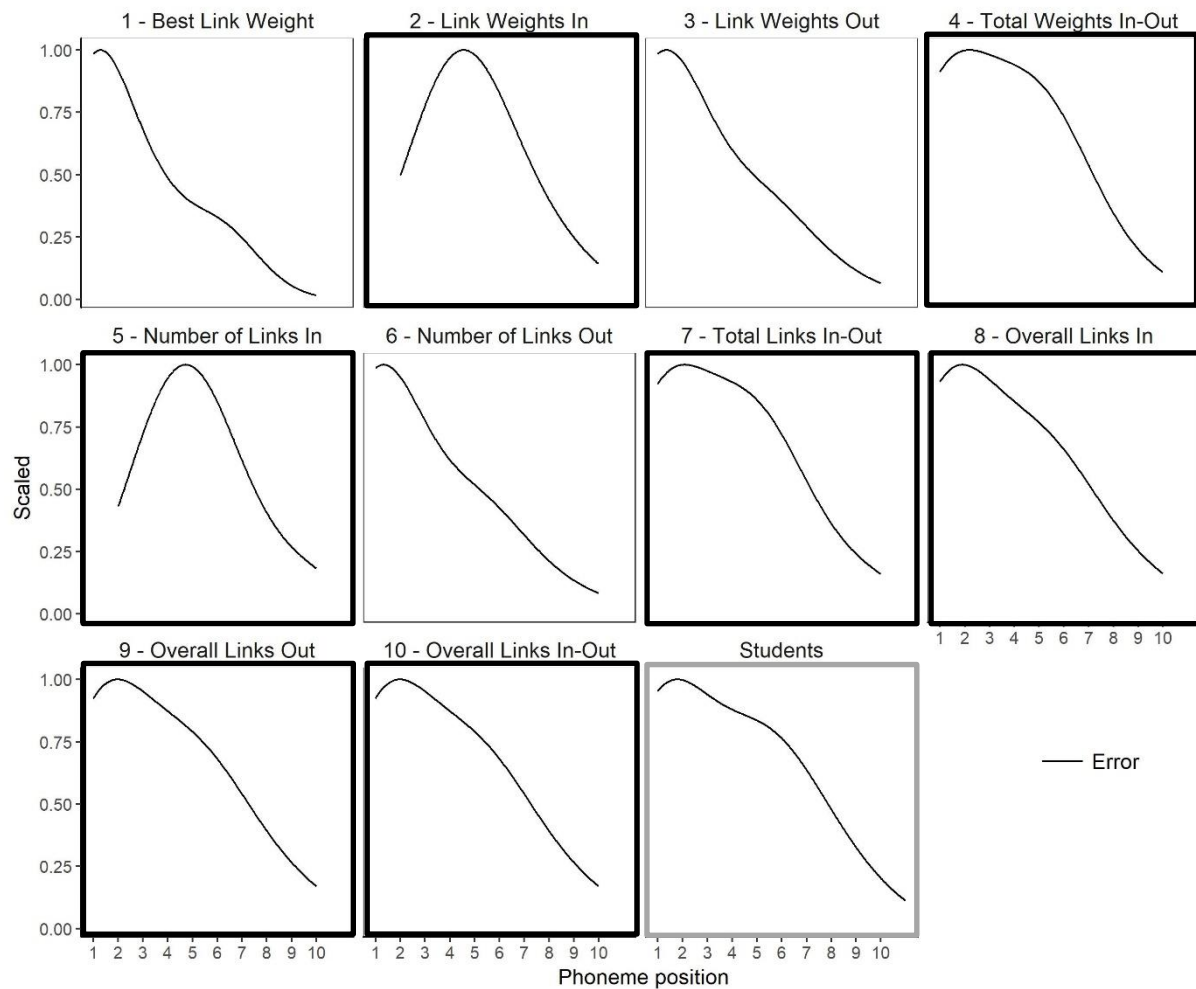


Figure 17. Error distributions for each group at grade seven level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 8.

Results from the Independent-samples Bayesian t tests comparing the error distributions of groups at grade seven level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	bf ₀₁	Error
1 - Best Link Weight	4.95738E-34	1.3562E-39
2 - Link Weights In	8.991472186	0.000165749
3 - Link Weights Out	5.68491E-19	3.73698E-24
4 - Total Weights In & Out	7.810800195	0.00014342
5 - Number of Links In	7.91770757	0.000145438
6 - Number of Links Out	5.3726E-16	4.11401E-21
7 - Total Links In & Out	5.196793164	9.43462E-05
8 - Overall Links In	14.21958939	0.00026552
9 - Overall Links Out	11.11293538	0.000206077
10 - Overall Links In & Out	11.11293538	0.000206077

Grade Nine Spelling

The accuracy distributions for each group for grade nine level spelling can be seen in Figure 18. Independent-samples Bayesian t-tests demonstrated that there was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the accuracy distributions for parameter seven and the accuracy distribution of the students' data (Table 9). There was no evidence in favour of the null hypothesis for any other parameter, indicating that these distributions likely differ from the students.

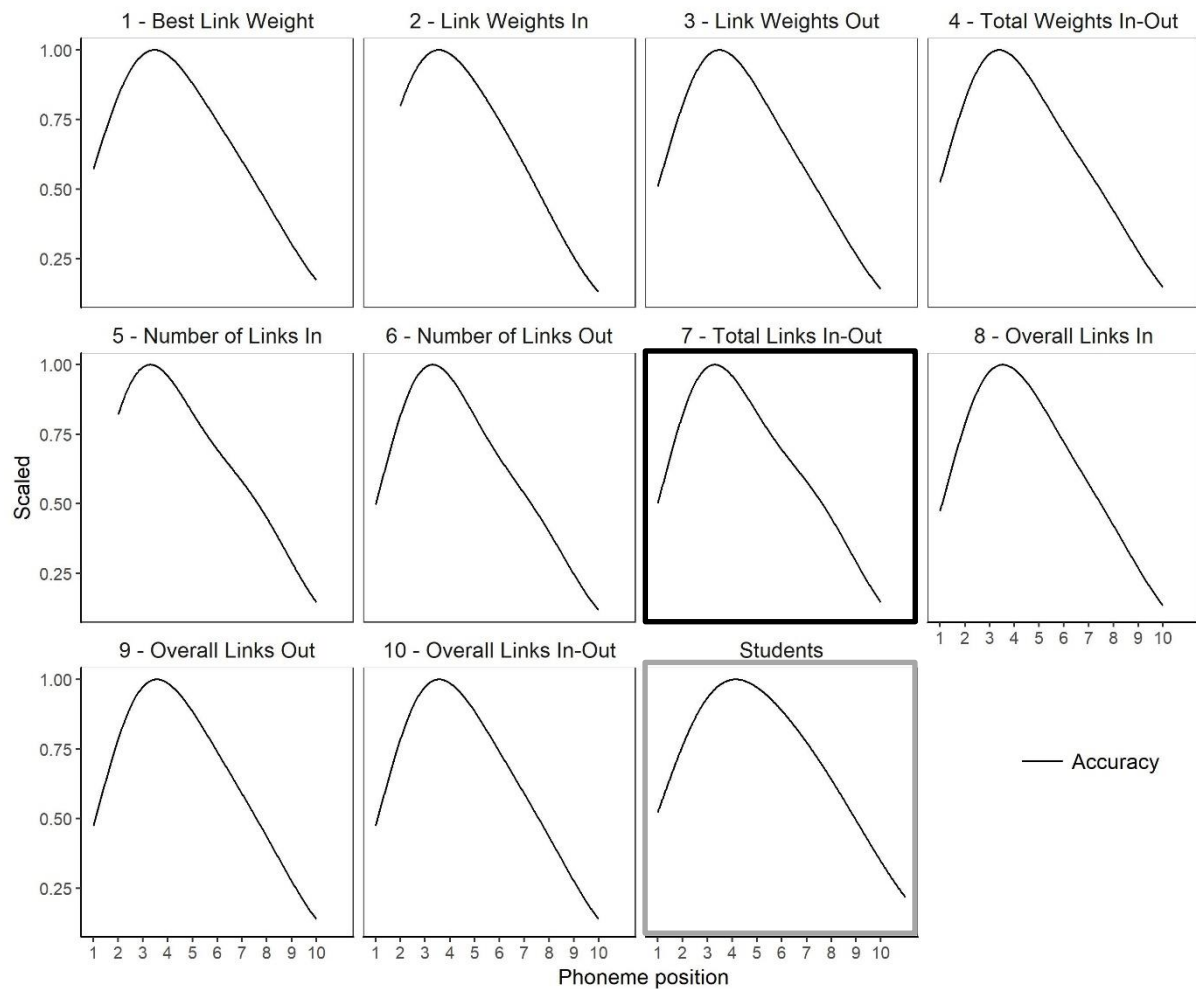


Figure 18. Accuracy distributions for each group at grade nine level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 9.

Results from the Independent-samples Bayesian t tests comparing the accuracy distributions of groups at grade nine level of spelling. Distributions with some evidence for the null hypothesis are indicated in bold.

Parameter	bf_{01}	Error
1 - Best Link Weight	0.568105429	0.00000971
2 - Link Weights In	5.84304E-07	7.11E-12
3 - Link Weights Out	1.50227E-09	1.6E-14
4 - Total Weights In & Out	0.148394486	0.00000245
5 - Number of Links In	0.007581823	0.000000116
6 - Number of Links Out	2.58325E-10	2.64E-15
7 - Total Links In & Out	2.727633457	0.0000486
8 - Overall Links In	2.78484E-05	3.71E-10
9 - Overall Links Out	0.001543973	2.27E-08
10 - Overall Links In & Out	0.001543973	2.27E-08

The error distributions for each group for grade nine level spelling can be seen in Figure 19. There was positive evidence in favour of the null hypothesis (Kass & Raftery, 1995); there was no difference between the error distributions for parameter 1: best link weight and the error distribution of the students' data (Table 10). There was no evidence in favour of the null hypothesis for any other parameter, indicating that these distributions likely differ from the students.

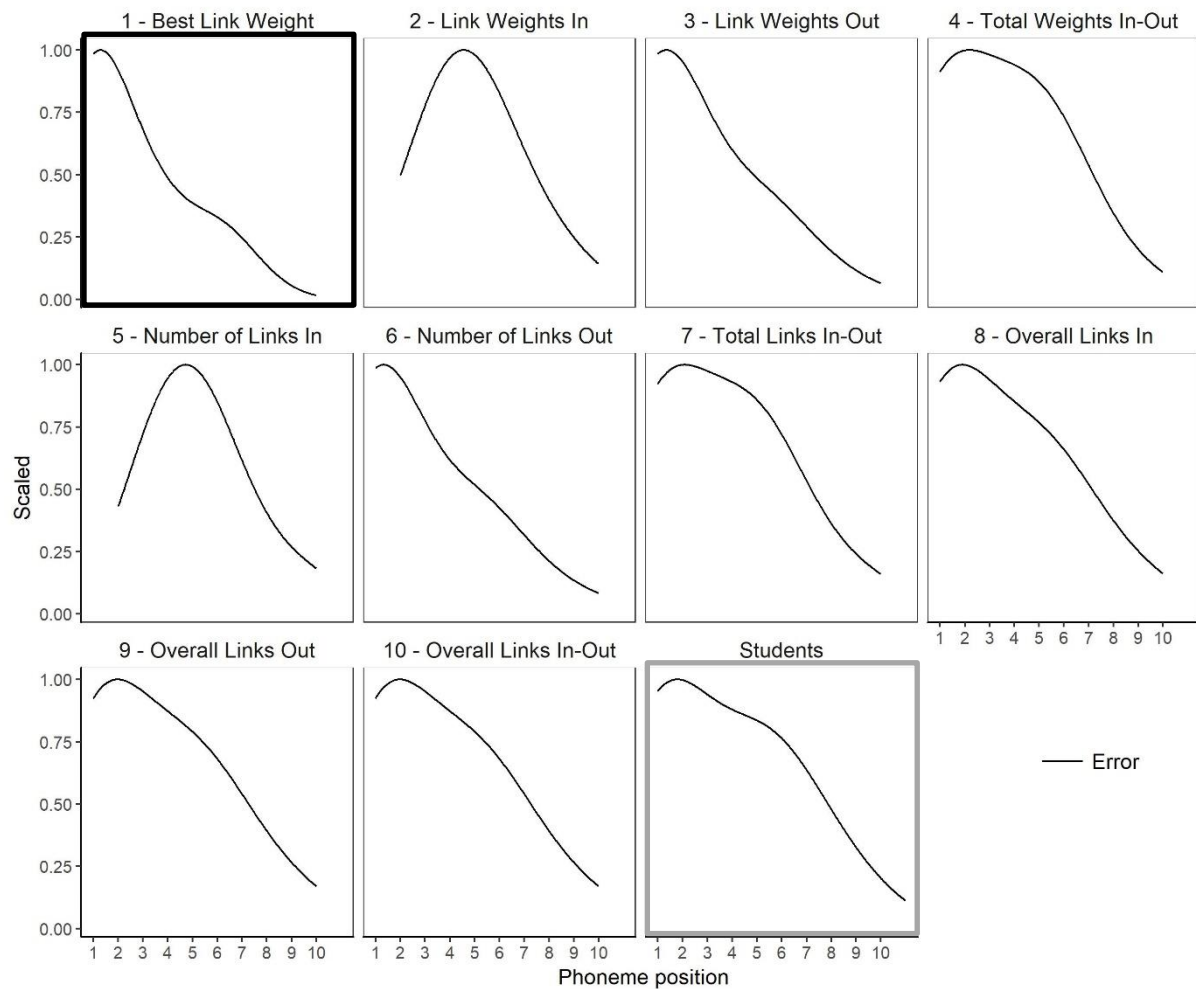


Figure 19. Error distributions for each group at grade seven level spelling.

Distributions for parameters with positive evidence in favour of the null hypothesis are outlined in black and the distribution of students is outlined in grey for comparison.

Table 10.

Results from the Independent-samples Bayesian t tests comparing the error distributions of groups at grade nine level of spelling. Distributions with positive evidence for the null hypothesis are indicated in bold.

Parameter	bf ₀₁	Error
1 - Best Link Weight	4.183162807	0.0000755
2 - Link Weights In	0.228669574	0.00000381
3 - Link Weights Out	9.08428E-09	1E-13
4 - Total Weights In & Out	0.000142669	1.98E-09
5 - Number of Links In	4.11868E-06	5.24E-11
6 - Number of Links Out	3.98381E-20	2.47E-25
7 - Total Links In & Out	1.40306E-10	1.41E-15
8 - Overall Links In	5.50106E-22	3.09E-27
9 - Overall Links Out	2.27287E-22	1.25E-27
10 - Overall Links In & Out	2.27287E-22	1.25E-27

Table 11 indicates the responses made by the model and students to homophones within the grade five level spelling list. See Appendix 11 for a full list of the model and student responses for each word in the grade nine testing list.

Table 11.

Responses given by the model and students for homophones within the grade nine testing list. The homophones for the word from the spelling list are indicated in brackets.

Word	Students	Model
faint	faint	fant
(feint)	feingt	
	fient	
	fant	
	fante	
	feighnt	
	fiant	

Chapter Five: Discussion

To determine whether a model is effective at reproducing human behaviour, validation must be conducted. I assessed operational validity both theoretically (i.e., conceptual and predictive validity) and empirically (i.e., data, event, and predictive validity) to provide robust evidence that spelling can be modelled as a process of Bayesian decision making. Initial data validity was established by training the model with spelling lists from the Queensland school curriculum (Department of Education and Training, 2018a-g) and testing the model with words from a NAPLAN computerised dictation task trial (Willet & Gardiner, 2009). The use of the dictation task trial also established event validity as the model completed the same task as the students. Predictive validity was examined by comparing Bayesian spelling model responses with student responses. Recall, I anticipated Bayesian spelling model responses would resemble student responses (i.e., empirical validation) when the selected parameter was analogous to the types of decisions human spellers make at that grade (i.e., theoretical validation) according to the Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). As such, each NAPLAN testing grade has been examined individually, from grade three (early to mid-spelling) to grade nine (proficient spelling). The final section examines the overall progression of spelling responses, comparing the model and students.

Grade Three Spelling

Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) suggest students in grade three use later phonological and early orthographic strategies to make spelling decisions, which is reflected in the spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of

Education and Training, 2018a-c). In this stage, students are refining their knowledge of phonological relationships and beginning to learn orthographic spelling rules, such as the “two vowels walking”, and “bossy R” rules (Bell, 2004; Cassar & Treiman, 1997; Hayes, Treiman, & Kessler, 2006; Rippel, 2019; Stirling, 2011; Treiman, 1993). Therefore, if the model replicates a human speller at grade three, the distribution of parameters that use this strategy—specifically parameter 4: *total link weights in/out*—should resemble the student distributions. As humans are not perfect spellers, I expect data for both accuracy (hypothesis 1) and error (hypothesis 2) will support my hypotheses.

Accuracy

Accuracy was assessed as a distribution and was defined as a correct response for a phoneme position. Hypothesis 1 was supported. Independent-samples Bayesian *t*-tests showed no difference between the accuracy distribution of parameter 4: *total link weights in/out* (which uses phonological mapping and letter position frequencies to make decisions about spellings) and the grade three students' accuracy distribution. Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019) predict use of this strategy, which provides operational validation. Furthermore, results align with research findings that grade three spellers largely use phonological strategies but are beginning to use orthography (Cassar & Treiman, 1997; Hayes, Treiman, & Kessler, 2006).

The other Bayesian model parameters that use information from later phonological and early orthographic strategies are parameters 2 and 3. These parameters describe how information is used when making a spelling decision using

this overall strategy; however, there was no evidence that these accuracy distributions resembled those of students. There was evidence for two parameters from a different class.

There was evidence supporting the null hypothesis that there is no difference between parameter 5: *number of links in* and parameter 7: *total links in/out*, compared to the students' accuracy distributions. Parameters 5 and 7 use a later orthographic strategy, which involves letter position information and N-grams. Parameter 5 uses a feed-forwards process to derive a spelling response, whereas parameter 7 represents the overall strategy. Interestingly, students appear to be using this later orthographic strategy with high accuracy, even though it represents the use of more complex orthographic strategies (i.e., N-grams) than would be predicted. This accuracy could be related to the use of letter position information. Like parameter 4, parameters 5 and 7 use letter position information to make spelling decisions, indicating that this information might be important for spelling decisions at the grade three level. This idea aligns with previous research highlighting the importance of letter position in experiments manipulating late phonological, early orthographic information (Scaltritti & Balota, 2013; Treiman & Boland, 2017).

Error

Error was defined as an incorrect response for a phoneme position and was assessed as a distribution. Results supported hypothesis 2 for error data. Independent-samples Bayesian *t*-tests showed there was no difference between the error distribution of parameter 4: *total link weights in/out* and the error distribution of grade three students. As this parameter uses phonological mapping and letter position frequencies to make decisions about spellings, use of this strategy would be

predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), which provides operational validation for the model at grade three level in terms of error.

The other Bayesian model parameters using early orthographic strategies are parameters 2: *link weights in* and 3: *link weights out*. These parameters describe how information is used when making a spelling decision with this overall early orthographic strategy. There was no evidence for parameter 3, but there was evidence that the error distribution of parameter 2 resembled the student data. This finding indicates that students are using a feed-forwards process (i.e., parameter 2) to make guesses about spellings in grade three; however, they are not achieving accuracy with this process.

There was also evidence in favour of the null hypothesis for parameters 7: *total links in/out*, 8: *overall links in*, 9: *overall links out*, and 10: *overall links in/out*, indicating that these distributions resembled the error distributions of grade three students. This finding demonstrates that students are using these strategies in grade three, albeit not successfully. Parameter 7 represents a mid-level orthographic strategy, which is a more advanced strategy than that of parameter 4 (according to stage models: Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). Parameters 8, 9, and 10 also represent a more complex orthographic strategy, utilising n-grams over all positions rather than specific letter positions. These results indicate that students are attempting to use more advanced orthographic strategies in grade three.

Together, the accuracy and error data suggest that students are using parameter 4: *total link weights in/out* for accuracy, as predicted; however, they are

also using parameters 5: *number of links in* and 7: *total links in/out*. Furthermore, students are making errors on parameter 4 as expected, but also making spelling attempts with parameters 2: *link weights in*, 7: *total links in/out*, 8: *overall links in*, 9: *overall links out*, and 10: *overall links in/out*. These findings indicate that regardless of accuracy, students are making attempts at spelling using more advanced strategies than would be predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). This finding is in line with previous research demonstrating more complex use of orthography and morphology in early grades than is predicted by typical Stage models (Chliounaki & Bryant, 2007; Kemp & Bryant, 2003; Kemp 2006; Treiman & Cassar, 1996). Overall, these findings indicate that the model is effectively reproducing human spelling behaviour for accuracy and error at the grade three level.

Homophones

The occurrence of two homophones in the grade three testing list (“great” and “pour”) is a limitation in the current study (see Table 3). Examination of the data showed that none of the model parameters produced a correct spelling for the word “great,” nor its homophone “grate”. Further inspection showed that the model parameters were always correct for the consonants in the first (“g”), second (“r”), and final positions (“t”); however, responses for the vowel sound in the third position (“ea”) included “a” (“grat”), “ay” (“grayt”; 30%), and “ey” (“greyt”). The student responses show a similar pattern, as responses for position one were always correct, and position two was correct on all but one occasion (“gat”); however, the students were more influenced by the homophone in the remaining two positions of the word. Responses in the final position included either the correct “t” or incorrect

“te”, and the homophone “grate” was the most frequent error produced by the students. The next most frequent error produced by the model was “grat”; however, the students did not produce the spellings “grayt” or “greyt”, even though they are legal English spellings.

Examination of parameter responses for the word “pour” (see Table 3) show that responses from parameter six produced correct spellings for the whole word. The remaining parameters provided correct spellings for position one (“p”). Responses for the final vowel sound were incorrect; “or”, and “au”. Interestingly, none of the parameters provided the correct spelling for the homophones “poor,” “pore” or “paw”.

Examination of student responses for the word “pour” shows a similar pattern, with responses for position one always being correct. For the final vowel position, students again appeared to be more influenced by the homophones as compared to the model. The homophone “pore” was the most frequent error produced by students, followed by the other homophone “poor”. These homophones were followed by the most frequent error produced by the model parameters, “por”. The students did not produce the spelling “pau”, although it is a legal English spelling.

It is possible that the homophones confounded analysis of parameter responses for these words in the testing list. Neither “great” nor its homophone “grate” were produced correctly by model parameters, and “pour” was produced correctly by one parameter, but its homophones “pore” and “poor” were not produced at all. In addition, responses from the students appeared to be more affected by the homophones; even with additional context information, students produced homophones as the most frequent errors. Student responses to homophones indicate only minor differences from model responses, which importantly indicates

that, in contrast to the modified Stage model of spelling (Treiman & Cassar, 1996), students may not be utilising morphological information to make a spelling decision. Interestingly, the next most frequent errors matched those of the model parameters; however, the impact of homophones for grade three level spelling remains unclear.

Grade Five Spelling

Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985) suggest that students in grade five use predominantly orthographic strategies to make spelling decisions, which is reflected in the Australian spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019). At this grade, students are learning orthographic rules such as “I before E, except after C” and the “fizzle” rule (Australian Curriculum, Assessment and Reporting Authority, 2019; Department of Education and Training, 2018x-u Newman, 2019; Stirling, 2011). Therefore, if the model replicates the behaviour of a human speller, the distribution of parameters that use this strategy, specifically parameter 7: *total links in/out*, should resemble the distributions of the grade five students. As humans are imperfect spellers (Treiman & Boland, 2017), parameter 7 should be represented for both accuracy and error; results support both hypotheses 3 and 4.

Accuracy

Results demonstrated support for hypothesis 3; independent-samples Bayesian *t*-tests showed there was no difference between the accuracy distribution of parameter 7: *total links in/out* and the accuracy distribution. This parameter uses both N-grams and letter position information to make spelling decisions, making it a mid-orthographic strategy. As use of this strategy at grade five level is predicted by

Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), this result provides operational validation for the model at the grade five level in terms of accuracy. Further, these results align with findings that spellers develop a relative position map of orthographic relationships and use this map to make spelling decisions (Dandurand et al., 2011).

The other Bayesian model parameters from the class utilising mid-orthographic strategies are parameters 5: *number of links in* and 6: *number of links out*. These parameters describe how information is used when making a spelling decision using this overall strategy. Results demonstrated no evidence for parameter 6, but there was evidence that the distribution for parameter 5 resembled the grade five students' accuracy data. This result indicates that students are utilising letter position and N-gram information in a feed-forwards manner (parameter 5) when making spelling decisions.

There was also evidence supporting the null hypothesis that there is no difference between parameters 2: *link weights in* and 4: *total link weights in/out*, and the accuracy distributions of grade five students. These parameters utilise an earlier orthographic strategy of spelling, which includes letter position relationships, but not N-grams. Parameter 2 uses a feed-forwards process to derive a spelling response, whereas parameter 4 represents an overall early orthographic strategy. Both parameters were represented in the error data for grade three students, indicating that students gain proficiency in the use of these strategies from grade three to grade five. These findings provide further evidence that students are utilising letter position information, but only as an overall strategy and in a feed-forwards, rather than feed-backwards manner. This finding aligns with previous research that

suggests spellers plan spellings ahead within words rather than adopt a serial process (Scaltritti & Balota, 2013; Treiman & Boland, 2017).

Error

Results demonstrated support for hypothesis 4; independent-samples Bayesian *t*-tests showed there was no difference between the error distribution of parameter 7: *total links in/out* and the error distribution of grade five students. This parameter uses both letter position and N-grams to make decisions about spellings. As use of this strategy is predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), the current results provide operational validation for the model at grade five in terms of error.

The other Bayesian model parameters from the mid-orthographic class are parameters 5: *number of links in* and 6: *number of links out*. These parameters describe how information is used when making a spelling decision using an overall mid-orthographic strategy. There was no evidence for parameter 5, but there was positive evidence that the error distribution of parameter 6 resembled the student data. Given there was evidence for parameter 5 for accuracy, it appears students are using this strategy to make spelling decisions, but unlike parameters 6 and 7, they are not making errors using this strategy. This finding means that students are most accurate when using a feed-forwards approach (parameter 5) and attempt but make errors when using a feed-backwards approach (parameter 6), for orthographic spelling strategies (parameter 7).

There was also positive evidence in favour of the null hypothesis for parameters 1: *best link weight*, 8: *overall links in*, 9: *overall links out*, and 10: *overall*

links in/out, indicating that these distributions resemble the error distributions of students. Thus, students are using these strategies in grade five, albeit not successfully. Parameter 1 represents an optimal spelling strategy, whereas parameters 8, 9, and 10 relate to advanced orthographic strategies.

As students learn orthographic strategies explicitly from grade three and morphological strategies from grade six, grade five students have possibly begun using these more complex strategies, which are the last aspects of an optimal spelling strategy. Thus, students are attempting these strategies to make spelling decisions, but not achieving accuracy. This trial and error (i.e., learning) is expected according to previous research (Cassar, & Treiman, 1997; Hayes, Treiman, & Kessler, 2006; Treiman, 1993), Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and educational curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019); there is also evidence of this inaccuracy in spelling research (Kemp, Mitchell, & Bryant, 2017). Overall, these findings indicate that the model is effectively reproducing human spelling behaviour for accuracy and error in the learning of spelling at grade five level.

Homophones

There were three homophones in the grade five testing list (see Table 6): “great” (“grate”), “muscle” (“mussel”) and “effects” (“affects”). As in grade three, examination of the data showed that none of the model parameters produced a correct spelling for the word “great”; however, unlike grade three, the model produced correct spelling of the homophone “grate.” Further inspection showed that model parameters were always correct for the consonants in the first (“g”) and second (“r”) positions, but the model responded with “a” (“grat,” “grate”) for the vowel

sound in the third position. The model produced the final “t” consonant correctly for “grat”, but incorrectly for the homophone “grate.” The student responses showed a similar pattern; responses for position one were always correct and position two was correct on all but one occasion (“gat”). The students also appeared to be influenced by the homophone in the remaining two positions of the word. Like the model, responses in the final position included either the correct “t” or incorrect “te”, and the homophone “grate” was the most frequent error produced by students. The next most frequent error was the same as that produced by the model parameters: “grat.”

The second homophone in the testing list was “muscle” (see Table 6). Once again, the model parameters did not spell this word correctly; however, the parameters were also incorrect with the spelling of the homophone (“mussel”). In this case, both the model and the students produced correct graphemes for positions one (“m”) and two (“u”). However, the model and some student responses were incorrect for the graphemes in the remaining positions: “sc” and “le.” It is possible that the homophone confounded model parameter responses in that the produced spelling “musl” could be a combination of both the testing word “muscle” and its homophone “mussel.” However, this explanation is improbable as the spelling is incorrect for both words.

The final homophone was “effects” (see Table 6). The model spelled the word correctly and did not produce the spelling for the homophone (“affects”). Indeed, both the model and the students made the same error most frequently (“effects”); furthermore, the students produced the misspelling more frequently than the homophone. The major difference between the responses of the model and responses of students was that the model also produced the grapheme “i” for the response to the initial position. A transcription error in the initial phoneme could

explain this error; however, I inspected the phonetic transcription in the Merriam-Webster dictionary (United States English pronunciation; “Effects,” n.d. a) and the Oxford dictionary (United Kingdom English pronunciation; “Effects,” n.d. b), and confirmed the transcription using an Australian pronunciation guide (Cox, 2012), making this explanation unlikely.

Grade Seven Spelling

Stage models of spelling and Australian spelling curriculum deem grade seven students to be near proficient spellers. Between grade five and grade seven, these students are taught advanced orthographic and morphological strategies to make spelling decisions (Australian Curriculum, Assessment and Reporting Authority, 2019). For example, students learn plural noun and doubling rules, which incorporate both orthographic and morphological elements (Department of Education and Training, 2018e-g). Therefore, if the model replicates human spelling behaviour, the distribution of parameters that use this strategy, specifically parameter 10: *total links in/out*, should resemble the distributions of grade seven students. As humans are imperfect spellers, parameter 10 should be represented for both accuracy and error. Results provided support for hypothesis 6 (error) only.

Accuracy

Results did not support hypothesis 5 for accuracy; independent-samples Bayesian *t*-tests showed no support for the null hypothesis, meaning the accuracy distribution for parameter 10 was different from the students' accuracy distribution. This parameter uses N-grams across letter positions to make spelling decisions,

which represents an advanced orthographic and morphological strategy. Instead there was some support for parameter 1: *best link weight*.

Parameter 1 represents an optimal strategy for spelling. Given that by the end of grade seven students are considered proficient spellers, and have progressed through all three stages of spelling, it is logical that students who were completing term two of grade seven when NAPLAN was administered could already be using an optimal strategy (Australian Curriculum, Assessment and Reporting Authority, 2019). Despite results not supporting the hypothesis, findings could be interpreted as support for operational validation of the model as use of an optimal spelling strategy at grade seven would be predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019).

Interestingly, parameter 1 was the only parameter that resembled the distributions of students for accuracy at the grade seven level. It is possible that the difference between grades five and seven represents a greater learning gap than between grades three and five, meaning the model was unable to capture the nuances in learning during this period. As such the error data may provide more information about which strategies students are using unsuccessfully in grade seven.

Error

Results demonstrated support for hypothesis 6; independent-samples Bayesian *t*-tests showed there was no difference between the error distribution of parameter 10: *overall links in/out* and the error distribution of the grade seven students. This parameter uses N-grams across letter positions to make decisions about spellings. Use of this strategy would be predicted by Stage models of spelling

(Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and spelling curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), which provides operational validation for the model at the grade seven level in terms of error.

The other Bayesian model parameters from the advanced orthographic class are parameters 8: *overall links in* and 9: *overall links out*. These parameters describe how information is utilised when making a spelling decision using an overall advanced orthographic strategy. There was evidence that the error distributions of both parameters 8 and 9 resembled those of students. Therefore, it appears that students are using all aspects of this strategy to make spelling decisions in grade seven but are making errors.

There was also evidence in favour of the null hypothesis for parameters 2: *link weights in*, 4: *total link weights in/out*, 5: *number of links in*, and 7: *total links in/out*. These findings indicate that these distributions resemble the error distributions of the students. Parameters 2 and 4 represent a late phonological and early orthographic strategy, whereas parameters 5 and 7 represent mid-level orthographic strategies. Both strategy classes have been explicitly taught in earlier grades according to the educational curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019) and use of these strategies is predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). It appears that students are using these strategies to make spelling decisions, but when they do, they are unsuccessful.

Taken together, results for accuracy and error make sense. Students in grade seven are considered almost proficient spellers; therefore, it is logical that these students utilise an optimal spelling strategy (parameter 1: *best link weight*), and

when they do, they are accurate. However, students are explicitly taught spelling in two additional school terms; therefore, it is also logical that students at this level would continue to make errors. As such, this progression of trial and error (i.e., learning) would be expected according to Stage spelling models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and education curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019). Overall, these findings indicate that the model is effectively reproducing human spelling behaviour for accuracy and error in the learning of spelling at the grade seven level.

Grade Nine Spelling

Stage spelling models and Australian curriculum consider students in grade nine to be proficient spellers; dictation tasks are not used nor is spelling explicitly taught after grade seven (Australian Curriculum, Assessment and Reporting Authority, 2019; Bear, 1991). Therefore, if the model is replicating the behaviour of a proficient human speller at grade nine level, the most appropriate analogous parameter is parameter 1: *best link weight*. As humans are imperfect spellers, the distributions for parameter 1 should resemble the student distributions for both accuracy and error. Results demonstrate support for hypothesis 8 (error) only.

Accuracy

Results did not support hypothesis 7; independent-samples Bayesian *t*-tests showed no support for the null hypothesis. Therefore, the accuracy distribution of parameter 1: *best link weight* is different from that of grade nine students. This result is surprising as parameter 1 uses an optimal spelling strategy to make spelling decisions, which is analogous to a proficient speller.

There was support for parameter 7: *total links in/out*, which represents a mid-orthographic strategy of spelling, utilising letter position and n-gram information. Given that students in grade nine are considered proficient spellers, and they are no longer explicitly taught spelling and do not participate in dictation tasks after grade seven, students are potentially not receiving adequate spelling practice and feedback. Research suggests that repeated misspellings reinforce spelling inaccuracies, thus if students are no longer receiving feedback on their spellings, it is logical that they would continue to make misspellings (Bradley & King, 1992). Furthermore, adult spellers, who are considered proficient, regularly make errors, even with phonologically derived information (Treiman & Boland, 2017). Instead, spellers might be using a sub-optimal spelling strategy for accuracy (parameter 7). Interestingly, only this parameter resembled the student distributions for accuracy. Similar to grades three, five, and seven, the error data likely provides more information about which strategies students are using at grade nine level, albeit not successfully.

Error

Results demonstrated support for hypothesis 8; independent-samples Bayesian *t*-tests showed there was no difference between the error distribution of parameter 1: *best link weight* and the error distribution of grade nine students. This parameter uses an optimal spelling strategy to make decisions about spellings, analogous to a proficient speller. As use of this strategy would be predicted by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and Australian curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019), my findings provide operational validation for the model at the

grade nine level in terms of error (). Unlike the data from previous grades, there was no evidence that the distributions of other parameters were similar to the student data.

Examining the accuracy and error data together, it appears that students in grade nine are predominantly using a mid-level orthographic strategy (parameter 7: *total links in/out*) and an optimal spelling strategy (parameter 1: *best link weight*); however, they are only achieving accuracy when using the orthographic strategy. Parameter 7 utilises both letter position and n-gram information and has been represented in the data for either accuracy or error for all grade tested herein. This strategy appears to be important for spelling in English. On the other hand, this evidence could also indicate that the educational curriculum emphasises learning this strategy. Given that students in grade nine are considered proficient spellers, who are no longer explicitly taught spelling and do not practice with dictation tasks, it is unsurprising that they do not maintain accuracy for optimal spelling (i.e., parameter 1). This regression in spelling strategies could indicate that extended, explicit teaching of spelling could improve spelling accuracy in the population and there is evidence to support this idea (Graham & Santangelo, 2014). Future research should investigate this idea. Overall, these findings indicate that the model is effectively reproducing human spelling behaviour for accuracy and error at the grade nine level.

Homophones

There was one homophone in the grade nine testing list: “faint” (see Table 11). Examination of the data showed that none of the model parameters produced a correct spelling for the word “faint” nor the homophone “feint.” Further examination

showed that model parameters were always correct for the consonants in the first (“f”) position; however, the model responded with “a” (“fant”) for the vowel sound in the second position. The model produced the fourth position “n” and final “t” consonants correctly. Comparison with student responses shows a similar pattern. Responses for position one “f” and position three “n” were always correct, with errors occurring on position two for all spelling mistakes. Unlike the model, students occasionally produced an incorrect grapheme for the “t” in the final position (“fante”). The students also appeared to be influenced by the homophone in the spelling errors for the vowel sound “ai”, with some students producing the “ei” or “ie” grapheme, whereas the model did not produce this grapheme as a response.

Despite the limitations regarding homophones, the current study demonstrates robust evidence for validation of the Bayesian model. Not only does the model effectively reproduce human spelling behaviour for grades three, five, seven, and nine, which provides empirical validation, but findings are also congruent with existing literature, which provides theoretical validation. I next examined the overall spelling progression through the grades in an attempt to improve our understanding of spelling and the learning process further.

Overall Spelling

It was anticipated that when data for all grades were examined, the spelling process would replicate the spelling process as described by Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and as reflected in the education curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019). That is, the distributions for parameters most closely resembling the distributions of the students for accuracy and error would begin with

parameters using less complex strategies and progress through to parameters using more advanced strategies. There is evidence that spelling acquisition progresses from use of the least to the most complex strategies and that spelling performance improves with educational level (Graham & Santangelo, 2014; Hayes, Treiman, & Kessler, 2006). The expected progression ranged from parameters calculated by letter position frequencies (parameters 2 and 3, but specifically parameter 4), to parameters calculating N-grams dependant on letter position (parameters 5 and 6, but specifically parameter 7), to parameters calculating the N-grams across all letter positions (parameters 8 and 9, but specifically parameter 10), and finally to parameter 1, as a representation of an optimal spelling strategy.

Accuracy

Examination of the results for accuracy distributions across all grades demonstrated that the model generally behaved in line with Stage spelling models and Australian curriculum. Strategies progressed from parameters 4, 5 and 7 in grade three, to parameters 2, 4, 5, and 7 in grade five, to parameter 1 in grade seven, and finally parameter 7 in grade nine. These findings indicate that the model followed the general pattern of strategies that would be predicted for students throughout these grades—progressing from simple strategies to more complex strategies.

Hypotheses for accuracy were supported for grades three (hypothesis 1) and five (hypothesis 3), but not grades seven (hypothesis 5) or nine (hypothesis 7). It is possible that the time differences in testing periods were too large to illustrate the nuances in spelling accuracy, particularly for the later grades. Students appeared to progress to an optimal spelling strategy just prior to the end of explicit teaching in

grade seven, and then regress from grade seven to grade nine, indicating that students may have difficulty maintaining accuracy once explicit spelling instruction and practice ceases. Recent research demonstrated that increasing the amount and length of time for explicit spelling instruction improved performance in spelling and reading and that these improvements were maintained over time (Graham & Santangelo, 2014). Replicating this research in an Australian population could be useful. Encouragingly, the findings for error were congruent with the overall findings for accuracy.

Error

Examination of the results for error distributions across all grades demonstrated that the model behaved as predicted based on Stage models of spelling (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985), and Australian curriculum (Australian Curriculum, Assessment and Reporting Authority, 2019). All hypotheses for error were supported (hypotheses 2, 4, 6, and 8), thereby validating that the model replicates human spelling behaviour in terms of error. Strategies progressed from parameters 2, 4, 7, 8, 9, and 10 in grade three, to parameters 1, 6, 7, 8, 9, and 10 in grade five, to parameters 2, 4, 5, 7, 8, 9, and 10 in grade seven, and finally parameter 1 in grade nine. These findings indicate that even when students were incorrect, they were using multiple strategies to make guesses about spellings at each respective level of learning.

Chapter Six: General Discussion

The validation process provided robust evidence that spelling can be modelled as a process of Bayesian decision making. The next step is to review the underlying conceptual validity to establish the model's usefulness in relation to human spelling. To do so, I will evaluate the model against the criteria applied to existing models of spelling (Chapter 1) and utilised in the design and development of the current model (Chapter 2). This will indicate the model is fit for purpose. Furthermore, the model will be situated within the research in this field, to examine how it aligns with existing models of spelling and how my findings contribute to the knowledge base. Finally, limitations of the current research and the model design will be considered, with a discussion of future research suggestions and applications.

Model Evaluation

Conceptual validity involves establishing a clear understanding and systematic use of the underlying, related concepts. In the case of the Bayesian model, criteria for a novel spelling model were identified through an extensive literature review process. The identified criteria were: ability to explain how spelling information is learned and managed, the capacity to generate testable hypotheses, ability to replicate human behaviour (e.g., speed of spelling decisions), and the ability to account for observed data using the most simple explanation (parsimony).

Existing spelling models are limited in their capacity to explain how spelling information is learned and managed. Stage models describe a pattern of learning that essentially progresses through a flowchart. Problematically, they do not attempt to replicate human behaviour, instead merely describing it, and emphasising the role of phonological learning. Later modifications to stage models have not overcome this

initial flaw and are particularly limited in their ability to explain the spelling choices of proficient spellers. Furthermore, stage models do not explain how spellers choose from multiple potential spellings or competing sources of information.

The Dual-Route Cascading (DRC) model describes a process of learning to spell using an indirect route of phoneme to grapheme conversion rules; however, the function of the indirect route is contentious and unclear and, as a result, the DRC model is similarly constrained. English is a language with a deep orthography that does not consistently adhere to the alphabetic principle. Therefore, there are multiple potential graphemes for each phoneme. The DRC model does not explain how phoneme to grapheme conversion rules are applied in an inconsistent language, like English.

The DRC model posits a direct route for proficient spellers, which proposes mapping from a phonological lexicon to an orthographic lexicon; however, some issues with the direct route remain unresolved. The DRC model of spelling was designed after the DRC model of reading, as a process of reading in reverse. If it was the case that spelling was reading in reverse, unexpectedly poor spellers should theoretically not exist. Unexpectedly poor spellers are defined as individuals who are proficient at reading, but not at spelling. If spelling were merely the process of reading in reverse, and proficient individuals use the same direct route for reading and spelling, then reading ability should transfer to spelling ability and vice versa. However, the relationship between spelling and reading is not reciprocal; although there is evidence that spelling ability contributes to reading ability, there is less evidence for the relationship in the opposite direction. Furthermore, the direct route assumes that words and spellings are stored as whole units in a mental lexicon. Therefore, a large vocabulary implies a large mental lexicon, which, in the form

described by the model, would take considerable cognitive resources to manage and use.

Integration of Multiple Patterns (IMP) proposes an alternate explanation for storing and managing information about words and spellings, incorporating the concept of statistical learning. According to IMP, the learning process for spelling can be explicit, such as teaching orthographic rules (e.g., the “I before E rule”), or implicit through exposure to language. The model proposes that spellers learn patterns between and within words and utilise these inherent statistical relationships to make spelling decisions. These patterns include all aspects of language as described by stage models, including phonological, orthographic, and morphological information; however, like the stage models, IMP cannot explain how competing information is managed in order to make a spelling decision.

The Bayesian model explains how information is learned and managed through the design of the model process, parameters, and outputs. The training process is analogous to learning in the school system as the model is explicitly provided with information about phoneme–grapheme relationships, similar to explicit teaching in the Australian curriculum, and is given training information in the form of spelling lists, which resemble those students receive in Australian schools. The parameters were designed based on the decisions human spellers make, and the information humans use when making decisions about spelling. Additionally, outputs were designed to provide data about how spelling information is used and managed in the context of competing information. Examining spelling decisions in the context of competing information was beyond the scope of my research; however, it is an operational feature of the model. This research modelled the learning process of using simple information to make spelling decisions and then moving to advanced

strategies, with a feed-forwards process identified as more useful for accurate spelling than a feed-backwards approach. Therefore, this research is a valid example of the capacity of the model to overcome limitations related to explanations of how information is learned and managed.

Relatedly, the predictive ability of existing models is constrained, because they predominantly *describe* spelling, which limits their capacity to generate testable hypotheses. The Bayesian model addresses this limitation through the characteristics of the information provided in the model outputs. Model outputs include information for all parameters, rather than only including the information utilised to make the spelling decision, or the outcome of that decision. Thus, specific hypotheses can be generated and tested, as all evaluated information is known. This research specifically tested the predictive validity of the model by generating and testing hypotheses about what parameters would be utilised at each testing grade. All hypotheses in relation to error were supported (hypotheses 2, 4, 6, and 8), and two of four hypotheses for accuracy were supported (hypotheses 1 and 3). Importantly, findings for accuracy were in line with what would be predicted based on existing models of spelling and spelling research (Graham & Santangelo, 2014). The combination of these design factors explain how information is learned and managed, and how this information can be used to generate and test specific hypotheses. My findings stand as a robust example of how this research can be conducted with the Bayesian model of spelling.

The Bayesian model's demonstrated capacity for predictive validity is also established by its ability to replicate human behaviour. Parameters and model processes were designed to be fast and parsimonious in order to mimic the efficiency of proficient human spellers. Proficient spellers are typically fast and

relatively accurate, particularly given the complexity of the task. Using common computer hardware, the Bayesian model can be trained with a dataset in excess of 3500 words in under 30 seconds and can be tested with a set of 100 words in under 10 seconds. This timing substantiates the underlying efficiency of parameter calculations. Furthermore, the information learned from the training phase encompasses statistical relationships including relative frequencies, letter positions, and N-grams. There is no need for cumbersome storage of words as whole units, as per the DRC model, which would impact speed and efficiency. Thus, the Bayesian model utilises relatively simple processes to replicate complex human behaviour.

One of the biggest criticisms in the use of computational models is that they are created to be successful in a way that humans cannot match. That is, they do not adequately represent the true nature of a naïve speller or reader, and that the reason that they are successful is through the selection of training materials. For example, in relation to spelling, human spellers are sensitive to exposure; thus, words that are frequently presented are learned well, whereas those that are less frequently presented are learned less well (i.e., frequency effect). This criticism was addressed by using representative training and testing stimuli to establish data validity. The model received the same training and testing materials as the human spellers in the comparison group. In addition, the model simulates the same task as completed by human spellers, establishing event validity. Confirming these concerns were resolved was important to ensure that model findings are valid.

Findings from research conducted with the Bayesian spelling model are broadly aligned with those of existing models. Although Stage models have been predominantly discussed herein, the Bayesian spelling model also finds broad

congruence with the DRC model and IMP, particularly in relation to spelling acquisition (learning).

DRC model

The DRC model proposes that spellers learn phoneme-grapheme conversion rules using the indirect route, and once proficient, map from a phonological to an orthographic lexicon in order to make a spelling decision. Information about how conversion rules for the indirect route operate is inconsistent; however, the rules are believed to utilise information such as frequencies, letter position, and N-grams (Perry & Ziegler, 2004). This description is congruent with parameters 2, 3, and 4 (frequencies and letter position), as well as parameters 5, 6, and 7 (N-grams and letter position) of the Bayesian model. As predicted by the DRC model, my experimental testing found evidence for the use of these strategies in grades three and five.

In terms of proficient spelling via the direct route, the relevant analogous parameter is parameter 1. This parameter 1 was found to be represented in grade seven spelling for accuracy and grade nine spelling for error. Students are considered proficient spellers from the end of grade seven; therefore, these findings align with predictions of the DRC model for proficient spellers.

Parameters 8, 9, and 10 are a different case. Given the current descriptions of the indirect and direct routes, it is difficult to determine the congruency between these parameters and the two routes. These parameters examine N-grams, as included in the indirect route, but map across words rather than between letter positions, as would be defined by the direct route. I found no evidence that these

parameters were used for accurate spelling decisions; however, future research examining these parameters could be more informative.

IMP

Comparison of IMP and the Bayesian model reveals many similarities. Both models propose statistical learning, as well as explicit and implicit exposure as mechanisms for learning and managing spelling. The Bayesian model calculates statistical relationships by way of 10 parameters in the training phase. This information is based on information derived from the characteristics of the training set, as well as explicit information provided about the relationships between phonemes and graphemes. In this way, the Bayesian model is congruent with the learning process described by IMP.

IMP posits that spellers learn patterns about all aspects of language but does not propose a specific progression such as that described by Stage models. Rather, spellers learn patterns in language based on exposure. Therefore, if the spelling curriculum is structured in a specific manner, spellers will learn within the context of that specific structure, which is reflected in their spelling decisions. Findings from the Bayesian spelling model are congruent with this idea. Further, the possibility of the structure of the Australian curriculum inducing the use of parameter 7 was posited in relation to evidence that it was represented at all grades tested herein.

The progression of learning demonstrated by the Bayesian model follows the progression of learning specified by the Australian curriculum. Indeed, hypotheses were structured in alignment with curriculum for each grade and positive evidence was found for hypotheses for each grade in relation to error, and for grades three and five in relation to accuracy. Although support for hypotheses in grades seven

and nine was not found, the results for these grades broadly aligned with predictions from information in the spelling curriculum. Of the existing models discussed herein, IMP is most congruent with the Bayesian model and future research should examine these similarities in greater detail.

Limitations and Future Directions

Although the Bayesian Model of reading provides a valid replication of human spelling behaviour, limitations in its design, as well as within the current research, have been identified. These limitations include issues in the translation of phonemes and graphemes, the inability to include some morphological information and exactly simulate a dictation task, the inability to examine contractions, and difficulty in obtaining representative testing data, which affected sample sizes.

The first issue was discovered in the initial piloting stage of training data and pertains to an unequal relationship between phonemes and graphemes. It affected the phonemes /j/ and /u:/ when they occurred together, the grapheme “o” in the first position (pronounced /w/ /ɒ/), and the grapheme “x” (pronounced /k/ /s/). For example, the word “box” is constructed of three graphemes but is pronounced with four phonemes “/b/ /ɒ/ /k/ /s/”. As the model cannot tolerate unequal numbers of phonemes to graphemes in the training phase, this inequality presented a methodological issue. A review of previous research did not elucidate how other researchers have managed this inequality. To overcome this problem, an additional three phonemes were created; this process was outlined in Chapter 3.

The effect of these created phonemes on the responses of the model is unclear; however, examination of the training lists showed that these phonemes were not used commonly. The created phonemes “o” and “u” did not appear at all in

the testing lists. The created “x” appeared on one occasion in grades three (“oxygen”), five (“oxygen”), and nine (“exotic”). The model made consistent errors on these particular words for grades three and five, and only achieved an accuracy of 30% for the word “exotic” in grade nine. As hypotheses for both accuracy and error were supported for grades three and five, and for error but not accuracy for grade nine, it does not appear that the addition of these phonemes impacted results. However, this issue could be examined in depth in the future.

A means of overcoming this potential limitation is to modify the operation of the training stage to incorporate early phonological learning. In this way, the model would learn the relationships between phonemes and graphemes through exposure, and without explicit instruction. Recent research demonstrated that pre-phonological spellers are sensitive to language patterns despite no explicit instruction (Treiman, et al., 2019); thus, this proposed operational feature is aligned with how human spellers learn. Future model builds could also include the capacity to examine invented spellings as research has shown these to be important for integrating phonological and orthographic knowledge, and for reading acquisition (Ouellette & Sénéchal, 2008a; Ouellette & Sénéchal, 2008b). These additional features would also address the potential criticism that the model is provided with the correct phoneme-grapheme pairs, whereas students are not.

Another difference between human spelling and the operation of the model pertains to the dictation task. In a classic dictation task, a speller is not only provided with the sound of the word (i.e., the word is said aloud), but spellers can also request a sentence containing the target word. In contrast, the only input information the model is given is the target word written in International Phonetic Alphabet (IPA), representing the word as it sounds when said aloud. This verbal information allows

the speller to draw upon context-related information, which adds to the amount of information available to make the spelling decision, and also allows the speller to differentiate between homophones. Information relating to context is most commonly categorised as morphological information; however, the model only receives morphological information that can be learned through statistical relationships. For example, the model has the capacity to learn rules related to doubling, plural nouns, and the “magic E”, but cannot examine etymological properties such as word roots. The inability to include all morphological information reduces the amount of information available to the model when making spelling decisions, and places restrictions on the types of information that can be examined experimentally when using the Bayesian model. Future model builds could consider including additional morphological information.

Morphological strategies are learned and used in the final stage of spelling according to Stage models (Bear, 1991; Ehri, 1992; Gentry, 1982; 2000; Henderson, 1985). Thus, this information is unlikely to be relevant at early stages of learning, except for the capacity to differentiate between homophones. Although the role of homophones was examined in Chapter 5 in detail, no firm conclusions can be drawn without more detailed experimentation. Given that morphology could be important in later spelling and the model demonstrated spelling regression from grades seven to nine, this regression potentially reflects an inability to examine all the information a human speller uses. Namely, the lack of morphological information, rather than a lack of practise as was posited herein, could also explain the spelling regression in grade nine. I cannot test this alternative explanation with my data; however, future research should examine this possibility directly.

Increasing the amount of information that the Bayesian model can access and respond with would also assist in overcoming sample size issues. A methodological issue I encountered was finding representative data sets that were large enough for adequate comparisons. The range of responses produced by model parameters was smaller than that produced by the samples of students, and this potential issue was identified across all words and all grades. This discrepancy in sample sizes affected data analysis, and it is important that future research consider how to best resolve this problem. One suggestion is to redevelop the model to include the capacity to investigate every possible combination of parameter position simultaneously. This redevelopment would increase output responses by potentially several orders of magnitude, however may make data analysis more difficult. Another suggestion is to increase the size of the testing set; however, appropriate, matching data from human spellers for comparison may prove difficult to locate, which makes this suggestion less tenable. Whilst it was beyond the scope of my thesis, an avenue for future researchers could be to collect the required data in an experimental or school setting. This method would ensure adequate quality, quantity, and scope.

Another feature that future developers should consider is the ability to examine contractions. Contractions occur when a word is shortened and graphemes (often vowels) are replaced with an apostrophe in the spelling of the contracted word. For example, the contraction for the word “cannot” is “can’t.” The only way to include contractions in the current study would have been to include each potential contraction and related grapheme combination individually, in the language information for the model. Thus, the model would receive this information and directly map across these spellings, with no ambiguity. As this would not be instructive to the spelling process, and there were no contractions included in the

NAPLAN testing lists, exclusion of these words could not have impacted results, contractions were consequently removed from the training lists.

The capacity to examine contractions could also lead to the inclusion of text language, or textese. A common social gripe is that textese is negatively impacting younger generations' linguistic capacity; however, spelling research to date has found no evidence to support this gripe (Kemp, 2010). Ultimately, the Bayesian model of spelling provides a means of testing this hypothesis experimentally.

Future development of the model could also include the capacity to simultaneously test each parameter and position combination. Not only would this development overcome the sample size issues discussed previously, but it would also allow for deeper analysis of letter position effects than was possible here. Whilst findings for letter position aligned with previous research, the capacity to examine every possible combination of parameter within each word, to find the optimal parameter–human match could elucidate sub-word effects at a finer level. Moreover, the analysis of specific spelling decisions, under conditions of competing information or strategies was beyond the scope of my thesis. Simultaneous testing and analysis of these data could be used in this context in future research.

In addition, this development could be useful for a natural language processing context. Natural language processing is a burgeoning research field within artificial intelligence (AI) and computer-mediated applications, but it is currently plagued with difficulties. One of the main issues is a difficulty in translating speech to text accurately and efficiently due to the complexity of language and the specifics of the task. Given that spelling, as a process of language production, has historically suffered from similar issues, it is possible that a Bayesian approach to natural language processing could yield similar gains. Future research could benefit

from integrating the Bayesian speller with AI and computer-mediated applications to address some of these known difficulties.

Despite the limitations, the current study demonstrates robust evidence for validation of the model throughout the spelling learning process. My thesis provides a rich basis from which to conduct further research and to address previously identified limitations. It is anticipated that future research and development of the model will add to knowledge of spelling as a cognitive process and could also provide a means for experimentally examining educational strategies and spelling disorders. Although spelling is not always given the due consideration it deserves as a process of language production, we know that spelling is an important aspect of written communication, which is fundamental to everyday life (Treiman, 2017a; 2017b).

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Appendix 1

Operation manual

The Bayesian spelling model has been designed with the goal of simplicity. On loading the software, the user is presented with four tabs; *settings*, *network*, *parameters*, and *results*. The first step is to load the information the model will use (*settings*), and then create the network to the required specifications, based on the language being examined and the characteristics of the training and testing stimuli loaded (*network*). After the network is created, modifications to how the model makes a spelling decision can be made (*parameters*). The model can then be trained and tested, using two testing options (*network*). Results are displayed in the *results* tab.

Settings

The *settings* tab contains three buttons and associated text boxes: *load phonemes* (phoneme/grapheme pairs), *load training word* (training words), and *load words* (words to spell). A screenshot of the *settings* tab is shown in Figure 1. *Load phonemes* (phoneme/grapheme pairs) provides the language of the model—in this example, Australian English. *Load training words* and *load words* provide a means of loading training and testing stimuli respectively.

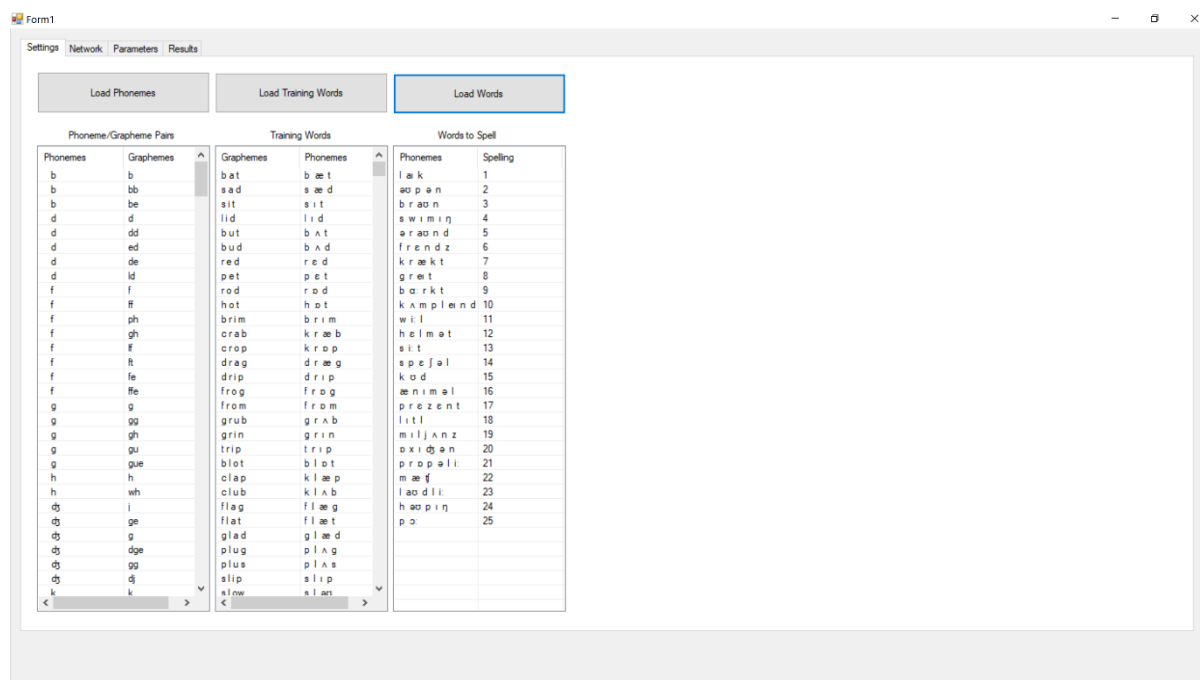
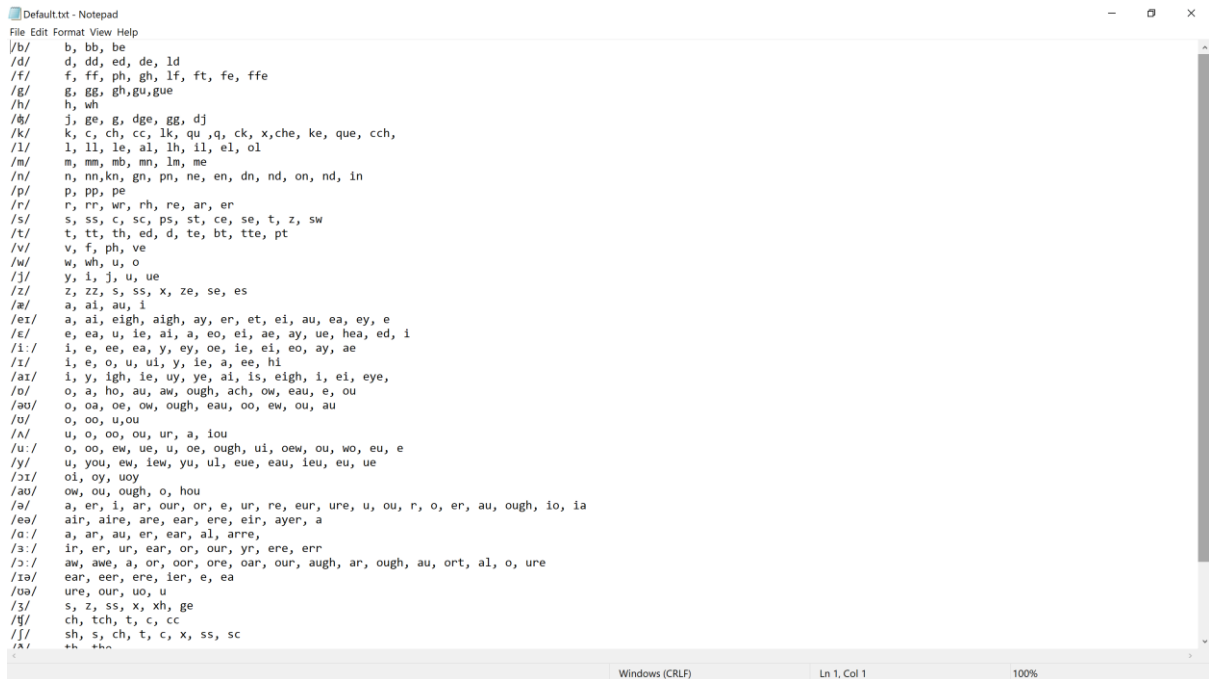


Figure 1. A screenshot of the settings tab of the Bayesian spelling model.

Language, training, and testing files need to be constructed in a specific format and saved as a .txt file. If using the International Phonetic Alphabet (IPA) for phonemes, the file should be saved in Unicode. All transcriptions must be consistent across files. To load language, training, and testing files, click the appropriate buttons and select the relevant files from the folders.

Language files. Language files provide a list of all the phonemes and their associated graphemes. Each line should contain a unique phoneme, constructed with the phoneme displayed first, separated by a tab, then each associated grapheme separated by commas. An example of this format is shown in Figure 2. The default location for the language file is the “phonemegraphemes” folder.



```

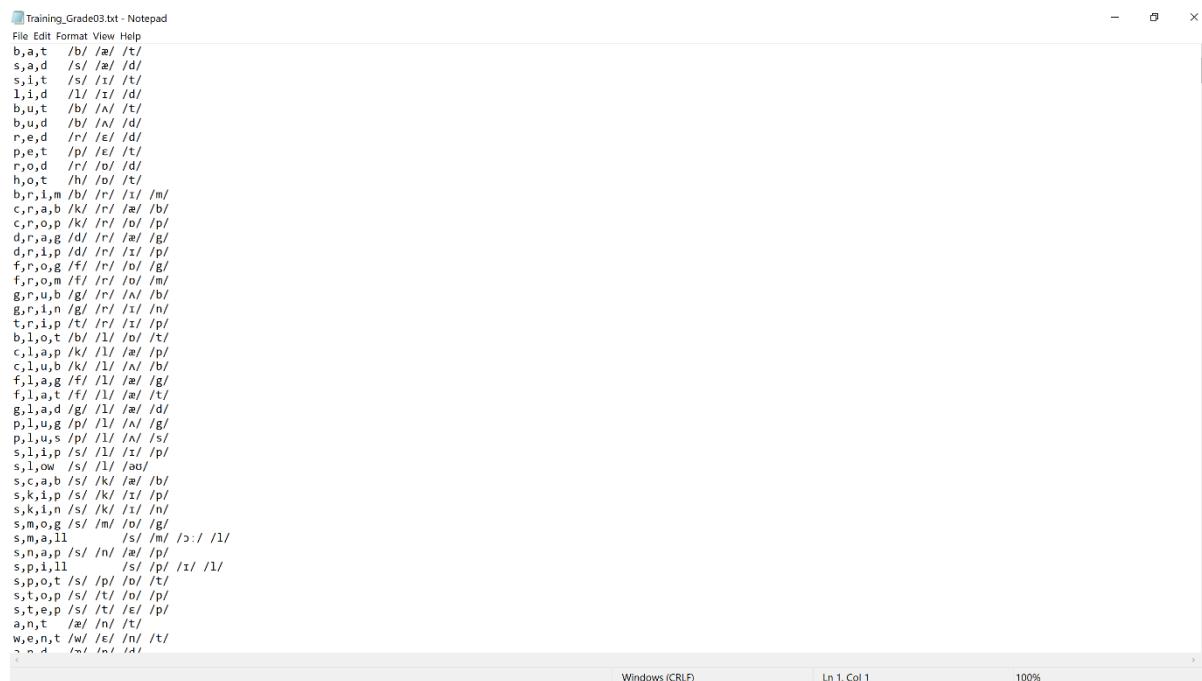
Default.txt - Notepad
File Edit Format View Help
/b/ b, bb, be
/d/ d, dd, ed, de, ld
/f/ f, ff, ph, gh, lf, ft, fe, ffe
/g/ g, gg, gh, gu, gue
/h/ h, wh
/j/ j, ge, g, dge, gg, dj
/k/ k, c, ch, cc, lk, qu, q, ck, x, che, ke, que, cch,
/l/ l, ll, le, al, lh, ll, el, ol
/m/ m, mm, mb, mn, lm, me
/n/ n, nn, kn, gn, pn, ne, en, dn, nd, on, nd, in
/p/ p, pp, pe
/r/ r, rr, wr, rh, re, ar, er
/s/ s, ss, c, sc, ps, st, ce, se, t, z, sw
/t/ t, tt, th, ed, d, te, bt, tte, pt
/v/ v, f, ph, ve
/w/ w, wh, u, o
/y/ y, i, j, u, ue
/z/ z, zz, s, ss, x, ze, se, es
/a/ a, ai, au, i
/ei/ a, ai, eigh, aigh, ay, er, et, ei, au, ea, ey, e
/e/ e, ea, u, ie, ai, a, eo, ei, ae, ay, ue, hea, ed, i
/i:/ i, e, ee, ea, y, ey, oe, ie, ei, eo, ay, ae
/i/ i, e, o, u, ui, y, ie, a, ee, hi
/ai/ i, y, igh, ie, uy, ye, ai, is, eigh, i, ei, eye,
/o/ o, a, ho, au, aw, ough, ach, ow, eau, e, ou
/oa/ o, oa, oe, ow, ough, eau, oo, ew, ou, au
/u/ o, oo, u, ou
/ʌ/ u, o, oo, ou, ur, a, iou
/u:/ o, oo, ew, ue, u, oe, ough, ui, oew, ou, wo, eu, e
/y/ u, you, ew, iew, yu, ul, eue, eau, ieu, eu, ue
/>i/ oi, oy, uoy
/au/ ow, ou, ough, o, hou
/a/ a, er, i, ar, our, or, e, ur, re, eur, ure, u, ou, r, o, er, au, ough, io, ia
/ea/ air, aire, are, ear, ere, eir, ayer, a
/a:/ a, ar, au, er, ear, al, arme,
/ɜ:/ ir, er, ur, ear, or, our, yr, ere, err
/>:/ aw, awe, a, or, oor, ore, oar, our, augh, ar, ough, au, ort, al, o, ure
/iə/ ear, eer, ere, ier, e, ea
/ua/ ure, our, uo, u
/z/ s, z, ss, x, xh, ge
/tʃ/ ch, tch, t, c, cc
/ʃ/ sh, s, ch, t, c, x, ss, sc
/ɹ/ ɹh, ɹh~

```

Figure 2. A screenshot of the format of a language file for the Bayesian spelling model.

Training files. The training files are constructed in a similar format to the language files. These are a list of all the training words displayed in graphemes and phonemes. The word is listed first, with each grapheme of the word separated by commas. A tab separates the graphemic word from the phonemic word. The phonemes for the word are bounded by forward slashes and separated by spaces, as per the example in Figure 3. The number of graphemes must be identical to the number of phonemes. Errors in this file construction will result in an error message in the training process of the model. The error message will identify which line contains the first error that the model has encountered but does not indicate if there are multiple errors. The error can be identified by examination of the training list at the identified line location. These errors can be caused by an unequal relationship between the number of phonemes and the number of graphemes for a word, an

incorrectly placed comma or forward slash, or a phoneme-grapheme pairing that is not included in the language file. The default location for this file is in the “trainingsets” folder.



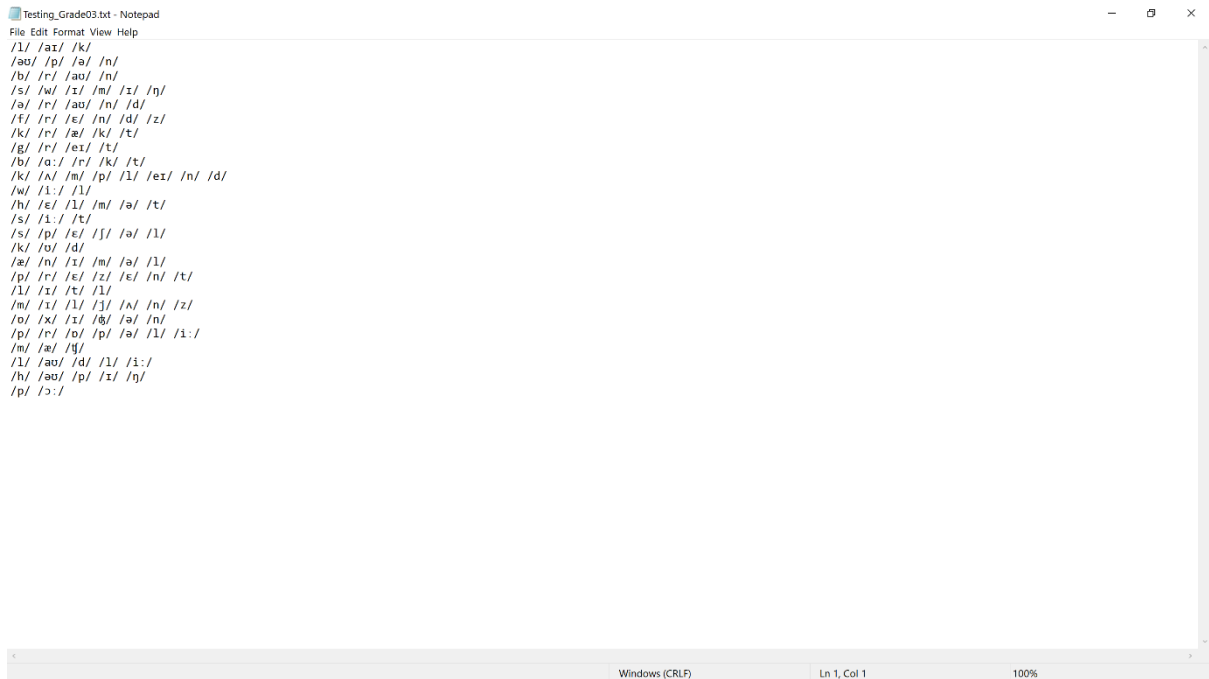
```

Training_Grade03.txt - Notepad
File Edit Format View Help
b_a,t /b/ /æ/ /t/
s_a,d /s/ /æ/ /d/
s_i,t /s/ /i/ /t/
l_i,d /l/ /i/ /d/
b_u,t /b/ /ʌ/ /t/
b_u,d /b/ /ʌ/ /d/
r_e,d /r/ /e/ /d/
p_e,t /p/ /e/ /t/
r_o,d /r/ /o/ /d/
h_o,t /h/ /o/ /t/
b_r,i,m /b/ /r/ /i/ /m/
c_r,a,b /k/ /r/ /æ/ /b/
c_r,o,p /k/ /r/ /o/ /p/
d_r,a,g /d/ /r/ /æ/ /g/
d_r,i,p /d/ /r/ /i/ /p/
f_r,o,g /f/ /r/ /o/ /g/
f_r,o,m /f/ /r/ /o/ /m/
g_r,u,b /g/ /r/ /ʌ/ /b/
g_r,i,p /g/ /r/ /i/ /p/
t_r,i,p /t/ /r/ /i/ /p/
b_l,o,t /b/ /l/ /o/ /t/
c_l,a,p /k/ /l/ /æ/ /p/
c_l,u,b /k/ /l/ /ʌ/ /b/
f_l,a,g /f/ /l/ /æ/ /g/
f_l,a,t /f/ /l/ /æ/ /t/
g_l,a,d /g/ /l/ /æ/ /d/
p_l,u,g /p/ /l/ /ʌ/ /g/
p_l,u,s /p/ /l/ /ʌ/ /s/
s_l,i,p /s/ /l/ /i/ /p/
s_l,o,w /s/ /l/ /oʊ/
s_c,a,b /s/ /k/ /æ/ /b/
s_k,i,p /s/ /k/ /i/ /p/
s_k,i,n /s/ /k/ /i/ /n/
s_m,o,g /s/ /m/ /o/ /g/
s_m,a,l,l /s/ /m/ /ɔ:/ /l/
s_n,a,p /s/ /n/ /æ/ /p/
s_p,i,l,l /s/ /p/ /i/ /l/
s_p,o,t /s/ /p/ /o/ /t/
s_t,o,p /s/ /t/ /o/ /p/
s_t,e,p /s/ /t/ /e/ /p/
a_n,t /æ/ /n/ /t/
w_a,e,n,t /w/ /e/ /n/ /t/

```

Figure 3. A screenshot of the format of a training file for the Bayesian spelling model.

Testing files. The testing files are a list of phonemic words constructed as a series of phonemes bounded with forward slashes and separated by spaces between each phoneme in each word (see Figure 4). Errors in this file construction will result in the model being unable to test the relevant word or words, thus this word(s) will be missing from the model output. Comparison of the testing list and the output will identify where the error(s) lie. These errors can be caused by an incorrectly placed forward slash, or a phoneme-grapheme pairing that is not included in the language file. The default location for this file is in the “spellinglists” folder.



```

Testing_Grade03.txt - Notepad
File Edit Format View Help
/l/ /aɪ/ /k/
/əʊ/ /p/ /ə/ /n/
/b/ /r/ /aʊ/ /n/
/s/ /w/ /z/ /m/ /z/ /ŋ/
/ə/ /r/ /aʊ/ /n/ /d/
/ɛ/ /r/ /e/ /n/ /d/ /z/
/k/ /r/ /ə/ /k/ /t/
/g/ /r/ /eɪ/ /t/
/b/ /a:/ /r/ /k/ /t/
/k/ /n/ /m/ /p/ /l/ /eɪ/ /n/ /d/
/w/ /ɜ:/ /l/
/h/ /e/ /l/ /m/ /ə/ /t/
/s/ /ɜ:/ /t/
/s/ /p/ /e/ /j/ /ə/ /l/
/k/ /o/ /d/
/ə/ /n/ /ɜ/ /m/ /ə/ /l/
/p/ /r/ /e/ /z/ /e/ /n/ /t/
/l/ /ɜ/ /t/ /l/
/m/ /ɜ/ /l/ /j/ /n/ /n/ /z/
/o/ /x/ /z/ /ə/ /ə/ /n/
/p/ /r/ /o/ /p/ /ə/ /l/ /ɜ:/
/m/ /ə/ /ŋ/
/l/ /əʊ/ /d/ /l/ /ɜ:/
/h/ /əʊ/ /p/ /z/ /ŋ/
/p/ /ɔ:/

```

Figure 4. A screenshot of the format of a testing file for the Bayesian spelling model.

Network

The *network* tab contains options for the creation, training, and testing of the network. The network is constructed as columns of nodes, which are the representation of each phoneme-grapheme pair at each position within a word. Thus, the model is arranged in columns of grapheme-phoneme pairs. A graphical representation of the architecture of the Bayesian spelling model is shown in Figure 5. The length of the column (“number of columns”) is automatically calculated once training words are loaded, according to the longest phonemic spelling word (spelling of the sound). Column length can also be set by the researcher by clicking the arrows or typing into the associated text box.

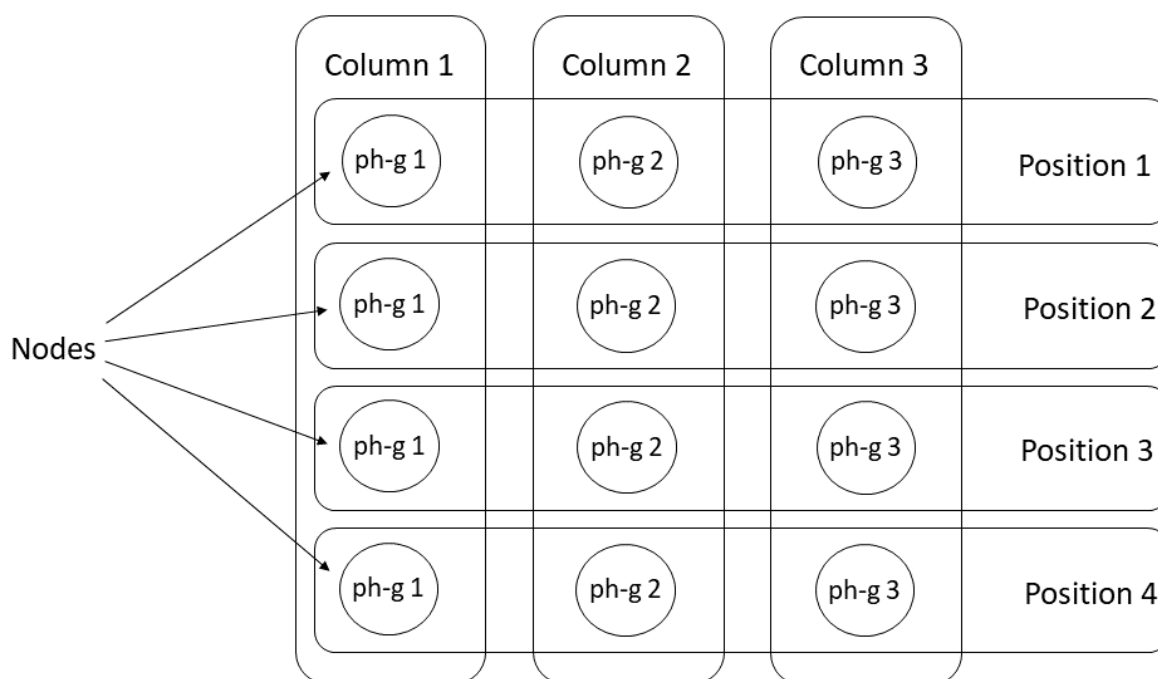


Figure 5. Graphical representation of the architecture of the Bayesian spelling model.

The length of the column is the number of phoneme positions (i.e., unique sounds) in the words to be spelled when they are written in a phonetic alphabet. The model can manage shorter words within a longer network but cannot manage longer words within a shorter network. For example, despite being spelled with four letters in English, the word “aunt” has three phonemes when written in IPA: /ɑ:/ /n/ /t/. Thus, “aunt” could be spelled within a network that is three columns (or more) in length. In contrast, the three-letter word “box” has four phonemes when spelled in IPA: /b/ /ɒ/ /k/ /s/. Thus, to be spelled by the model, “box” would require a network at least four columns long.

Once the column length has been selected, the network can be created by selecting the “create” button. This created network is shown in the large text box

(see Figure 6 for an example). In an untrained network, each phoneme-grapheme pair is represented at each position in the column, for the length of the column, as set by the researcher. However, in a trained network, the number of nodes depends upon the characteristics of the training set. Nodes representing phoneme-grapheme pairs that have a link weight of zero are removed. A link weight is the frequency of the phoneme-grapheme pair in that position (i.e., node), thus nodes with a link weight of zero are not present in that potential position within the training set.

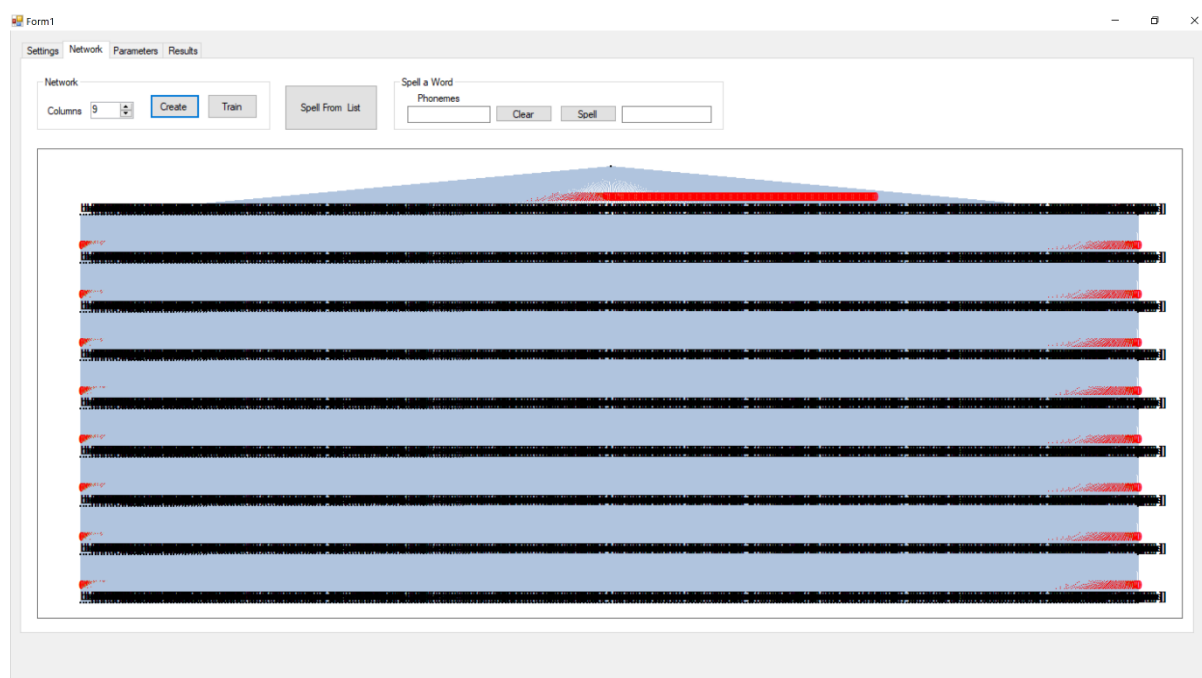


Figure 6. A screenshot of an untrained network in the *network* tab of the Bayesian spelling model.

Training

Training is the process of generating connection link weights based on the pattern of phoneme-grapheme pairs within the training word list. The number of times one node (i.e., phoneme-grapheme pair) links to another node at the next position is counted, and the sum of this frequency count becomes the weight value

for that connection. All connection links with a weight of 0—there were no connections between those nodes in the training data—are removed as part of the training process. In the case of the nodes in the first position, the number of times that a word begins with each phoneme-grapheme pair in that training word list is calculated as the connection weight.

Once a network has been created, it can be trained by clicking the “train” button. The model will pare back the connections between the nodes of the network and provide a location for each phoneme-grapheme pair in each position that is represented within the training set. Frequency information is also presented in red text. Single words can be mapped throughout the network, and users can zoom in to see the connection weights for each pathway leading to and from each node. An example of a trained network is shown in Figure 7.

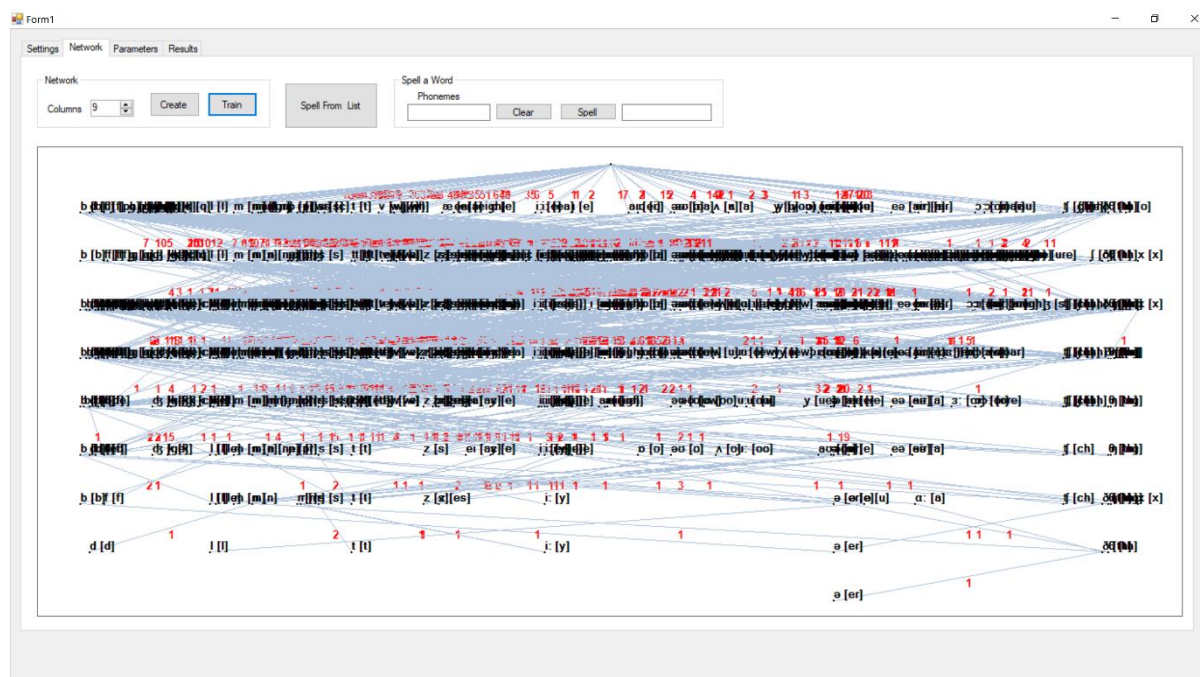


Figure 7. A screenshot of a trained network in the *network* tab of the Bayesian spelling model.

Testing

There are two options for testing the created network once it has been trained: “spell from a list” and “spell a word.” The underlying testing process for both options is the same. The model is exposed to phonemic stimuli for both “spell a word” and “spell from a list” testing, and the model provides a graphemic response. How the response is displayed differs between the options.

To use the “spell a word” option, the user types into the “phonemes” box under the “spell a word” and “phonemes” headings. Once the user has clicked in this box, a phonemic keyboard is displayed in the top right of the screen (see Figure 8). Phonemes are selected by clicking on the relevant buttons (e.g., “ɪ x ɑ: m p l”), and if a mistake is made, the “clear” button to the right of the text box is used to erase. Users can also type into the text box using their computer keyboard. Once the user has entered the phonemic word to be spelled, the “spell” button is clicked and the graphemic response produced by the model is shown in the text box to the right of the “spell” button (e.g., “exampl”).

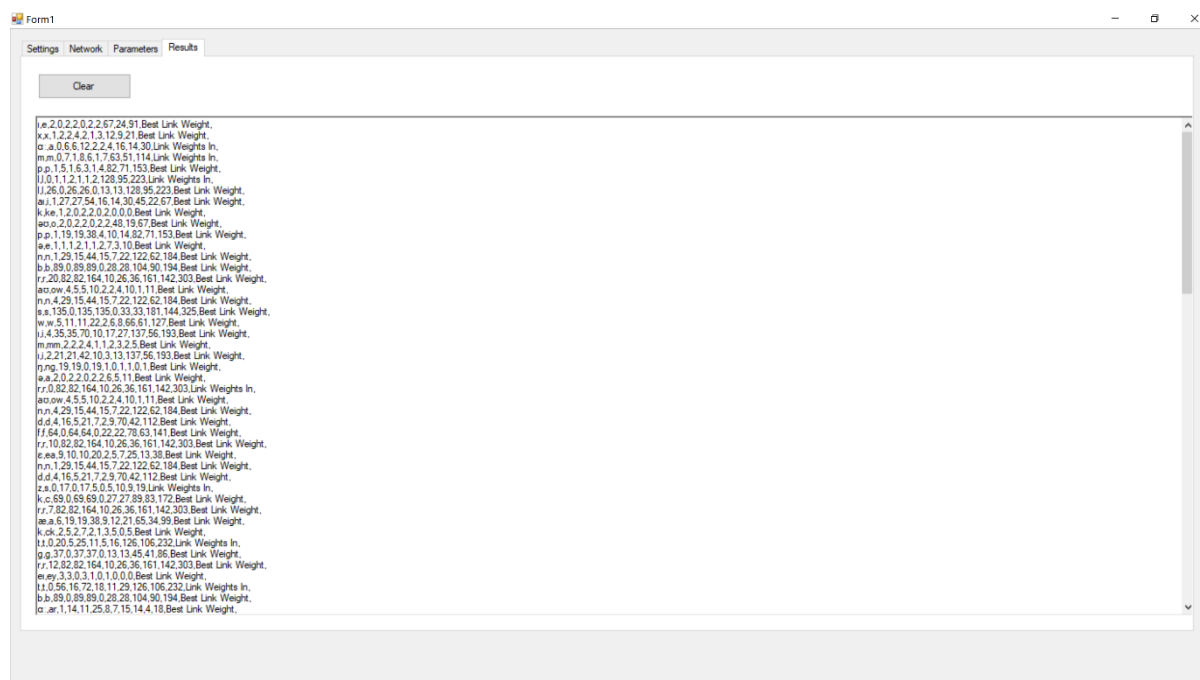


Figure 9. A screenshot of the “results” tab of the Bayesian spelling model when the “spell from a list” option has been used.

Parameters

The third tab is used for managing parameters. Parameters are the potential decision-making strategies that the model can use to determine a spelling output. There are 10 parameters, which are described in detail at the end of this section. The first parameter in the parameter list is selected as the method to decide on a spelling unless there is a tied result (i.e., equal values). In this instance, the model cycles through the parameters in either the default order or an order set by the researcher, using the next parameter on the list until the tie is broken. Researchers can remove parameters and modify their order of use.

To change the order of the parameters, the arrows and click boxes can be used, as per the example in Figure 10. To remove parameters, unselect the relevant click boxes. However, if too few parameters are chosen, the model may be unable to

break a tie and thus cannot make a spelling decision. This will result in a “0” being returned for parameter values and parameter choices in the output. Increasing the number of parameters and re-running the testing process will resolve this issue.

Parameter modifications can be saved as a separate file by selecting “save” and saving the file in the appropriate folder. Previous settings can be loaded using the “load” function on the parameters page. The default order for parameters is “best link weight”, “link weights in,” “link weights out,” “total link weights in/out,” “number of links in,” “number of links out,” “total links in/out,” “overall links in,” “overall links out,” and “overall links in/out.”

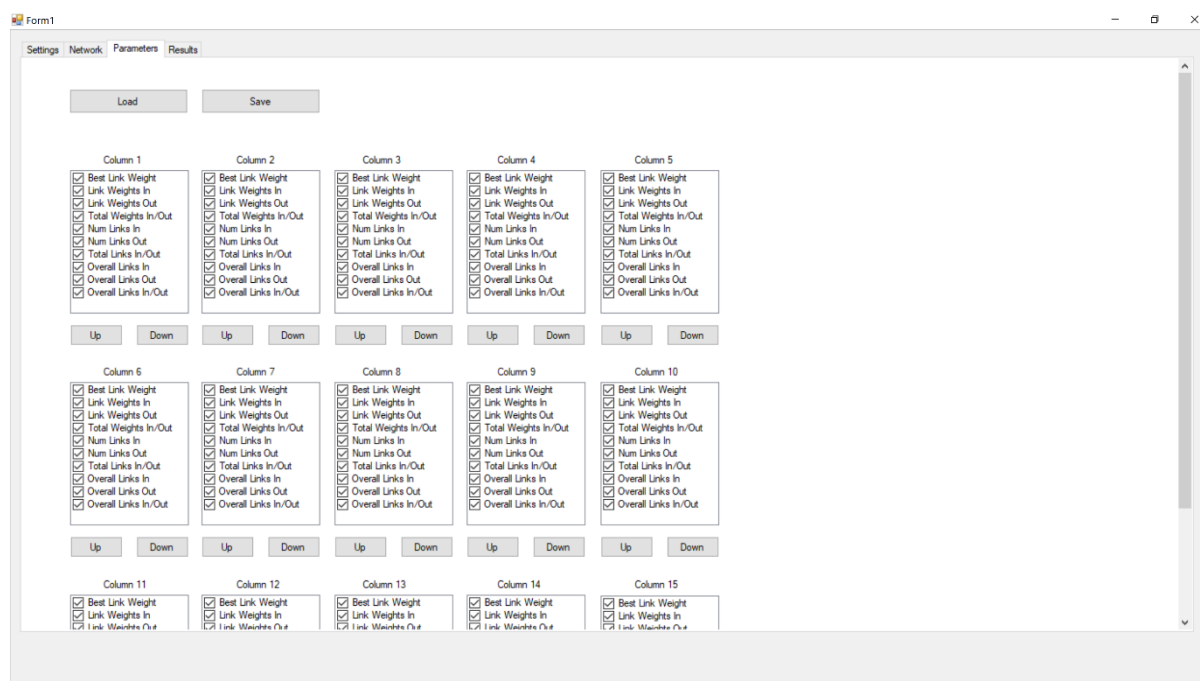


Figure 10. A screenshot of the *parameters* tab of the Bayesian spelling model.

Parameter Calculations

There are 10 parameters in total and information to compute them is derived from the frequency data gathered in the training phase. Parameters can be

calculated from either weights or links. Weights are frequency counts from the number of times a node was represented in the training set, whereas links are the number of connecting links between nodes or columns. For example, a representation of three nodes from two columns is shown in Figure 11. In this example, node X is in position 1, seeking to choose a node for the next potential spelling. Nodes A and B are in position 2 and are both potential candidates. Node A has an overall weight of 21 ($10 + 3 + 5 + 1 + 2 = 21$) and 5 overall connections, whereas node B has an overall weight of 15 ($1 + 1 + 3 + 7 + 3 = 15$) and 5 overall connections. Parameters select the candidate nodes with the highest values according to their specific criteria.

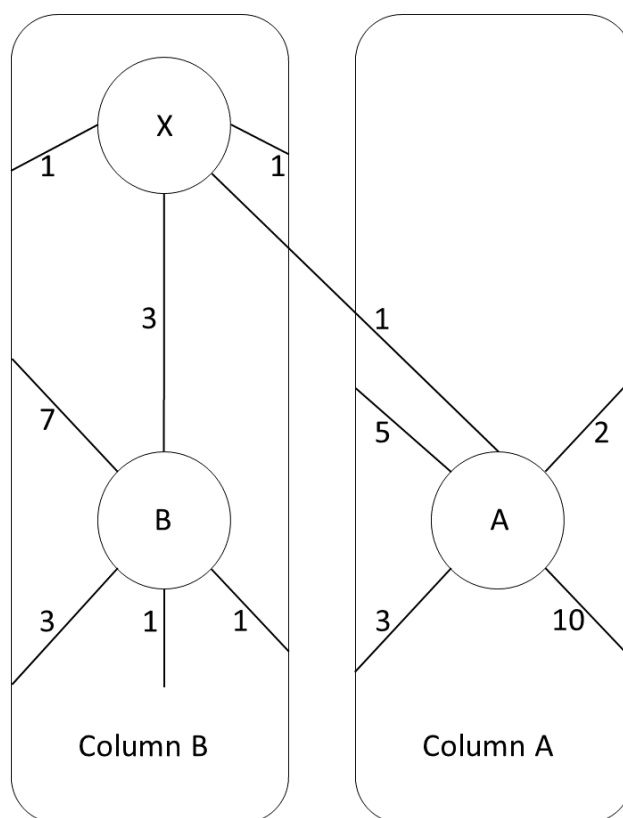


Figure 11. Graphical representation of a Bayesian spelling network with two columns and three nodes.

Best link weight. This parameter compares the link weights for all connecting nodes. The node with the highest value connecting link weight is selected. In Figure 11, node A has a connecting link weight of 1, whereas node B has a connecting link weight of 3. Therefore, node X would choose node B as the next potential spelling.

Link weights in. This parameter is the summed value of all link weights in to the candidate node from all other nodes. The node with the highest number of total link weights in is selected. In Figure 11, node A has 3 links in and their weights sum to 8 ($2 + 1 + 5 = 8$), whereas node B has 2 links in and their weights sum to 10 ($3 + 7 = 10$). As such, node X would choose node B as the next potential spelling.

Link weights out. This parameter is the summed value of all link weights out of the candidate node from all other nodes. The node with the highest value of total link weights out is selected. In Figure 11, node A has 2 links out and their weights sum to 13 ($10 + 3 = 13$), whereas node B has 3 links out and their weights sum to 5 ($1 + 1 + 3 = 5$). Thus, node X would choose node A as the next potential spelling.

Total link weights in/out. This parameter is the sum of all link weights in and out of the candidate node from all other nodes. The node with the highest value of total link weights in and out is selected. In Figure 11, node A has a weight sum of 8 for links in and 13 for links out which is a total weight of 21, whereas node B has a weight sum of 10 for links in and 5 for links out, which is a total weight of 15. As such, node X would choose node A as the next potential spelling.

Number of links in. This parameter is the number of links in to the candidate node from all other nodes. The node with the highest number of links in is selected. In Figure 11, node A has 3 links in, whereas node B has 2 links in. Therefore node X would choose node A as the next potential spelling.

Number of links out. This parameter is the number of links out of the candidate node from all other nodes. The node with the highest number of links out is selected. In Figure 11, node A has 2 links out, whereas node B has 3 links out. Thus, node X would choose node B as the next potential spelling based on the “number of links out” parameter.

Total links in/out. This parameter is the number of links in and out of the candidate node from all other nodes. The node with the highest number of links in and out is selected. In Figure 11, node A has 3 links in and 2 links out, leading to 5 links overall, whereas node B has 2 links in and 3 links out, which is also 5 links overall. The model would not be able to make a choice for this parameter based on the “total links in/out” calculation and therefore would move to the next parameter in the list to break the tie.

Overall links in. This parameter is the sum of the number of all links in to a column. That is, the number of links in to each node in a column is summed and the node in the position under examination that corresponds to the column with the highest number of links in is selected. This parameter allows the researcher to examine a phoneme-grapheme pair in all positions. In Figure 11, node A is in column A, and there are 3 links in to node A; therefore, there are 3 links in to column A. Node X and node B are in column B and there are no links in to node X and 2 links in to node B; therefore, there are 2 links in to column B. In this example, node X needs to link to either node A or node B as they are in the next position. Node X would link to node A as there are a greater number of links in to column A than there are in to column B.

Overall links out. This parameter is the sum of the number of all links out of a column. That is, the number of links out from each position in a column is summed

and the node in the position under examination that corresponds to the column with the highest number of links out is selected. This parameter also allows the researcher to examine a phoneme-grapheme pair in all positions. In Figure 11, node A is in column A, and there are 2 links out from node A; therefore, there are 2 links out from column A. Node X and node B are in column B and there are 4 links out from node X and 3 links out from node B; therefore, there are 7 links out from column B. In this example, node X needs to link to either node A or node B as they are in the next position. Node X would link to node B as there are a greater number of links out from column B than there are from column A.

Total overall links. This parameter is the sum of the number of all links in to and out from a column. That is, the number of links in to and out from each position in a column is summed and the node in the position under examination that corresponds to the column with the highest number of links in and out is selected. Again, this parameter allows the researcher to examine a phoneme-grapheme pair in all positions. In Figure 11, node A is in column A, and there are 3 links into node A and 2 links out from node A, leading to a total of 5 overall links for column A. Node X and node B are in column B and as there are no links in to node X and 4 links out from node X, and 2 links in to node B and 3 links out from node B, leading to a total of 9 overall for column B. In this example, node X needs to link to either node A or node B as they are in the next position. Node X would link to node B as there are a greater number of links in to and out from column B than there are for column A.

Appendix 2

Phoneme - Grapheme pairs

Phonemes	Graphemes
/b/	b, bb, be
/d/	d, dd, ed, de, ld
/f/	f, ff, ph, gh, lf, ft, fe, ffe
/g/	g, gg, gh,gu,gue
/h/	h, wh
/dʒ/	j, ge, g, dge, gg, dj
/k/	k, c, ch, cc, lk, qu ,q, ck, x,che, ke, que, cch,
/l/	l, ll, le, al, lh, il, el, ol
/m/	m, mm, mb, mn, lm, me
/n/	n, nn,kn, gn, pn, ne, en, dn, nd, on, nd, in
/p/	p, pp, pe
/r/	r, rr, wr, rh, re, ar, er
/s/	s, ss, c, sc, ps, st, ce, se, t, z, sw
/t/	t, tt, th, ed, d, te, bt, tte, pt
/v/	v, f, ph, ve
/w/	w, wh, u, o
/j/	y, i, j, u, ue
/z/	z, zz, s, ss, x, ze, se, es
/æ/	a, ai, au, i
/eɪ/	a, ai, eigh, aigh, ay, er, et, ei, au, ea, ey, e
/ɛ/	e, ea, u, ie, ai, a, eo, ei, ae, ay, ue, hea, ed, i
/i:/	i, e, ee, ea, y, ey, oe, ie, ei, eo, ay, ae
/ɪ/	i, e, o, u, ui, y, ie, a, ee, hi
/aɪ/	i, y, igh, ie, uy, ye, ai, is, eigh, i, ei, eye,
/ɒ/	o, a, ho, au, aw, ough, ach, ow, eau, e, ou
/əʊ/	o, oa, oe, ow, ough, eau, oo, ew, ou, au
/ʊ/	o, oo, u,ou
/ʌ/	u, o, oo, ou, ur, a, iou
/u:/	o, oo, ew, ue, u, oe, ough, ui, oew, ou, wo, eu, e

/y/	u, you, ew, iew, yu, ul, eue, eau, ieu, eu, ue
/ɔɪ/	oi, oy, uoy
/aʊ/	ow, ou, ough, o, hou
/ə/	a, er, i, ar, our, or, e, ur, re, eur, ure, u, ou, r, o, er, au, ough, io, ia
/eə/	air, aire, are, ear, ere, eir, ayer, a
/ɑː/	a, ar, au, er, ear, al, arre,
/ɜː/	ir, er, ur, ear, or, our, yr, ere, err
/ɔː/	aw, awe, a, or, oor, ore, oar, our, augh, ar, ough, au, ort, al, o, ure
/ɪə/	ear, eer, ere, ier, e, ea
/ʊə/	ure, our, uo, u
/z/	s, z, ss, x, xh, ge
/tʃ/	ch, tch, t, c, cc
/ʃ/	sh, s, ch, t, c, x, ss, sc
/ð/	th, the
/θ/	th
/ŋ/	ng, n, ngue, gn
/o/	wo, o
/x/	k, ks, cs, x

Appendix 3**Default parameter list**

Parameter Number	Parameter Name
Parameter 1	Best Link Weight
Parameter 2	Link Weights In
Parameter 3	Link Weights Out
Parameter 4	Total Weights In/Out
Parameter 5	Number of Links In
Parameter 6	Number of Links Out
Parameter 7	Total Links In/Out
Parameter 8	Overall Links In
Parameter 9	Overall Links Out
Parameter 10	Overall Links In/Out

Appendix 4

Training stimuli by grade

Grade	Word	Graphemes	Phonemes
3	bat	b,a,t	/b/ /æ/ /t/
3	sad	s,a,d	/s/ /æ/ /d/
3	sit	s,i,t	/s/ /ɪ/ /t/
3	lid	l,i,d	/l/ /ɪ/ /d/
3	but	b,u,t	/b/ /ʌ/ /t/
3	bud	b,u,d	/b/ /ʌ/ /d/
3	red	r,e,d	/r/ /ɛ/ /d/
3	pet	p,e,t	/p/ /ɛ/ /t/
3	rod	r,o,d	/r/ /ɒ/ /d/
3	hot	h,o,t	/h/ /ɒ/ /t/
3	brim	b,r,i,m	/b/ /r/ /ɪ/ /m/
3	crab	c,r,a,b	/k/ /r/ /æ/ /b/
3	crop	c,r,o,p	/k/ /r/ /ɒ/ /p/
3	drag	d,r,a,g	/d/ /r/ /æ/ /g/
3	drip	d,r,i,p	/d/ /r/ /ɪ/ /p/
3	frog	f,r,o,g	/f/ /r/ /ɒ/ /g/
3	from	f,r,o,m	/f/ /r/ /ɒ/ /m/
3	grub	g,r,u,b	/g/ /r/ /ʌ/ /b/
3	grin	g,r,i,n	/g/ /r/ /ɪ/ /n/
3	trip	t,r,i,p	/t/ /r/ /ɪ/ /p/
3	blot	b,l,o,t	/b/ /l/ /ɒ/ /t/
3	clap	c,l,a,p	/k/ /l/ /æ/ /p/
3	club	c,l,u,b	/k/ /l/ /ʌ/ /b/
3	flag	f,l,a,g	/f/ /l/ /æ/ /g/
3	flat	f,l,a,t	/f/ /l/ /æ/ /t/
3	glad	g,l,a,d	/g/ /l/ /æ/ /d/
3	plug	p,l,u,g	/p/ /l/ /ʌ/ /g/
3	plus	p,l,u,s	/p/ /l/ /ʌ/ /s/
3	slip	s,l,i,p	/s/ /l/ /ɪ/ /p/
3	slow	s,l,ow	/s/ /l/ /əʊ/
3	scab	s,c,a,b	/s/ /k/ /æ/ /b/
3	skip	s,k,i,p	/s/ /k/ /ɪ/ /p/
3	skin	s,k,i,n	/s/ /k/ /ɪ/ /n/
3	smog	s,m,o,g	/s/ /m/ /ɒ/ /g/
3	small	s,m,a,ɪl	/s/ /m/ /ɔ: /l/
3	snap	s,n,a,p	/s/ /n/ /æ/ /p/
3	spill	s,p,i,ɪl	/s/ /p/ /ɪ/ /l/
3	spot	s,p,o,t	/s/ /p/ /ɒ/ /t/
3	stop	s,t,o,p	/s/ /t/ /ɒ/ /p/
3	step	s,t,e,p	/s/ /t/ /ɛ/ /p/

3	ant	a,n,t	/æ/ /n/ /t/
3	went	w,e,n,t	/w/ /ɛ/ /n/ /t/
3	and	a,n,d	/æ/ /n/ /d/
3	send	s,e,n,d	/s/ /ɛ/ /n/ /d/
3	bank	b,a,n,k	/b/ /æ/ /ŋ/ /k/
3	sink	s,i,n,k	/s/ /ɪ/ /ŋ/ /k/
3	camp	c,a,m,p	/k/ /æ/ /m/ /p/
3	bump	b,u,m,p	/b/ /ʌ/ /m/ /p/
3	best	b,e,s,t	/b/ /ɛ/ /s/ /t/
3	must	m,u,s,t	/m/ /ʌ/ /s/ /t/
3	boy	b,oy	/b/ /ɔɪ/
3	joy	j,oy	/dʒ/ /ɔɪ/
3	toy	t,oy	/t/ /ɔɪ/
3	soy	s,oy	/s/ /ɔɪ/
3	toys	t,oy,s	/t/ /ɔɪ/ /z/
3	coin	c,oi,n	/k/ /ɔɪ/ /n/
3	boil	b,oi,l	/b/ /ɔɪ/ /l/
3	oil	oi,l	/ɔɪ/ /l/
3	join	j,oi,n	/dʒ/ /ɔɪ/ /n/
3	foil	f,oi,l	/f/ /ɔɪ/ /l/
3	web	w,e,b	/w/ /ɛ/ /b/
3	them	th,e,m	/ð/ /ɛ/ /m/
3	yes	y,e,s	/j/ /ɛ/ /s/
3	egg	e,gg	/ɛ/ /g/
3	next	n,e,x,t	/n/ /ɛ/ /x/ /t/
3	head	h,ea,d	/h/ /ɛ/ /d/
3	bread	b,r,ea,d	/b/ /r/ /ɛ/ /d/
3	thread	th,r,ea,d	/θ/ /r/ /ɛ/ /d/
3	spread	s,p,r,ea,d	/s/ /p/ /r/ /ɛ/ /d/
3	breath	b,r,ea,th	/b/ /r/ /ɛ/ /θ/
3	name	n,a,me	/n/ /eɪ/ /m/
3	late	l,a,te	/l/ /eɪ/ /t/
3	eve	e,ve	/i:/ /v/
3	like	l,i,ke	/l/ /aɪ/ /k/
3	mine	m,i,ne	/m/ /aɪ/ /n/
3	size	s,i,ze	/s/ /aɪ/ /z/
3	home	h,o,me	/h/ /əʊ/ /m/
3	note	n,o,te	/n/ /əʊ/ /t/
3	huge	h,u,ge	/h/ /y/ /dʒ/
3	cute	c,u,te	/k/ /y/ /t/
3	rain	r,ai,n	/r/ /eɪ/ /n/
3	sail	s,ai,l	/s/ /eɪ/ /l/
3	day	d,ay	/d/ /eɪ/
3	play	p,l,ay	/p/ /l/ /eɪ/
3	be	b,e	/b/ /i:/

3	me	m,e	/m/ i:/
3	team	t,ea,m	/t/ i:/ /m/
3	week	w,ee,k	/w/ i:/ /k/
3	my	m,y	/m/ /aɪ/
3	by	b,y	/b/ /aɪ/
3	go	g,o	/g/ /əʊ/
3	no	n,o	/n/ /əʊ/
3	oat	oa,t	/əʊ/ /t/
3	road	r,oa,d	/r/ /əʊ/ /d/
3	boat	b,oa,t	/b/ /əʊ/ /t/
3	new	n,ew	/n/ /y/
3	few	f,ew	/f/ /y/
3	grew	g,r,ew	/g/ /r/ /u:/
3	due	d,ue	/d/ /y/
3	blue	b,l,ue	/b/ /l/ /u:/
3	chin	ch,i,n	/tʃ/ /ɪ/ /n/
3	chat	ch,a,t	/tʃ/ /æ/ /t/
3	phone	ph,o,ne	/f/ /əʊ/ /n/
3	photo	ph,o,t,o	/f/ /əʊ/ /t/ /əʊ/
3	shop	sh,o,p	/ʃ/ /ɒ/ /p/
3	shut	sh,u,t	/ʃ/ /ʌ/ /t/
3	this	th,i,s	/ð/ /ɪ/ /s/
3	they	th,ey	/ð/ /eɪ/
3	what	wh,a,t	/w/ /ɒ/ /t/
3	when	wh,e,n	/w/ /ɛ/ /n/
3	off	o,ff	/ɒ/ /f/
3	cuff	c,u,ff	/k/ /ʌ/ /f/
3	staff	s,t,a,ff	/s/ /t/ /ɑ:/ /f/
3	bell	b,e,ll	/b/ /ɛ/ /l/
3	call	c,a,ll	/k/ /ɔ:/ /l/
3	hill	h,i,ll	/h/ /ɪ/ /l/
3	glass	g,l,a,ss	/g/ /l/ /ɑ:/ /s/
3	dress	d,r,e,ss	/d/ /r/ /ɛ/ /s/
3	jazz	j,a,zz	/dʒ/ /æ/ /z/
3	buzz	b,u,zz	/b/ /ʌ/ /z/
3	to	t,o	/t/ /u:/
3	too	t,oo	/t/ /u:/
3	two	t,wo	/t/ /u:/
3	sea	s,ea	/s/ /i:/
3	see	s,ee	/s/ /i:/
3	one	o,ne	/ɒ/ /n/
3	won	w,o,n	/w/ /ʌ/ /n/
3	be	b,e	/b/ /i:/
3	bee	b,ee	/b/ /i:/
3	for	f,or	/f/ /ɔ:/

3	four	f,our	/f/ /ɔ:/
3	give	g,i,ve	/g/ /ɪ/ /v/
3	love	l,o,ve	/l/ /ʌ/ /v/
3	have	h,a,ve	/h/ /æ/ /v/
3	live	l,i,ve	/l/ /ɪ/ /v/
3	move	m,o,ve	/m/ /u:/ /v/
3	some	s,o,me	/s/ /ʌ/ /m/
3	none	n,o,ne	/n/ /ʌ/ /n/
3	gone	g,o,ne	/g/ /ɒ/ /n/
3	done	d,o,ne	/d/ /ʌ/ /n/
3	come	c,o,me	/k/ /ʌ/ /m/
3	far	f,ar	/f/ /ɑ:/
3	car	c,ar	/k/ /ɑ:/
3	star	s,t,ar	/s/ /t/ /ɑ:/
3	art	ar,t	/ɑ:/ /t/
3	her	h,er	/h/ /ɜ:/
3	were	w,ere	/w/ /ɜ:/
3	term	t,er,m	/t/ /ɜ:/ /m/
3	sir	s,ir	/s/ /ɜ:/
3	bird	b,ir,d	/b/ /ɜ:/ /d/
3	girl	g,ir,l	/g/ /ɜ:/ /l/
3	for	f,or	/f/ /ɔ:/
3	born	b,or,n	/b/ /ɔ:/ /n/
3	cord	c,or,d	/k/ /ɔ:/ /d/
3	fork	f,or,k	/f/ /ɔ:/ /k/
3	pork	p,or,k	/p/ /ɔ:/ /k/
3	horn	h,or,n	/h/ /ɔ:/ /n/
3	fur	f,ur	/f/ /ɜ:/
3	hurt	h,ur,t	/h/ /ɜ:/ /t/
3	turn	t,ur,n	/t/ /ɜ:/ /n/
3	burn	b,ur,n	/b/ /ɜ:/ /n/
3	helped	h,e,l,p,ed	/h/ /ɛ/ /l/ /p/ /t/
3	jumped	j,u,m,p,ed	/dʒ/ /ʌ/ /m/ /p/ /t/
3	picked	p,i,ck,ed	/p/ /ɪ/ /k/ /t/
3	asked	a,s,k,ed	/ɑ:/ /s/ /k/ /t/
3	missed	m,i,ss,ed	/m/ /ɪ/ /s/ /t/
3	walked	w,al,k,ed	/w/ /ɔ:/ /k/ /t/
3	played	p,l,ay,ed	/p/ /l/ /eɪ/ /d/
3	ended	e,n,d,e,d	/ɛ/ /n/ /d/ /ɪ/ /d/
3	packed	p,a,ck,ed	/p/ /æ/ /k/ /t/
3	crossed	c,r,o,ss,ed	/k/ /r/ /ɒ/ /s/ /t/
3	Sunday	s,u,n,d,ay	/s/ /ʌ/ /n/ /d/ /eɪ/
3	Monday	m,o,n,d,ay	/m/ /ʌ/ /n/ /d/ /eɪ/
3	Tuesday	t,ue,s,d,ay	/t/ /y/ /z/ /d/ /eɪ/
3	Wednesday	w,e,dn,es,d,ay	/w/ /ɛ/ /n/ /z/ /d/ /eɪ/

3	Thursday	th,ur,s,d,ay	/θ/ /ɜ:/ /z/ /d/ /eɪ/
3	Friday	f,r,i,d,ay	/f/ /r/ /aɪ/ /d/ /eɪ/
3	Saturday	s,a,t,ur,d,ay	/s/ /æ/ /t/ /ə/ /d/ /eɪ/
3	summer	s,u,mm,er	/s/ /ʌ/ /m/ /ə/
3	autumn	au,t,u,mn	/ɔ:/ /t/ /ə/ /m/
3	winter	w,i,n,t,er	/w/ /ɪ/ /n/ /t/ /ə/
3	spring	s,p,r,i,ng	/s/ /p/ /r/ /ɪ/ /ŋ/
3	quit	q,u,i,t	/k/ /w/ /ɪ/ /t/
3	quiz	q,u,i,z	/k/ /w/ /ɪ/ /z/
3	queen	q,u,ee,n	/k/ /w/ /i:/ /n/
3	quail	q,u,ai,l	/k/ /w/ /eɪ/ /l/
3	quack	q,u,a,ck	/k/ /w/ /æ/ /k/
3	quick	q,u,i,ck	/k/ /w/ /ɪ/ /k/
3	twig	t,w,i,g	/t/ /w/ /ɪ/ /g/
3	twin	t,w,i,n	/t/ /w/ /ɪ/ /n/
3	twit	t,w,i,t	/t/ /w/ /ɪ/ /t/
3	two	t,wo	/t/ /u:/
3	on	o,n	/ɒ/ /n/
3	off	o,ff	/ɒ/ /f/
3	doll	d,o,ll	/d/ /ɒ/ /l/
3	of	o,f	/ɒ/ /v/
3	cold	c,o,l,d	/k/ /ɒ/ /l/ /d/
3	front	f,r,o,n,t	/f/ /r/ /ʌ/ /n/ /t/
3	for	f,or	/f/ /ɔ:/
3	golf	g,o,l,f	/g/ /ɒ/ /l/ /f/
3	son	s,o,n	/s/ /ʌ/ /n/
3	won	w,o,n	/w/ /ʌ/ /n/
3	out	ou,t	/aʊ/ /t/
3	our	o,ur	/aʊ/ /ə/
3	foul	f,ou,l	/f/ /aʊ/ /l/
3	sour	s,o,ur	/s/ /aʊ/ /ə/
3	loud	l,ou,d	/l/ /aʊ/ /d/
3	cow	c,ow	/k/ /aʊ/
3	now	n,ow	/n/ /aʊ/
3	how	h,ow	/h/ /aʊ/
3	down	d,ow,n	/d/ /aʊ/ /n/
3	town	t,ow,n	/t/ /aʊ/ /n/
3	lunches	l,u,n,ch,e,s	/l/ /ʌ/ /n/ /tʃ/ /ɪ/ /z/
3	beaches	b,ea,ch,e,s	/b/ /i:/ /tʃ/ /ɪ/ /z/
3	bunches	b,u,n,ch,e,s	/b/ /ʌ/ /n/ /tʃ/ /ɪ/ /z/
3	matches	m,a,tch,e,s	/m/ /æ/ /tʃ/ /ɪ/ /z/
3	patches	p,a,tch,e,s	/p/ /æ/ /tʃ/ /ɪ/ /z/
3	dishes	d,i,sh,e,s	/d/ /ɪ/ /ʃ/ /ɪ/ /z/
3	brushes	b,r,u,sh,e,s	/b/ /r/ /ʌ/ /ʃ/ /ɪ/ /z/
3	wishes	w,i,sh,e,s	/w/ /ɪ/ /ʃ/ /ɪ/ /z/

3	bushes	b,u,sh,e,s	/b/ /ʊ/ /ʃ/ /ɪ/ /z/
3	crashes	c,r,a,sh,e,s	/k/ /r/ /æ/ /ʃ/ /ɪ/ /z/
3	dresses	d,r,e,ss,e,s	/d/ /r/ /ɛ/ /s/ /ɪ/ /z/
3	classes	c,l,a,ss,e,s	/k/ /l/ /ɑ:/ /s/ /ɪ/ /z/
3	glasses	g,l,a,ss,e,s	/g/ /l/ /ɑ:/ /s/ /ɪ/ /z/
3	atlases	a,t,l,a,s,e,s	/æ/ /t/ /l/ /ə/ /s/ /ɪ/ /z/
3	buses	b,u,s,e,s	/b/ /ʌ/ /s/ /ɪ/ /z/
3	gases	g,a,s,e,s	/g/ /æ/ /s/ /ɪ/ /z/
3	foxes	f,o,x,e,s	/f/ /ɒ/ /x/ /ɪ/ /z/
3	boxes	b,o,x,e,s	/b/ /ɒ/ /x/ /ɪ/ /z/
3	taxes	t,a,x,e,s	/t/ /æ/ /x/ /ɪ/ /z/
3	faxes	f,a,x,e,s	/f/ /æ/ /x/ /ɪ/ /z/
3	singer	s,i,ng,er	/s/ /ɪ/ /ŋ/ /ə/
3	teacher	t,ea,ch,er	/t/ /i:/ /tʃ/ /ə/
3	builder	b,ui,l,d,er	/b/ /ɪ/ /l/ /d/ /ə/
3	painter	p,ai,n,t,er	/p/ /eɪ/ /n/ /t/ /ə/
3	player	p,l,ay,er	/p/ /l/ /eɪ/ /ə/
3	leader	l,ea,d,er	/l/ /i:/ /d/ /ə/
3	printer	p,r,i,n,t,er	/p/ /r/ /ɪ/ /n/ /t/ /ə/
3	cleaner	c,l,ea,n,er	/k/ /l/ /i:/ /n/ /ə/
3	farmer	f,ar,m,er	/f/ /ɑ:/ /m/ /ə/
3	worker	w,or,k,er	/w/ /ɜ:/ /k/ /ə/
3	going	g,o,i,ng	/g/ /əʊ/ /ɪ/ /ŋ/
3	ending	e,n,d,i,ng	/ɛ/ /n/ /d/ /ɪ/ /ŋ/
3	playing	p,l,ay,i,ng	/p/ /l/ /eɪ/ /ɪ/ /ŋ/
3	eating	ea,t,i,ng	/i:/ /t/ /ɪ/ /ŋ/
3	flying	f,l,y,i,ng	/f/ /l/ /aɪ/ /ɪ/ /ŋ/
3	talking	t,al,k,i,ng	/t/ /ɔ:/ /k/ /ɪ/ /ŋ/
3	jumping	j,u,m,p,i,ng	/dʒ/ /ʌ/ /m/ /p/ /ɪ/ /ŋ/
3	cooking	c,oo,k,i,ng	/k/ /ʊ/ /k/ /ɪ/ /ŋ/
3	sleeping	s,l,ee,p,i,ng	/s/ /l/ /i:/ /p/ /ɪ/ /ŋ/
3	reading	r,ea,d,i,ng	/r/ /i:/ /d/ /ɪ/ /ŋ/
3	first	f,ir,s,t	/f/ /ɜ:/ /s/ /t/
3	second	s,e,c,o,n,d	/s/ /ɛ/ /k/ /ə/ /n/ /d/
3	third	th,ir,d	/θ/ /ɜ:/ /d/
3	fourth	f,our,th	/f/ /ɔ:/ /θ/
3	fifth	f,i,f,th	/f/ /ɪ/ /f/ /θ/
3	sixth	s,i,x,th	/s/ /ɪ/ /x/ /θ/
3	seventh	s,e,v,en,th	/s/ /ɛ/ /v/ /n/ /θ/
3	eighth	eigh,th	/eɪ/ /θ/
3	ninth	n,i,n,th	/n/ /aɪ/ /n/ /θ/
3	tenth	t,e,n,th	/t/ /ɛ/ /n/ /θ/
3	orange	o,r,a,n,ge	/ɒ/ /r/ /ɪ/ /n/ /dʒ/
3	yellow	y,e,ll,ow	/j/ /ɛ/ /l/ /əʊ/
3	green	g,r,ee,n	/g/ /r/ /i:/ /n/

3	blue	b,l,ue	/b/ /l/ /u:/
3	white	wh,i,te	/w/ /aɪ/ /t/
3	black	b,l,a,ck	/b/ /l/ /æ/ /k/
3	grey	g,r,ey	/g/ /r/ /eɪ/
3	brown	b,r,ow,n	/b/ /r/ /aʊ/ /n/
3	pink	p,i,n,k	/p/ /ɪ/ /ŋ/ /k/
3	purple	p,ur,p,le	/p/ /ɜ:/ /p/ /l/
3	today	t,o,d,ay	/t/ /ə/ /d/ /eɪ/
3	bedroom	b,e,d,r,oo,m	/b/ /ɛ/ /d/ /r/ /u:/ /m/
3	playground	p,l,ay,g,r,ou,n,d	/p/ /l/ /eɪ/ /g/ /r/ /aʊ/ /n/ /d/
3	downstairs	d,ow,n,s,t,air,s	/d/ /aʊ/ /n/ /s/ /t/ /eə/ /z/
3	outside	ou,t,s,i,de	/aʊ/ /t/ /s/ /aɪ/ /d/
3	birthday	b,ir,th,d,ay	/b/ /ɜ:/ /θ/ /d/ /eɪ/
3	homework	h,o,me,w,or,k	/h/ /əʊ/ /m/ /w/ /ɜ:/ /k/
3	lunchbox	l,u,n,ch,b,o,x	/l/ /ʌ/ /n/ /tʃ/ /b/ /ɒ/ /x/
3	timetable	t,i,me,t,a,b,le	/t/ /aɪ/ /m/ /t/ /eɪ/ /b/ /l/
3	classroom	c,l,a,ss,r,oo,m	/k/ /l/ /ɑ:/ /s/ /r/ /u:/ /m/
3	send	s,e,n,d	/s/ /ɛ/ /n/ /d/
3	wind	w,i,n,d	/w/ /ɪ/ /n/ /d/
3	hand	h,a,n,d	/h/ /æ/ /n/ /d/
3	bank	b,a,n,k	/b/ /æ/ /ŋ/ /k/
3	drink	d,r,i,n,k	/d/ /r/ /ɪ/ /ŋ/ /k/
3	went	w,e,n,t	/w/ /ɛ/ /n/ /t/
3	plant	p,l,a,n,t	/p/ /l/ /eə/ /n/ /t/
3	jump	j,u,m,p	/dʒ/ /ʌ/ /m/ /p/
3	stamp	s,t,a,m,p	/s/ /t/ /æ/ /m/ /p/
3	lamp	l,a,m,p	/l/ /æ/ /m/ /p/
3	our	o,ur	/aʊ/ /ə/
3	out	ou,t	/aʊ/ /t/
3	round	r,ou,n,d	/r/ /aʊ/ /n/ /d/
3	about	a,b,ou,t	/ʌ/ /b/ /aʊ/ /t/
3	house	h,ou,se	/h/ /aʊ/ /s/
3	now	n,ow	/n/ /aʊ/
3	how	h,ow	/h/ /aʊ/
3	down	d,ow,n	/d/ /aʊ/ /n/
3	brown	b,r,ow,n	/b/ /r/ /aʊ/ /n/
3	town	t,ow,n	/t/ /aʊ/ /n/
3	behind	b,e,h,i,n,d	/b/ /ɪ/ /h/ /aɪ/ /n/ /d/
3	between	b,e,t,w,ee,n	/b/ /ɪ/ /t/ /w/ /i:/ /n/
3	because	b,e,c,au,se	/b/ /ɪ/ /k/ /ɒ/ /z/
3	need	n,ee,d	/n/ /i:/ /d/
3	meet	m,ee,t	/m/ /i:/ /t/
3	teach	t,ea,ch	/t/ /i:/ /tʃ/
3	read	r,ea,d	/r/ /i:/ /d/
3	busy	b,u,s,y	/b/ /ɪ/ /z/ /i:/

3	family	f,a,m,i,l,y	/f/ /æ/ /m/ /ɪ/ /l/ /i:/
3	story	s,t,o,r,y	/s/ /t/ /ɔ:/ /r/ /i:/
3	April	a,p,r,i,l	/eɪ/ /p/ /r/ /ə/ /l/
3	sail	s,a,i,l	/s/ /eɪ/ /l/
3	ate	a,t,e	/eɪ/ /t/
3	made	m,a,d,e	/m/ /eɪ/ /d/
3	Sunday	s,u,n,d,a,y	/s/ /ʌ/ /n/ /d/ /eɪ/
3	Monday	m,o,n,d,a,y	/m/ /ʌ/ /n/ /d/ /eɪ/
3	Tuesday	t,u,e,s,d,a,y	/t/ /y/ /z/ /d/ /eɪ/
3	Wednesday	w,e,d,n,e,s,d,a,y	/w/ /ɛ/ /n/ /z/ /d/ /eɪ/
3	Thursday	th,u,r,s,d,a,y	/θ/ /ɜ:/ /z/ /d/ /eɪ/
3	Friday	f,r,i,d,a,y	/f/ /r/ /aɪ/ /d/ /eɪ/
3	Saturday	s,a,t,u,r,d,a,y	/s/ /æ/ /t/ /ə/ /d/ /eɪ/
3	find	f,i,n,d	/f/ /aɪ/ /n/ /d/
3	kind	k,i,n,d	/k/ /aɪ/ /n/ /d/
3	mind	m,i,n,d	/m/ /aɪ/ /n/ /d/
3	blind	b,l,i,n,d	/b/ /l/ /aɪ/ /n/ /d/
3	grind	g,r,i,n,d	/g/ /r/ /aɪ/ /n/ /d/
3	wild	w,i,l,d	/w/ /aɪ/ /l/ /d/
3	mild	m,i,l,d	/m/ /aɪ/ /l/ /d/
3	child	ch,i,l,d	/tʃ/ /aɪ/ /l/ /d/
3	sigh	s,igh	/s/ /aɪ/
3	high	h,igh	/h/ /aɪ/
3	coin	c,oi,n	/k/ /ɔɪ/ /n/
3	point	p,oi,n,t	/p/ /ɔɪ/ /n/ /t/
3	noise	n,oi,se	/n/ /ɔɪ/ /z/
3	boy	b,oy	/b/ /ɔɪ/
3	enjoy	e,n,j,oy	/ɪ/ /n/ /dʒ/ /ɔɪ/
3	good	g,oo,d	/g/ /ʊ/ /d/
3	soon	s,oo,n	/s/ /u:/ /n/
3	would	w,ou,ld	/w/ /ʊ/ /d/
3	could	c,ou,ld	/k/ /ʊ/ /d/
3	should	sh,ou,ld	/ʃ/ /ʊ/ /d/
3	roll	r,o,ll	/r/ /əʊ/ /l/
3	cold	c,o,l,d	/k/ /ɒ/ /l/ /d/
3	gold	g,o,l,d	/g/ /ɒ/ /l/ /d/
3	fold	f,o,l,d	/f/ /ɒ/ /l/ /d/
3	told	t,o,l,d	/t/ /ɒ/ /l/ /d/
3	bolt	b,o,l,t	/b/ /ɒ/ /l/ /t/
3	most	m,o,s,t	/m/ /əʊ/ /s/ /t/
3	post	p,o,s,t	/p/ /əʊ/ /s/ /t/
3	comb	c,o,mb	/k/ /əʊ/ /m/
3	both	b,o,th	/b/ /əʊ/ /θ/
3	why	wh,y	/w/ /aɪ/
3	sky	s,k,y	/s/ /k/ /aɪ/

3	try	t,r,y	/t/ /r/ /aɪ/
3	wipe	w,i,pe	/w/ /aɪ/ /p/
3	time	t,i,me	/t/ /aɪ/ /m/
3	goat	g,oa,t	/g/ /əʊ/ /t/
3	toast	t,oa,s,t	/t/ /əʊ/ /s/ /t/
3	globe	g,l,o,be	/g/ /l/ /əʊ/ /b/
3	those	th,o,se	/ð/ /əʊ/ /z/
3	drove	d,r,o,ve	/d/ /r/ /əʊ/ /v/
3	veil	v,e,i,l	/v/ /eɪ/ /l/
3	eight	eigh,t	/eɪ/ /t/
3	brave	b,r,a,ve	/b/ /r/ /eɪ/ /v/
3	field	f,i,e,l,d	/f/ /i:/ /l/ /d/
3	brief	b,r,i,e,f	/b/ /r/ /i:/ /f/
3	dream	d,r,ea,m	/d/ /r/ /i:/ /m/
3	high	h,igh	/h/ /aɪ/
3	night	n,igh,t	/n/ /aɪ/ /t/
3	glide	g,l,i,de	/g/ /l/ /aɪ/ /d/
3	shine	sh,i,ne	/ʃ/ /aɪ/ /n/
3	grow	g,r,ow	/g/ /r/ /əʊ/
3	snow	s,n,ow	/s/ /n/ /əʊ/
3	post	p,o,s,t	/p/ /əʊ/ /s/ /t/
3	most	m,o,s,t	/m/ /əʊ/ /s/ /t/
3	comb	c,o,mb	/k/ /əʊ/ /m/
3	both	b,o,th	/b/ /əʊ/ /θ/
3	you	you	/y/
3	use	u,se	/y/ /z/
3	cube	c,u,be	/k/ /y/ /b/
3	June	j,u,ne	/dʒ/ /u:/ /n/
3	scrap	s,c,r,a,p	/s/ /k/ /r/ /æ/ /p/
3	screw	s,c,r,ew	/s/ /k/ /r/ /u:/
3	screen	s,c,r,ee,n	/s/ /k/ /r/ /i:/ /n/
3	strip	s,t,r,i,p	/s/ /t/ /r/ /ɪ/ /p/
3	street	s,t,r,ee,t	/s/ /t/ /r/ /i:/ /t/
3	string	s,t,r,i,ng	/s/ /t/ /r/ /ɪ/ /ŋ/
3	stretch	s,t,r,e,tch	/s/ /t/ /r/ /ɛ/ /tʃ/
3	sprain	s,p,r,ai,n	/s/ /p/ /r/ /eɪ/ /n/
3	spray	s,p,r,ay	/s/ /p/ /r/ /eɪ/
3	spring	s,p,r,i,ng	/s/ /p/ /r/ /ɪ/ /ŋ/
3	throw	th,r,ow	/θ/ /r/ /əʊ/
3	three	th,r,ee	/θ/ /r/ /i:/
3	thread	th,r,ea,d	/θ/ /r/ /ɛ/ /d/
3	shred	sh,r,e,d	/ʃ/ /r/ /ɛ/ /d/
3	shrink	sh,r,i,n,k	/ʃ/ /r/ /ɪ/ /ŋ/ /k/
3	shriek	sh,r,ie,k	/ʃ/ /r/ /i:/ /k/
3	square	s,q,u,are	/s/ /k/ /w/ /eə/

3	squint	s,q,u,i,n,t	/s/ /k/ /w/ /ɪ/ /n/ /t/
3	squash	s,q,u,a,sh	/s/ /k/ /w/ /ɒ/ /ʃ/
3	squeal	s,q,u,ea,l	/s/ /k/ /w/ /i:/ /l/
3	hot	h,o,t	/h/ /ɒ/ /t/
3	hotter	h,o,tt,er	/h/ /ɒ/ /t/ /ə/
3	hottest	h,o,tt,e,s,t	/h/ /ɒ/ /t/ /ɪ/ /s/ /t/
3	big	b,i,g	/b/ /ɪ/ /g/
3	bigger	b,i,gg,er	/b/ /ɪ/ /g/ /ə/
3	biggest	b,i,gg,e,s,t	/b/ /ɪ/ /g/ /ɪ/ /s/ /t/
3	long	l,o,ng	/l/ /ɒ/ /ŋ/
3	longer	l,o,n,g,er	/l/ /ɒ/ /ŋ/ /g/ /ə/
3	longest	l,o,n,g,e,s,t	/l/ /ɒ/ /ŋ/ /g/ /ɪ/ /s/ /t/
3	flies	f,l,ie,s	/f/ /l/ /aɪ/ /z/
3	babies	b,a,b,ie,s	/b/ /eɪ/ /b/ /i:/ /z/
3	cities	c,i,t,ie,s	/s/ /ɪ/ /t/ /i:/ /z/
3	ladies	l,a,d,ie,s	/l/ /eɪ/ /d/ /ɪ/ /z/
3	stories	s,t,o,r,ie,s	/s/ /t/ /ɔ:/ /r/ /i:/ /z/
3	copies	c,o,p,ie,s	/k/ /ɒ/ /p/ /i:/ /z/
3	leaves	l,ea,ve,s	/l/ /i:/ /v/ /z/
3	calves	c,al,ve,s	/k/ /ɑ:/ /v/ /z/
3	knives	kn,i,ve,s	/n/ /aɪ/ /v/ /z/
3	shelves	sh,e,l,ve,s	/ʃ/ /ɛ/ /l/ /v/ /z/
3	helping	h,e,l,p,i,ng	/h/ /ɛ/ /l/ /p/ /ɪ/ /ŋ/
3	asking	a,s,k,i,ng	/ɑ:/ /s/ /k/ /ɪ/ /ŋ/
3	talking	t,al,k,i,ng	/t/ /ɔ:/ /k/ /ɪ/ /ŋ/
3	working	w,or,k,i,ng	/w/ /ɜ:/ /k/ /ɪ/ /ŋ/
3	counting	c,ou,n,t,i,ng	/k/ /aʊ/ /n/ /t/ /ɪ/ /ŋ/
3	shopping	sh,o,pp,i,ng	/ʃ/ /ɒ/ /p/ /ɪ/ /ŋ/
3	patting	p,a,tt,i,ng	/p/ /æ/ /t/ /ɪ/ /ŋ/
3	dropping	d,r,o,pp,i,ng	/d/ /r/ /ɒ/ /p/ /ɪ/ /ŋ/
3	flipping	f,l,i,pp,i,ng	/f/ /l/ /ɪ/ /p/ /ɪ/ /ŋ/
3	stopping	s,t,o,pp,i,ng	/s/ /t/ /ɒ/ /p/ /ɪ/ /ŋ/
3	undo	u,n,d,o	/ʌ/ /n/ /d/ /u:/
3	unfold	u,n,f,o,l,d	/ʌ/ /n/ /f/ /ɒ/ /l/ /d/
3	unclean	u,n,c,l,ea,n	/ʌ/ /n/ /k/ /l/ /i:/ /n/
3	unkind	u,n,k,i,n,d	/ʌ/ /n/ /k/ /aɪ/ /n/ /d/
3	unwrap	u,n,wr,a,p	/ʌ/ /n/ /r/ /æ/ /p/
3	redo	r,e,d,o	/r/ /i:/ /d/ /u:/
3	remake	r,e,m,a,ke	/r/ /i:/ /m/ /eɪ/ /k/
3	replay	r,e,p,l,ay	/r/ /i:/ /p/ /l/ /eɪ/
3	return	r,e,t,ur,n	/r/ /ɪ/ /t/ /ɜ:/ /n/
3	reuse	r,e,u,se	/r/ /i:/ /y/ /z/
3	to	t,o	/t/ /u:/
3	too	t,oo	/t/ /u:/
3	two	t,wo	/t/ /u:/

3	so	s,o	/s/ /əʊ/
3	sew	s,ew	/s/ /əʊ/
3	sun	s,u,n	/s/ /ʌ/ /n/
3	son	s,o,n	/s/ /ʌ/ /n/
3	won	w,o,n	/w/ /ʌ/ /n/
3	one	o,ne	/o/ /n/
3	for	f,or	/f/ /ɔ:/
3	four	f,our	/f/ /ɔ:/
3	their	th,eir	/ð/ /eə/
3	there	th,ere	/ð/ /eə/
3	knee	kn,ee	/n/ /i:/
3	know	kn,ow	/n/ /əʊ/
3	knew	kn,ew	/n/ /y/
3	knife	kn,i,fe	/n/ /aɪ/ /f/
3	knot	kn,o,t	/n/ /ɒ/ /t/
3	wrote	wr,o,te	/r/ /əʊ/ /t/
3	write	wr,i,te	/r/ /aɪ/ /t/
3	wrap	wr,a,p	/r/ /æ/ /p/
3	wrong	wr,o,ng	/r/ /ɒ/ /ŋ/
3	wrist	wr,i,s,t	/r/ /ɪ/ /s/ /t/
3	calf	c,al,f	/k/ /ɑ:/ /f/
3	palm	p,al,m	/p/ /ɑ:/ /m/
3	talk	t,al,k	/t/ /ɔ:/ /k/
3	walk	w,al,k	/w/ /ɔ:/ /k/
3	half	h,al,f	/h/ /ɑ:/ /f/
3	arm	ar,m	/ɑ:/ /m/
3	card	c,ar,d	/k/ /ɑ:/ /d/
3	park	p,ar,k	/p/ /ɑ:/ /k/
3	care	c,are	/k/ /eə/
3	rare	r,are	/r/ /eə/
3	stare	s,t,are	/s/ /t/ /eə/
3	air	air	/eə/
3	hair	h,air	/h/ /eə/
3	chair	ch,air	/tʃ/ /eə/
3	term	t,er,m	/t/ /ɜ:/ /m/
3	verse	v,er,se	/v/ /ɜ:/ /s/
3	year	y,ea,r	/j/ /i:/ /ə/
3	hear	h,ea,r	/h/ /i:/ /ə/
3	deer	d,ee,r	/d/ /i:/ /ə/
3	cheer	ch,ee,r	/tʃ/ /i:/ /ə/
3	girl	g,ir,l	/g/ /ɜ:/ /l/
3	third	th,ir,d	/θ/ /ɜ:/ /d/
3	fire	f,i,re	/f/ /aɪ/ /ə/
3	hire	h,i,re	/h/ /aɪ/ /ə/

3	storm	s,t,or,m	/s/ /t/ /ɔ:/ /m/
3	short	sh,or,t	/ʃ/ /ɔ:/ /t/
3	sport	s,p,or,t	/s/ /p/ /ɔ:/ /t/
3	more	m,ore	/m/ /ɔ:/
3	sore	s,ore	/s/ /ɔ:/
3	wore	w,ore	/w/ /ɔ:/
3	burn	b,ur,n	/b/ /ɜ:/ /n/
3	nurse	n,ur,se	/n/ /ɜ:/ /s/
3	curve	c,ur,ve	/k/ /ɜ:/ /v/
3	cure	c,ure	/k/ /ʊə/
3	sure	s,ure	/ʃ/ /ɔ:/
3	flooded	f,l,oo,d,e,d	/f/ /l/ /ʌ/ /d/ /ɪ/ /d/
3	needed	n,ee,d,e,d	/n/ /i:/ /d/ /ɪ/ /d/
3	waited	w,ai,t,e,d	/w/ /eɪ/ /t/ /ɪ/ /d/
3	shouted	sh,ou,t,e,d	/ʃ/ /aʊ/ /t/ /ɪ/ /d/
3	headed	h,ea,d,e,d	/h/ /ɛ/ /d/ /ɪ/ /d/
3	peaked	p,ea,k,ed	/p/ /i:/ /k/ /t/
3	cooked	c,oo,k,ed	/k/ /ʊ/ /k/ /t/
3	looked	l,oo,k,ed	/l/ /ʊ/ /k/ /t/
3	hooked	h,oo,k,ed	/h/ /ʊ/ /k/ /t/
3	leaked	l,ea,k,ed	/l/ /i:/ /k/ /t/
3	joined	j,oi,n,ed	/dʒ/ /ɔɪ/ /n/ /d/
3	sailed	s,ai,l,ed	/s/ /eɪ/ /l/ /d/
3	poured	p,our,ed	/p/ /ɔ:/ /d/
3	cooled	c,oo,l,ed	/k/ /u:/ /l/ /d/
3	screamed	s,c,r,ea,m,ed	/s/ /k/ /r/ /i:/ /m/ /d/
3	coat	c,oa,t	/k/ /əʊ/ /t/
3	card	c,ar,d	/k/ /ɑ:/ /d/
3	cave	c,a,ve	/k/ /eɪ/ /v/
3	coin	c,oi,n	/k/ /ɔɪ/ /n/
3	cake	c,a,ke	/k/ /eɪ/ /k/
3	curl	c,ur,l	/k/ /ɜ:/ /l/
3	cast	c,a,s,t	/k/ /ɑ:/ /s/ /t/
3	circle	c,ir,c,le	/s/ /ɜ:/ /k/ /l/
3	cent	c,e,n,t	/s/ /ɛ/ /n/ /t/
3	centre	c,e,n,t,re	/s/ /ɛ/ /n/ /t/ /ə/
3	city	c,i,t,y	/s/ /ɪ/ /t/ /i:/
3	face	f,a,ce	/f/ /eɪ/ /s/
3	dance	d,a,n,ce	/d/ /ɑ:/ /n/ /s/
3	voice	v,oi,ce	/v/ /ɔɪ/ /s/
3	once	o,n,ce	/ɔ/ /n/ /s/
3	goat	g,oa,t	/g/ /əʊ/ /t/
3	goal	g,oa,l	/g/ /əʊ/ /l/
3	gate	g,a,te	/g/ /eɪ/ /t/
3	gone	g,o,ne	/g/ /ɒ/ /n/

3	game	g,a,me	/g/ /eɪ/ /m/
3	garden	g,ar,d,en	/g/ /ɑ:/ /d/ /n/
3	guess	gu,e,ss	/g/ /ɛ/ /s/
3	stage	s,t,a,ge	/s/ /t/ /eɪ/ /dʒ/
3	germ	g,er,m	/dʒ/ /ɜ:/ /m/
3	page	p,a,ge	/p/ /eɪ/ /dʒ/
3	gym	g,y,m	/dʒ/ /ɪ/ /m/
3	age	a,ge	/eɪ/ /dʒ/
3	gem	g,e,m	/dʒ/ /ɛ/ /m/
3	huge	h,u,ge	/h/ /y/ /dʒ/
3	giant	g,i,a,n,t	/dʒ/ /aɪ/ /ə/ /n/ /t/
3	remind	r,e,m,i,n,d	/r/ /ɪ/ /m/ /aɪ/ /n/ /d/
3	reuse	r,e,u,se	/r/ /i:/ /y/ /z/
3	refill	r,e,f,i,ll	/r/ /i:/ /f/ /ɪ/ /l/
3	replay	r,e,p,l,ay	/r/ /i:/ /p/ /l/ /eɪ/
3	refer	r,e,f,er	/r/ /ɪ/ /f/ /ɜ:/
3	unfair	u,n,f,air	/ʌ/ /n/ /f/ /eə/
3	unpack	u,n,p,a,ck	/ʌ/ /n/ /p/ /æ/ /k/
3	unfold	u,n,f,o,l,d	/ʌ/ /n/ /f/ /ɒ/ /l/ /d/
3	unkind	u,n,k,i,n,d	/ʌ/ /n/ /k/ /aɪ/ /n/ /d/
3	unlock	u,n,l,o,ck	/ʌ/ /n/ /l/ /ɒ/ /k/
3	update	u,p,d,a,te	/ʌ/ /p/ /d/ /eɪ/ /t/
3	uphill	u,p,h,i,ll	/ʌ/ /p/ /h/ /ɪ/ /l/
3	upset	u,p,s,e,t	/ʌ/ /p/ /s/ /ɛ/ /t/
3	upstairs	u,p,s,t,air,s	/ʌ/ /p/ /s/ /t/ /eə/ /z/
3	upload	u,p,l,oa,d	/ʌ/ /p/ /l/ /əʊ/ /d/
3	could	c,ou,ld	/k/ /ʊ/ /d/
3	should	sh,ou,ld	/ʃ/ /ʊ/ /d/
3	would	w,ou,ld	/w/ /ʊ/ /d/
3	flood	f,l,oo,d	/f/ /l/ /ʌ/ /d/
3	blood	b,l,oo,d	/b/ /l/ /ʌ/ /d/
3	head	h,ea,d	/h/ /ɛ/ /d/
3	measure	m,ea,s,ure	/m/ /ɛ/ /ɜ/ /ə/
3	thread	th,r,ea,d	/θ/ /r/ /ɛ/ /d/
3	bread	b,r,ea,d	/b/ /r/ /ɛ/ /d/
3	health	h,ea,l,th	/h/ /ɛ/ /l/ /θ/
3	weather	w,ea,th,er	/w/ /ɛ/ /ð/ /ə/
3	feather	f,ea,th,er	/f/ /ɛ/ /ð/ /ə/
3	heavy	h,ea,v,y	/h/ /ɛ/ /v/ /i:/
3	breakfast	b,r,ea,k,f,a,s,t	/b/ /r/ /ɛ/ /k/ /f/ /ə/ /s/ /t/
3	ready	r,ea,d,y	/r/ /ɛ/ /d/ /i:/
3	greedy	g,r,ee,d,y	/g/ /r/ /i:/ /d/ /i:/
3	tricky	t,r,i,ck,y	/t/ /r/ /ɪ/ /k/ /i:/
3	cloudy	c,l,ou,d,y	/k/ /l/ /aʊ/ /d/ /i:/
3	speedy	s,p,ee,d,y	/s/ /p/ /i:/ /d/ /i:/

3	sleepy	s,l,ee,p,y	/s/ /l/ /i:/ /p/ /i:/
3	smelly	s,m,e,ll,y	/s/ /m/ /ɛ/ /l/ /i:/
3	rocky	r,o,ck,y	/r/ /ɒ/ /k/ /i:/
3	risky	r,i,s,k,y	/r/ /ɪ/ /s/ /k/ /i:/
3	dirty	d,ir,t,y	/d/ /ɜ:/ /t/ /i:/
3	thirsty	th,ir,s,t,y	/θ/ /ɜ:/ /s/ /t/ /i:/
3	healthy	h,ea,l,th,y	/h/ /ɛ/ /l/ /θ/ /i:/
3	sticky	s,t,i,ck,y	/s/ /t/ /ɪ/ /k/ /i:/
3	rainy	r,ai,n,y	/r/ /eɪ/ /n/ /i:/
3	bumpy	b,u,m,p,y	/b/ /ʌ/ /m/ /p/ /i:/
3	funny	f,u,nn,y	/f/ /ʌ/ /n/ /i:/
3	bank	b,a,n,k	/b/ /æ/ /ŋ/ /k/
3	right	r,igh,t	/r/ /aɪ/ /t/
3	sink	s,i,n,k	/s/ /ɪ/ /ŋ/ /k/
3	march	m,ar,ch	/m/ /ɑ:/ /tʃ/
3	suit	s,ui,t	/s/ /u:/ /t/
3	turn	t,ur,n	/t/ /ɜ:/ /n/
3	watch	w,a,tch	/w/ /ɒ/ /tʃ/
3	nail	n,ai,l	/n/ /eɪ/ /l/
3	chop	ch,o,p	/tʃ/ /ɒ/ /p/
3	cast	c,a,s,t	/k/ /ɑ:/ /s/ /t/
3	beam	b,ea,m	/b/ /i:/ /m/
3	bark	b,ar,k	/b/ /ɑ:/ /k/
3	bat	b,a,t	/b/ /æ/ /t/
3	bill	b,i,ll	/b/ /ɪ/ /l/
3	back	b,a,ck	/b/ /æ/ /k/
3	sigh	s,igh	/s/ /aɪ/
3	high	h,igh	/h/ /aɪ/
3	thigh	th,igh	/θ/ /aɪ/
3	sight	s,igh,t	/s/ /aɪ/ /t/
3	light	l,igh,t	/l/ /aɪ/ /t/
3	night	n,igh,t	/n/ /aɪ/ /t/
3	right	r,igh,t	/r/ /aɪ/ /t/
3	might	m,igh,t	/m/ /aɪ/ /t/
3	fight	f,igh,t	/f/ /aɪ/ /t/
3	tight	t,igh,t	/t/ /aɪ/ /t/
3	bright	b,r,igh,t	/b/ /r/ /aɪ/ /t/
3	fright	f,r,igh,t	/f/ /r/ /aɪ/ /t/
3	flight	f,l,igh,t	/f/ /l/ /aɪ/ /t/
3	delight	d,e,l,igh,t	/d/ /ɪ/ /l/ /aɪ/ /t/
3	tonight	t,o,n,igh,t	/t/ /ə/ /n/ /aɪ/ /t/
3	wash	w,a,sh	/w/ /ɒ/ /ʃ/
3	want	w,a,n,t	/w/ /ɒ/ /n/ /t/
3	watch	w,a,tch	/w/ /ɒ/ /tʃ/
3	swap	s,w,a,p	/s/ /w/ /ɒ/ /p/

3	swan	s,w,a,n	/s/ /w/ /ɒ/ /n/
3	ward	w,ar,d	/w/ /ɔ:/ /d/
3	warm	w,ar,m	/w/ /ɔ:/ /m/
3	warn	w,ar,n	/w/ /ɔ:/ /n/
3	swarm	s,w,ar,m	/s/ /w/ /ɔ:/ /m/
3	word	w,or,d	/w/ /ɜ:/ /d/
3	work	w,or,k	/w/ /ɜ:/ /k/
3	world	w,or,l,d	/w/ /ɜ:/ /l/ /d/
3	worm	w,or,m	/w/ /ɜ:/ /m/
3	worse	w,or,se	/w/ /ɜ:/ /s/
3	worth	w,or,th	/w/ /ɜ:/ /θ/
3	eleventh	e,l,e,v,en,th	/ə/ /l/ /ɛ/ /v/ /n/ /θ/
3	twelfth	t,w,e,l,f,th	/t/ /w/ /ɛ/ /l/ /f/ /θ/
3	thirteenth	th,ir,t,ee,n,th	/θ/ /ɜ:/ /t/ /i:/ /n/ /θ/
3	fourteenth	f,our,t,ee,n,th	/f/ /ɔ:/ /t/ /i:/ /n/ /θ/
3	fifteenth	f,i,f,t,ee,n,th	/f/ /ɪ/ /f/ /t/ /i:/ /n/ /θ/
3	sixteenth	s,i,x,t,ee,n,th	/s/ /ɪ/ /x/ /t/ /i:/ /n/ /θ/
3	seventeenth	s,e,v,en,t,ee,n,th	/s/ /ɛ/ /v/ /n/ /t/ /i:/ /n/ /θ/
3	eighteenth	eigh,t,ee,n,th	/eɪ/ /t/ /i:/ /n/ /θ/
3	nineteenth	n,i,ne,t,ee,n,th	/n/ /aɪ/ /n/ /t/ /i:/ /n/ /θ/
3	twentieth	t,w,e,n,t,i,e,th	/t/ /w/ /ɛ/ /n/ /t/ /ɪ/ /ə/ /θ/
3	January	j,a,n,u,a,r,y	/dʒ/ /æ/ /n/ /y/ /eə/ /r/ /i:/
3	February	f,e,b,r,u,a,r,y	/f/ /ɛ/ /b/ /r/ /u:/ /eə/ /r/ /i:/
3	March	m,ar,ch	/m/ /ɑ:/ /tʃ/
3	April	a,p,r,i,l	/eɪ/ /p/ /r/ /ə/ /l/
3	May	m,ay	/m/ /eɪ/
3	June	j,u,ne	/dʒ/ /u:/ /n/
3	July	j,u,l,y	/dʒ/ /ə/ /l/ /aɪ/
3	August	au,g,u,s,t	/ɔ:/ /g/ /ə/ /s/ /t/
3	September	s,e,p,t,e,m,b,er	/s/ /ɛ/ /p/ /t/ /ɛ/ /m/ /b/ /ə/
3	October	o,c,t,o,b,er	/ɒ/ /k/ /t/ /əʊ/ /b/ /ə/
3	November	n,o,v,e,m,b,er	/n/ /əʊ/ /v/ /ɛ/ /m/ /b/ /ə/
3	December	d,e,c,e,m,b,er	/d/ /ɪ/ /s/ /ɛ/ /m/ /b/ /ə/
3	notebook	n,o,t,e,b,oo,k	/n/ /əʊ/ /t/ /b/ /ʊ/ /k/
3	railway	r,ai,l,w,ay	/r/ /eɪ/ /l/ /w/ /eɪ/
3	keyboard	k,e,y,b,oar,d	/k/ /i:/ /b/ /ɔ:/ /d/
3	wheelchair	wh,ee,l,ch,air	/w/ /i:/ /l/ /tʃ/ /eə/
3	himself	h,i,m,s,e,l,f	/h/ /ɪ/ /m/ /s/ /ɛ/ /l/ /f/
3	herself	h,e,r,s,e,l,f	/h/ /ɜ:/ /s/ /ɛ/ /l/ /f/
3	yourself	y,our,s,e,l,f	/j/ /ɔ:/ /s/ /ɛ/ /l/ /f/
3	newspaper	n,ew,s,p,a,p,er	/n/ /y/ /z/ /p/ /eɪ/ /p/ /ə/
3	rainbow	r,ai,n,b,ow	/r/ /eɪ/ /n/ /b/ /əʊ/
3	sunshine	s,u,n,sh,i,ne	/s/ /ʌ/ /n/ /ʃ/ /aɪ/ /n/
3	farewell	f,are,w,e,ll	/f/ /eə/ /w/ /ɛ/ /l/
3	without	w,i,th,ou,t	/w/ /ɪ/ /ð/ /aʊ/ /t/

3	afternoon	a,f,t,er,n,oo,n	/ɑ:/ /f/ /t/ /ə/ /n/ /u:/ /n/
3	grandfather	g,r,a,n,d,f,a,th,er	/g/ /r/ /æ/ /n/ /d/ /f/ /ɑ:/ /ð/ /ə/
3	grandmother	g,r,a,n,d,m,o,th,er	/g/ /r/ /æ/ /n/ /m/ /n/ /ð/ /ə/
3	buses	b,u,s,e,s	/b/ /n/ /s/ /ɪ/ /z/
3	gases	g,a,s,e,s	/g/ /æ/ /s/ /ɪ/ /z/
3	wishes	w,i,sh,e,s	/w/ /ɪ/ /ʃ/ /ɪ/ /z/
3	dishes	d,i,sh,e,s	/d/ /ɪ/ /ʃ/ /ɪ/ /z/
3	classes	c,l,a,ss,e,s	/k/ /l/ /ɑ:/ /s/ /ɪ/ /z/
3	crosses	c,r,o,ss,e,s	/k/ /r/ /ɒ/ /s/ /ɪ/ /z/
3	kisses	k,i,ss,e,s	/k/ /ɪ/ /s/ /ɪ/ /z/
3	boxes	b,o,x,e,s	/b/ /ɒ/ /x/ /ɪ/ /z/
3	waxes	w,a,x,e,s	/w/ /æ/ /x/ /ɪ/ /z/
3	matches	m,a,tch,e,s	/m/ /æ/ /tʃ/ /ɪ/ /z/
3	beaches	b,ea,ch,e,s	/b/ /i:/ /tʃ/ /ɪ/ /z/
3	churches	ch,ur,ch,e,s	/tʃ/ /ɜ:/ /tʃ/ /ɪ/ /z/
3	lunches	l,u,n,ch,e,s	/l/ /n/ /n/ /tʃ/ /ɪ/ /z/
3	waltzes	w,a,l,t,z,e,s	/w/ /ɒ/ /l/ /t/ /s/ /ɪ/ /z/
3	quizzes	q,u,i,zz,e,s	/k/ /w/ /ɪ/ /z/ /ɪ/ /z/
3	close	c,l,o,se	/k/ /l/ /əʊ/ /s/
3	closer	c,l,o,s,er	/k/ /l/ /əʊ/ /s/ /ə/
3	closest	c,l,o,s,e,s,t	/k/ /l/ /əʊ/ /s/ /ɪ/ /s/ /t/
3	far	f,ar	/f/ /ɑ:/
3	further	f,ur,th,er	/f/ /ɜ:/ /ð/ /ə/
3	furthest	f,ur,th,e,s,t	/f/ /ɜ:/ /ð/ /ɪ/ /s/ /t/
3	rough	r,ou,gh	/r/ /n/ /f/
3	rougher	r,ou,gh,er	/r/ /n/ /f/ /ə/
3	roughest	r,ou,gh,e,s,t	/r/ /n/ /f/ /ɪ/ /s/ /t/
3	healthy	h,ea,l,th,y	/h/ /ɛ/ /l/ /θ/ /i:/
3	healthier	h,ea,l,th,i,er	/h/ /ɛ/ /l/ /θ/ /ɪ/ /ə/
3	healthiest	h,ea,l,th,i,e,s,t	/h/ /ɛ/ /l/ /θ/ /ɪ/ /ɛ/ /s/ /t/
3	calm	c,al,m	/k/ /ɑ:/ /m/
3	calmer	c,al,m,er	/k/ /ɑ:/ /m/ /ə/
3	calmest	c,al,m,e,s,t	/k/ /ɑ:/ /m/ /ɪ/ /s/ /t/
3	sport	s,p,or,t	/s/ /p/ /ɔ:/ /t/
3	short	sh,or,t	/ʃ/ /ɔ:/ /t/
3	fortnight	f,or,t,n,igh,t	/f/ /ɔ:/ /t/ /n/ /aɪ/ /t/
3	explore	e,x,p,l,ore	/ɪ/ /x/ /p/ /l/ /ɔ:/
3	support	s,u,pp,or,t	/s/ /ə/ /p/ /ɔ:/ /t/
3	export	e,x,p,or,t	/ɛ/ /x/ /p/ /ɔ:/ /t/
3	flora	f,l,o,r,a	/f/ /l/ /ɔ:/ /r/ /ə/
3	sour	s,o,ur	/s/ /aʊ/ /ə/
3	flour	f,l,o,ur	/f/ /l/ /aʊ/ /ə/
3	course	c,our,se	/k/ /ɔ:/ /s/
3	board	b,oar,d	/b/ /ɔ:/ /d/
3	soar	s,oar	/s/ /ɔ:/

3	turn	t,ur,n	/t/ /ɜ:/ /n/
3	burn	b,ur,n	/b/ /ɜ:/ /n/
3	nurse	n,ur,se	/n/ /ɜ:/ /s/
3	or	or	/ɔ:/
3	oar	oar	/ɔ:/
3	male	m,a,le	/m/ /eɪ/ /l/
3	mail	m,ai,l	/m/ /eɪ/ /l/
3	whole	wh,o,le	/h/ /əʊ/ /l/
3	hole	h,o,le	/h/ /əʊ/ /l/
3	weather	w,ea,th,er	/w/ /ɛ/ /ð/ /ə/
3	whether	wh,e,th,er	/w/ /ɛ/ /ð/ /ə/
3	our	ou,r	/aʊ/ /ə/
3	hour	hou,r	/aʊ/ /ə/
3	break	b,r,ea,k	/b/ /r/ /eɪ/ /k/
3	brake	b,r,a,ke	/b/ /r/ /eɪ/ /k/
3	ate	a,te	/eɪ/ /t/
3	eight	eigh,t	/eɪ/ /t/
3	there	th,ere	/ð/ /eə/
3	their	th,eir	/ð/ /eə/
3	gnat	gn,a,t	/n/ /æ/ /t/
3	gnaw	gn,aw	/n/ /ɔ:/
3	gnarl	gn,ar,l	/n/ /ɑ:/ /l/
3	gnome	gn,o,me	/n/ /əʊ/ /m/
3	wrap	wr,a,p	/r/ /æ/ /p/
3	write	wr,i,te	/r/ /aɪ/ /t/
3	wrote	wr,o,te	/r/ /əʊ/ /t/
3	wrong	wr,o,ng	/r/ /ɒ/ /ŋ/
3	wreck	wr,e,ck	/r/ /ɛ/ /k/
3	wrist	wr,i,s,t	/r/ /ɪ/ /s/ /t/
3	knot	kn,o,t	/n/ /ɒ/ /t/
3	know	kn,ow	/n/ /əʊ/
3	knee	kn,ee	/n/ /i:/
3	knock	kn,o,ck	/n/ /ɒ/ /k/
3	knight	kn,igh,t	/n/ /aɪ/ /t/
3	found	f,ou,n,d	/f/ /aʊ/ /n/ /d/
3	about	a,b,ou,t	/ʌ/ /b/ /aʊ/ /t/
3	bounce	b,ou,n,ce	/b/ /aʊ/ /n/ /s/
3	how	h,ow	/h/ /aʊ/
3	brown	b,r,ow,n	/b/ /r/ /aʊ/ /n/
3	crowd	c,r,ow,d	/k/ /r/ /aʊ/ /d/
3	clown	c,l,ow,n	/k/ /l/ /aʊ/ /n/
3	plough	p,l,ough	/p/ /l/ /aʊ/
3	pause	p,au,se	/p/ /ɔ:/ /z/
3	saucer	s,au,c,er	/s/ /ɔ:/ /s/ /ə/
3	August	au,g,u,s,t	/ɔ:/ /g/ /ə/ /s/ /t/

3	crawl	c,r,aw,l	/k/ /r/ /ɔ:/ /l/
3	straw	s,t,r,aw	/s/ /t/ /r/ /ɔ:/
3	draw	d,r,aw	/d/ /r/ /ɔ:/
3	taught	t,augh,t	/t/ /ɔ:/ /t/
3	lodge	l,o,dge	/l/ /ɒ/ /dʒ/
3	ledge	l,e,dge	/l/ /ɛ/ /dʒ/
3	fridge	f,r,i,dge	/f/ /r/ /ɪ/ /dʒ/
3	wedge	w,e,dge	/w/ /ɛ/ /dʒ/
3	judge	j,u,dge	/dʒ/ /ʌ/ /dʒ/
3	bridge	b,r,i,dge	/b/ /r/ /ɪ/ /dʒ/
3	badge	b,a,dge	/b/ /æ/ /dʒ/
3	stage	s,t,a,ge	/s/ /t/ /eɪ/ /dʒ/
3	huge	h,u,ge	/h/ /y/ /dʒ/
3	cage	c,a,ge	/k/ /eɪ/ /dʒ/
3	page	p,a,ge	/p/ /eɪ/ /dʒ/
3	change	ch,a,n,ge	/tʃ/ /eɪ/ /n/ /dʒ/
3	charge	ch,ar,ge	/tʃ/ /ɑ:/ /dʒ/
3	orange	o,r,a,n,ge	/ɒ/ /r/ /ɪ/ /n/ /dʒ/
3	village	v,i,ll,a,ge	/v/ /ɪ/ /l/ /ɪ/ /dʒ/
3	vein	v,e,i,n	/v/ /eɪ/ /n/
3	weigh	w,eigh	/w/ /eɪ/
3	sleigh	s,l,eigh	/s/ /l/ /eɪ/
3	eigh,th	eigh,th	/eɪ/ /θ/
3	freight	f,r,eigh,t	/f/ /r/ /eɪ/ /t/
3	eighteen	eigh,t,ee,n	/eɪ/ /t/ /i:/ /n/
3	they	th,ey	/ð/ /eɪ/
3	grey	g,r,ey	/g/ /r/ /eɪ/
3	prey	p,r,ey	/p/ /r/ /eɪ/
3	straight	s,t,r,aigh,t	/s/ /t/ /r/ /eɪ/ /t/
3	receive	r,e,c,e,i,ve	/r/ /ɪ/ /s/ /i:/ /v/
3	either	ei,th,er	/aɪ/ /ð/ /ə/
3	people	p,eo,p,le	/p/ /i:/ /p/ /l/
3	honey	h,o,n,ey	/h/ /ʌ/ /n/ /i:/
3	trolley	t,r,o,ll,ey	/t/ /r/ /ɒ/ /l/ /i:/
3	piece	p,ie,ce	/p/ /i:/ /s/
3	chief	ch,ie,f	/tʃ/ /i:/ /f/
3	brief	b,r,ie,f	/b/ /r/ /i:/ /f/
3	believe	b,e,l,ie,ve	/b/ /ɪ/ /l/ /i:/ /v/
3	movie	m,o,v,ie	/m/ /u:/ /v/ /i:/
3	ski	s,k,i	/s/ /k/ /i:/
3	taxi	t,a,x,i	/t/ /æ/ /x/ /i:/
3	screen	s,c,r,ee,n	/s/ /k/ /r/ /i:/ /n/
3	freeze	f,r,ee,ze	/f/ /r/ /i:/ /z/
3	sheep	sh,ee,p	/ʃ/ /i:/ /p/
3	please	p,l,ea,se	/p/ /l/ /i:/ /z/

3	clean	c,l,ea,n	/k/ /l/ /i:/ /n/
3	breathe	b,r,ea,the	/b/ /r/ /i:/ /ð/
3	scream	s,c,r,ea,m	/s/ /k/ /r/ /i:/ /m/
3	pie	p,ie	/p/ /aɪ/
3	lie	l,ie	/l/ /aɪ/
3	guy	g,uy	/g/ /aɪ/
3	buy	b,uy	/b/ /aɪ/
3	kind	k,i,n,d	/k/ /aɪ/ /n/ /d/
3	sign	s,i,gn	/s/ /aɪ/ /n/
3	blind	b,l,i,n,d	/b/ /l/ /aɪ/ /n/ /d/
3	climb	c,l,i,mb	/k/ /l/ /aɪ/ /m/
3	smile	s,m,i,le	/s/ /m/ /aɪ/ /l/
3	twice	t,w,i,ce	/t/ /w/ /aɪ/ /s/
3	quite	q,u,i,te	/k/ /w/ /aɪ/ /t/
3	open	o,p,e,n	/əʊ/ /p/ /ə/ /n/
3	ocean	o,c,ea,n	/əʊ/ /ʃ/ /ɛ/ /n/
3	notice	n,o,t,i,ce	/n/ /əʊ/ /t/ /ɪ/ /s/
3	phone	ph,o,ne	/f/ /əʊ/ /n/
3	close	c,l,o,se	/k/ /l/ /əʊ/ /s/
3	coast	c,oa,s,t	/k/ /əʊ/ /s/ /t/
3	coach	c,oa,ch	/k/ /əʊ/ /tʃ/
3	throat	th,r,oa,t	/θ/ /r/ /əʊ/ /t/
3	though	th,ough	/ð/ /əʊ/
3	dough	d,ough	/d/ /əʊ/
3	unit	u,n,i,t	/y/ /n/ /ɪ/ /t/
3	music	m,u,s,i,c	/m/ /y/ /z/ /ɪ/ /k/
3	human	h,u,m,a,n	/h/ /y/ /m/ /ə/ /n/
3	student	s,t,u,d,e,n,t	/s/ /t/ /y/ /d/ /ə/ /n/ /t/
3	uniform	u,n,i,f,or,m	/y/ /n/ /ɪ/ /f/ /ɔ:/ /m/
3	statue	s,t,a,t,ue	/s/ /t/ /æ/ /t/ /y/
3	rescue	r,e,s,c,ue	/r/ /ɛ/ /s/ /k/ /y/
3	knew	kn,ew	/n/ /y/
3	stew	s,t,ew	/s/ /t/ /y/
3	nephew	n,e,ph,ew	/n/ /ɛ/ /f/ /y/
3	strain	s,t,r,ai,n	/s/ /t/ /r/ /eɪ/ /n/
3	straight	s,t,r,aigh,t	/s/ /t/ /r/ /eɪ/ /t/
3	strange	s,t,r,a,n,ge	/s/ /t/ /r/ /eɪ/ /n/ /dʒ/
3	strawberry	s,t,r,aw,b,e,rr,y	/s/ /t/ /r/ /ɔ:/ /b/ /ə/ /r/ /i:/
3	stressful	s,t,r,e,ss,f,u,l	/s/ /t/ /r/ /ɛ/ /s/ /f/ /ə/ /l/
3	three	th,r,ee	/θ/ /r/ /i:/
3	thrill	th,r,i,ll	/θ/ /r/ /ɪ/ /l/
3	threat	th,r,ea,t	/θ/ /r/ /ɛ/ /t/
3	thrive	th,r,i,ve	/θ/ /r/ /aɪ/ /v/
3	through	th,r,ough	/θ/ /r/ /u:/
3	script	s,c,r,i,p,t	/s/ /k/ /r/ /ɪ/ /p/ /t/

3	scrunch	s,c,r,u,n,ch	/s/ /k/ /r/ /ʌ/ /n/ /tʃ/
3	scratch	s,c,r,a,tch	/s/ /k/ /r/ /æ/ /tʃ/
3	scribble	s,c,r,i,bb,le	/s/ /k/ /r/ /ɪ/ /b/ /l/
3	scramble	s,c,r,a,m,b,le	/s/ /k/ /r/ /æ/ /m/ /b/ /l/
3	squash	s,q,u,a,sh	/s/ /k/ /w/ /ɒ/ /ʃ/
3	squirt	s,q,u,ir,t	/s/ /k/ /w/ /ɜ:/ /t/
3	squawk	s,q,u,aw,k	/s/ /k/ /w/ /ɔ:/ /k/
3	squirrel	s,q,u,i,rr,e,l	/s/ /k/ /w/ /ɪ/ /r/ /ə/ /l/
3	squeeze	s,q,u,ee,ze	/s/ /k/ /w/ /i:/ /z/
3	much	m,u,ch	/m/ /ʌ/ /tʃ/
3	teach	t,ea,ch	/t/ /i:/ /tʃ/
3	beach	b,ea,ch	/b/ /i:/ /tʃ/
3	coach	c,oa,ch	/k/ /əʊ/ /tʃ/
3	speech	s,p,ee,ch	/s/ /p/ /i:/ /tʃ/
3	lunch	l,u,n,ch	/l/ /ʌ/ /n/ /tʃ/
3	attach	a,tt,a,ch	/ə/ /t/ /æ/ /tʃ/
3	which	wh,i,ch	/w/ /ɪ/ /tʃ/
3	approach	a,pp,r,oa,ch	/ə/ /p/ /r/ /əʊ/ /tʃ/
3	sandwich	s,a,n,d,w,i,ch	/s/ /æ/ /n/ /d/ /w/ /ɪ/ /tʃ/
3	catch	c,a,tch	/k/ /æ/ /tʃ/
3	pitch	p,i,tch	/p/ /ɪ/ /tʃ/
3	fetch	f,e,tch	/f/ /ɛ/ /tʃ/
3	match	m,a,tch	/m/ /æ/ /tʃ/
3	watch	w,a,tch	/w/ /ɒ/ /tʃ/
3	sketch	s,k,e,tch	/s/ /k/ /ɛ/ /tʃ/
3	stitch	s,t,i,tch	/s/ /t/ /ɪ/ /tʃ/
3	scratch	s,c,r,a,tch	/s/ /k/ /r/ /æ/ /tʃ/
3	kitchen	k,i,tch,e,n	/k/ /ɪ/ /tʃ/ /ɪ/ /n/
3	butcher	b,u,tch,er	/b/ /ʊ/ /tʃ/ /ə/
3	saw	s,aw	/s/ /ɔ:/
3	fed	f,e,d	/f/ /ɛ/ /d/
3	lost	l,o,s,t	/l/ /ɒ/ /s/ /t/
3	felt	f,e,l,t	/f/ /ɛ/ /l/ /t/
3	swam	s,w,a,m	/s/ /w/ /æ/ /m/
3	paid	p,ai,d	/p/ /eɪ/ /d/
3	wore	w,ore	/w/ /ɔ:/
3	kept	k,e,p,t	/k/ /ɛ/ /p/ /t/
3	broke	b,r,o,ke	/b/ /r/ /əʊ/ /k/
3	chose	ch,o,se	/tʃ/ /əʊ/ /z/
3	froze	f,r,o,ze	/f/ /r/ /əʊ/ /z/
3	said	s,ai,d	/s/ /ɛ/ /d/
3	began	b,e,g,a,n	/b/ /ɪ/ /g/ /æ/ /n/
3	heard	h,ear,d	/h/ /ɜ:/ /d/
3	found	f,ou,n,d	/f/ /aʊ/ /n/ /d/
3	knew	kn,ew	/n/ /y/

3	thought	th,ough,t	/θ/ /ɔ:/ /t/
3	taught	t,augh,t	/t/ /ɔ:/ /t/
3	bought	b,ough,t	/b/ /ɔ:/ /t/
3	brought	b,r,ough,t	/b/ /r/ /ɔ:/ /t/
3	leaves	l,ea,ve,s	/l/ /i:/ /v/ /z/
3	lives	l,i,ve,s	/l/ /ɪ/ /v/ /z/
3	halves	h,al,ve,s	/h/ /ɑ:/ /v/ /z/
3	shelves	sh,e,l,ve,s	/ʃ/ /ɛ/ /l/ /v/ /z/
3	hooves	h,oo,ve,s	/h/ /u:/ /v/ /z/
3	thieves	th,ie,ve,s	/θ/ /i:/ /v/ /z/
3	parties	p,ar,t,ie,s	/p/ /ɑ:/ /t/ /i:/ /z/
3	armies	ar,m,ie,s	/ɑ:/ /m/ /i:/ /z/
3	families	f,a,m,i,l,ie,s	/f/ /æ/ /m/ /ɪ/ /l/ /i:/ /z/
3	replies	r,e,p,l,ie,s	/r/ /ɪ/ /p/ /l/ /aɪ/ /z/
3	berries	b,e,rr,ie,s	/b/ /ɛ/ /r/ /i:/ /z/
3	countries	c,ou,n,t,r,ie,s	/k/ /ʌ/ /n/ /t/ /r/ /i:/ /z/
3	duties	d,u,t,ie,s	/d/ /y/ /t/ /i:/ /z/
3	heroes	h,e,r,o,es	/h/ /ɪ/ /r/ /əʊ/ /z/
3	echoes	e,ch,o,es	/ɛ/ /k/ /əʊ/ /z/
3	tomatoes	t,o,m,a,t,o,es	/t/ /ə/ /m/ /ɑ:/ /t/ /əʊ/ /z/
3	videos	v,i,d,e,o,s	/v/ /ɪ/ /d/ /ɪ/ /əʊ/ /z/
3	pianos	p,i,a,n,o,s	/p/ /ɪ/ /æ/ /n/ /əʊ/ /z/
3	photos	ph,o,t,o,s	/f/ /əʊ/ /t/ /əʊ/ /z/
3	radios	r,a,d,i,o,s	/r/ /eɪ/ /d/ /ɪ/ /əʊ/ /z/
3	dancing	d,a,n,c,i,ng	/d/ /ɑ:/ /n/ /s/ /ɪ/ /ŋ/
3	moving	m,o,v,i,ng	/m/ /u:/ /v/ /ɪ/ /ŋ/
3	hoping	h,o,p,i,ng	/h/ /əʊ/ /p/ /ɪ/ /ŋ/
3	pasting	p,a,s,t,i,ng	/p/ /eɪ/ /s/ /t/ /ɪ/ /ŋ/
3	waving	w,a,v,i,ng	/w/ /eɪ/ /v/ /ɪ/ /ŋ/
3	causing	c,au,s,i,ng	/k/ /ɔ:/ /z/ /ɪ/ /ŋ/
3	using	u,s,i,ng	/y/ /z/ /ɪ/ /ŋ/
3	smiling	s,m,i,l,i,ng	/s/ /m/ /aɪ/ /l/ /ɪ/ /ŋ/
3	tasting	t,a,s,t,i,ng	/t/ /eɪ/ /s/ /t/ /ɪ/ /ŋ/
3	closing	c,l,o,s,i,ng	/k/ /l/ /əʊ/ /z/ /ɪ/ /ŋ/
3	winning	w,i,nn,i,ng	/w/ /ɪ/ /n/ /ɪ/ /ŋ/
3	swimming	s,w,i,mm,i,ng	/s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/
3	skipping	s,k,i,pp,i,ng	/s/ /k/ /ɪ/ /p/ /ɪ/ /ŋ/
3	shopping	sh,o,pp,i,ng	/ʃ/ /ɒ/ /p/ /ɪ/ /ŋ/
3	quitting	q,u,i,tt,i,ng	/k/ /w/ /ɪ/ /t/ /ɪ/ /ŋ/
3	trimming	t,r,i,mm,i,ng	/t/ /r/ /ɪ/ /m/ /ɪ/ /ŋ/
3	gripping	g,r,i,pp,i,ng	/g/ /r/ /ɪ/ /p/ /ɪ/ /ŋ/
3	stepping	s,t,e,pp,i,ng	/s/ /t/ /ɛ/ /p/ /ɪ/ /ŋ/
3	dragging	d,r,a,gg,i,ng	/d/ /r/ /æ/ /g/ /ɪ/ /ŋ/
3	beginning	b,e,g,i,nn,i,ng	/b/ /ɪ/ /g/ /ɪ/ /n/ /ɪ/ /ŋ/
3	sheep	sh,ee,p	/ʃ/ /i:/ /p/

3	fish	f,i,sh	/f/ /ɪ/ /ʃ/
3	dirt	d,ir,t	/d/ /ɜ:/ /t/
3	deer	d,ee,r	/d/ /i:/ /ə/
3	series	s,e,r,ie,s	/s/ /i:/ /r/ /i:/ /z/
3	moose	m,oo,se	/m/ /u:/ /s/
3	bread	b,r,ea,d	/b/ /r/ /ɛ/ /d/
3	snow	s,n,ow	/s/ /n/ /əʊ/
3	aircraft	air,c,r,a,f,t	/eə/ /k/ /r/ /ɑ:/ /f/ /t/
3	homework	h,o,m,e,w,or,k	/h/ /əʊ/ /m/ /w/ /ɜ:/ /k/
3	men	m,e,n	/m/ /ɛ/ /n/
3	feet	f,ee,t	/f/ /i:/ /t/
3	dice	d,i,ce	/d/ /aɪ/ /s/
3	mice	m,i,ce	/m/ /aɪ/ /s/
3	women	w,o,m,e,n	/w/ /ɪ/ /m/ /ɪ/ /n/
3	teeth	t,ee,th	/t/ /i:/ /θ/
3	geese	g,ee,se	/g/ /i:/ /s/
3	children	ch,i,l,d,r,e,n	/tʃ/ /ɪ/ /l/ /d/ /r/ /ə/ /n/
3	people	p,eo,p,le	/p/ /i:/ /p/ /l/
3	fungi	f,u,n,g,i	/f/ /ʌ/ /ŋ/ /g/ /aɪ/
5	waist	w,ai,s,t	/w/ /eɪ/ /s/ /t/
5	waste	w,a,s,te	/w/ /eɪ/ /s/ /t/
5	plane	p,l,a,ne	/p/ /l/ /eɪ/ /n/
5	plain	p,l,ai,n	/p/ /l/ /eɪ/ /n/
5	die	d,ie	/d/ /aɪ/
5	dye	d,ye	/d/ /aɪ/
5	grate	g,r,a,te	/g/ /r/ /eɪ/ /t/
5	great	g,r,ea,t	/g/ /r/ /eɪ/ /t/
5	I	i	/aɪ/
5	eye	eye	/aɪ/
5	mail	m,ai,l	/m/ /eɪ/ /l/
5	male	m,a,le	/m/ /eɪ/ /l/
5	eight	eigh,t	/eɪ/ /t/
5	ate	a,te	/eɪ/ /t/
5	fate	f,a,te	/f/ /eɪ/ /t/
5	fete	f,e,te	/f/ /eɪ/ /t/
5	weigh	w,eigh	/w/ /eɪ/
5	way	w,ay	/w/ /eɪ/
5	write	wr,i,te	/r/ /aɪ/ /t/
5	right	r,igh,t	/r/ /aɪ/ /t/
5	people	p,eo,p,le	/p/ /i:/ /p/ /l/
5	title	t,i,t,le	/t/ /aɪ/ /t/ /l/
5	angle	a,n,g,le	/æ/ /ŋ/ /g/ /l/
5	little	l,i,tt,le	/l/ /ɪ/ /t/ /l/
5	able	a,b,le	/eɪ/ /b/ /l/
5	apple	a,pp,le	/æ/ /p/ /l/

5	bottle	b,o,tt,le	/b/ /ɒ/ /t/ /l/
5	candle	c,a,n,d,le	/k/ /æ/ /n/ /d/ /l/
5	cycle	c,y,c,le	/s/ /aɪ/ /k/ /l/
5	ankle	a,n,k,le	/æ/ /ŋ/ /k/ /l/
5	parcel	p,ar,c,el	/p/ /ɑ:/ /s/ /l/
5	towel	t,ow,e,l	/t/ /aʊ/ /ə/ /l/
5	travel	t,r,a,v,el	/t/ /r/ /æ/ /v/ /l/
5	cancel	c,a,n,c,e,l	/k/ /æ/ /n/ /s/ /ə/ /l/
5	vowel	v,ow,e,l	/v/ /aʊ/ /ə/ /l/
5	level	l,e,v,el	/l/ /ɛ/ /v/ /l/
5	model	m,o,d,el	/m/ /ɒ/ /d/ /l/
5	jewel	j,ew,e,l	/dʒ/ /u:/ /ə/ /l/
5	label	l,a,b,el	/l/ /eɪ/ /b/ /l/
5	novel	n,o,v,e,l	/n/ /ɒ/ /v/ /ə/ /l/
5	thirsty	th,ir,s,t,y	/θ/ /ɜ:/ /s/ /t/ /i:/
5	birthday	b,ir,th,d,ay	/b/ /ɜ:/ /θ/ /d/ /eɪ/
5	circus	c,ir,c,u,s	/s/ /ɜ:/ /k/ /ə/ /s/
5	thirty	th,ir,t,y	/θ/ /ɜ:/ /t/ /i:/
5	thirteen	th,ir,t,ee,n	/θ/ /ɜ:/ /t/ /i:/ /n/
5	further	f,ur,th,er	/f/ /ɜ:/ /ð/ /ə/
5	purple	p,ur,p,le	/p/ /ɜ:/ /p/ /l/
5	hurting	h,ur,t,i,ng	/h/ /ɜ:/ /t/ /ɪ/ /ŋ/
5	curtain	c,ur,t,ai,n	/k/ /ɜ:/ /t/ /ɛ/ /n/
5	player	p,l,ay,er	/p/ /l/ /eɪ/ /ə/
5	person	p,er,s,on	/p/ /ɜ:/ /s/ /n/
5	certain	c,er,t,ai,n	/s/ /ɜ:/ /t/ /ɛ/ /n/
5	eraser	e,r,a,s,er	/ɪ/ /r/ /eɪ/ /z/ /ə/
5	chapter	ch,a,p,t,er	/tʃ/ /æ/ /p/ /t/ /ə/
5	story	s,t,o,r,y	/s/ /t/ /ɔ:/ /r/ /i:/
5	worthy	w,or,th,y	/w/ /ɜ:/ /ð/ /i:/
5	homework	h,o,me,w,or,k	/h/ /əʊ/ /m/ /w/ /ɜ:/ /k/
5	before	b,e,f,ore	/b/ /ɪ/ /f/ /ɔ:/
5	wording	w,or,d,i,ng	/w/ /ɜ:/ /d/ /ɪ/ /ŋ/
5	working	w,or,k,i,ng	/w/ /ɜ:/ /k/ /ɪ/ /ŋ/
5	father	f,a,th,er	/f/ /ɑ:/ /ð/ /ə/
5	discover	d,i,s,c,o,v,er	/d/ /ɪ/ /s/ /k/ /ʌ/ /v/ /ə/
5	weather	w,ea,th,er	/w/ /ɛ/ /ð/ /ə/
5	other	o,th,er	/ʌ/ /ð/ /ə/
5	answer	a,n,sw,er	/ɑ:/ /n/ /s/ /ə/
5	mother	m,o,th,er	/m/ /ʌ/ /ð/ /ə/
5	sister	s,i,s,t,er	/s/ /ɪ/ /s/ /t/ /ə/
5	parent	p,a,r,e,n,t	/p/ /eə/ /r/ /ə/ /n/ /t/
5	party	p,ar,t,y	/p/ /ɑ:/ /t/ /i:/
5	solar	s,o,l,ar	/s/ /əʊ/ /l/ /ə/

5	calendar	c,a,l,e,n,d,a,r	/k/ /æ/ /l/ /ɪ/ /n/ /d/ /ə/
5	dollar	d,o,l,l,a,r	/d/ /ɒ/ /l/ /ə/
5	artist	a,r,t,i,s,t	/ɑ:/ /t/ /ɪ/ /s/ /t/
5	garden	g,a,r,d,e,n	/g/ /ɑ:/ /d/ /n/
5	doctor	d,o,c,t,o,r	/d/ /ɒ/ /k/ /t/ /ə/
5	author	a,u,t,h,o,r	/ɔ:/ /θ/ /ə/
5	motor	m,o,t,o,r	/m/ /əʊ/ /t/ /ə/
5	visitor	v,i,s,i,t,o,r	/v/ /ɪ/ /z/ /ɪ/ /t/ /ə/
5	actor	a,c,t,o,r	/æ/ /k/ /t/ /ə/
5	sailor	s,a,i,l,o,r	/s/ /eɪ/ /l/ /ə/
5	grabbed	g,r,a,b,b,e,d	/g/ /r/ /æ/ /b/ /d/
5	sobbed	s,o,b,b,e,d	/s/ /ɒ/ /b/ /d/
5	shopped	ʃ,o,p,p,e,d	/ʃ/ /ɒ/ /p/ /t/
5	planned	p,l,a,n,n,e,d	/p/ /l/ /æ/ /n/ /d/
5	dropped	d,r,o,p,p,e,d	/d/ /r/ /ɒ/ /p/ /t/
5	spotted	s,p,o,t,t,e,d	/s/ /p/ /ɒ/ /t/ /ɪ/ /d/
5	jogged	dʒ,o,g,g,e,d	/dʒ/ /ɒ/ /g/ /d/
5	wrapped	wr,a,p,p,e,d	/r/ /æ/ /p/ /t/
5	tripped	t,r,i,p,p,e,d	/t/ /r/ /ɪ/ /p/ /t/
5	slipped	s,l,i,p,p,e,d	/s/ /l/ /ɪ/ /p/ /t/
5	served	s,e,r,v,e,d	/s/ /ɜ:/ /v/ /d/
5	agreed	a,g,r,e,e,d	/ə/ /g/ /r/ /i:/ /d/
5	loved	l,o,v,e,d	/l/ /ʌ/ /v/ /d/
5	smiled	s,m,i,l,e,d	/s/ /m/ /aɪ/ /l/ /d/
5	phoned	ph,o,n,e,d	/f/ /əʊ/ /n/ /d/
5	used	u,s,e,d	/u:/ /z/ /d/
5	pasted	p,a,s,t,e,d	/p/ /eɪ/ /s/ /t/ /ɪ/ /d/
5	shared	ʃ,h,a,r,e,d	/ʃ/ /eə/ /d/
5	joked	dʒ,o,k,e,d	/dʒ/ /əʊ/ /k/ /t/
5	tasted	t,a,s,t,e,d	/t/ /eɪ/ /s/ /t/ /ɪ/ /d/
5	urge	ɜr,dʒ	/ɜ:/ /dʒ/
5	barge	b,a,r,dʒ	/b/ /ɑ:/ /dʒ/
5	merge	m,e,r,dʒ	/m/ /ɜ:/ /dʒ/
5	large	l,a,r,dʒ	/l/ /ɑ:/ /dʒ/
5	charge	tʃ,a,r,dʒ	/tʃ/ /ɑ:/ /dʒ/
5	recharge	r,e,tʃ,a,r,dʒ	/r/ /i:/ /tʃ/ /ɑ:/ /dʒ/
5	discharge	d,i,tʃ,a,r,dʒ	/d/ /ɪ/ /s/ /tʃ/ /ɑ:/ /dʒ/
5	emerge	e,m,e,r,dʒ	/ɪ/ /m/ /ɜ:/ /dʒ/
5	bulge	b,u,l,dʒ	/b/ /ʌ/ /l/ /dʒ/
5	indulge	ɪ,n,d,u,l,dʒ	/ɪ/ /n/ /d/ /ʌ/ /l/ /dʒ/
5	divulge	d,i,v,u,l,dʒ	/d/ /aɪ/ /v/ /ʌ/ /l/ /dʒ/
5	exchange	e,x,tʃ,eɪn,dʒ	/ɪ/ /x/ /tʃ/ /eɪ/ /n/ /dʒ/
5	sponge	s,p,o,n,dʒ	/s/ /p/ /ʌ/ /n/ /dʒ/
5	strange	s,t,r,eɪn,dʒ	/s/ /t/ /r/ /eɪ/ /n/ /dʒ/

5	lounge	l,ou,n,ge	/l/ /aʊ/ /n/ /dʒ/
5	change	ch,a,n,ge	/tʃ/ /eɪ/ /n/ /dʒ/
5	range	r,a,n,ge	/r/ /eɪ/ /n/ /dʒ/
5	arrange	a,rr,a,n,ge	/ə/ /r/ /eɪ/ /n/ /dʒ/
5	hinge	h,i,n,ge	/h/ /ɪ/ /n/ /dʒ/
5	fringe	f,r,i,n,ge	/f/ /r/ /ɪ/ /n/ /dʒ/
5	easy	ea,s,y	/i:/ /z/ /i:/
5	copy	c,o,p,y	/k/ /ɒ/ /p/ /i:/
5	carry	c,a,rr,y	/k/ /æ/ /r/ /i:/
5	hurry	h,u,rr,y	/h/ /ʌ/ /r/ /i:/
5	duty	d,u,t,y	/d/ /y/ /t/ /i:/
5	diary	d,i,a,r,y	/d/ /aɪ/ /ə/ /r/ /i:/
5	busy	b,u,s,y	/b/ /ɪ/ /z/ /i:/
5	many	m,a,n,y	/m/ /ɛ/ /n/ /i:/
5	fury	f,u,r,y	/f/ /ʊə/ /r/ /i:/
5	memory	m,e,m,o,r,y	/m/ /ɛ/ /m/ /ə/ /r/ /i:/
5	softly	s,o,f,t,l,y	/s/ /ɒ/ /f/ /t/ /l/ /i:/
5	shortly	sh,or,t,l,y	/ʃ/ /ɔ:/ /t/ /l/ /i:/
5	quietly	q,u,i,e,t,l,y	/k/ /w/ /aɪ/ /ə/ /t/ /l/ /i:/
5	friendly	f,r,i,e,n,d,l,y	/f/ /r/ /ɛ/ /n/ /d/ /l/ /i:/
5	finally	f,i,n,a,l,l,y	/f/ /aɪ/ /n/ /ə/ /l/ /i:/
5	partly	p,ar,t,l,y	/p/ /ɑ:/ /t/ /l/ /i:/
5	badly	b,a,d,l,y	/b/ /æ/ /d/ /l/ /i:/
5	gladly	g,l,a,d,l,y	/g/ /l/ /æ/ /d/ /l/ /i:/
5	slowly	s,l,ow,l,y	/s/ /l/ /əʊ/ /l/ /i:/
5	lately	l,a,t,e,l,y	/l/ /eɪ/ /t/ /l/ /i:/
5	unable	u,n,a,b,le	/ʌ/ /n/ /eɪ/ /b/ /l/
5	unhappy	u,n,h,a,pp,y	/ʌ/ /n/ /h/ /æ/ /p/ /i:/
5	unusual	u,n,u,s,u,a,l	/ʌ/ /n/ /y/ /z/ /ʊ/ /ə/ /l/
5	unclean	u,n,c,l,ea,n	/ʌ/ /n/ /k/ /l/ /i:/ /n/
5	untie	u,n,t,ie	/ʌ/ /n/ /t/ /aɪ/
5	return	r,e,t,ur,n	/r/ /ɪ/ /t/ /ɜ:/ /n/
5	repeat	r,e,p,ea,t	/r/ /ɪ/ /p/ /i:/ /t/
5	replace	r,e,p,l,a,ce	/r/ /ɪ/ /p/ /l/ /eɪ/ /s/
5	recall	r,e,c,a,l,l	/r/ /ɪ/ /k/ /ɔ:/ /l/
5	remake	r,e,m,a,ke	/r/ /i:/ /m/ /eɪ/ /k/
5	recycle	r,e,c,y,c,le	/r/ /i:/ /s/ /aɪ/ /k/ /l/
5	upright	u,p,r,igh,t	/ʌ/ /p/ /r/ /aɪ/ /t/
5	upgrade	u,p,g,r,a,de	/ʌ/ /p/ /g/ /r/ /eɪ/ /d/
5	upon	u,p,o,n	/ə/ /p/ /ɒ/ /n/
5	upset	u,p,s,e,t	/ʌ/ /p/ /s/ /ɛ/ /t/
5	midday	m,i,d,d,ay	/m/ /ɪ/ /d/ /d/ /eɪ/
5	midnight	m,i,d,n,igh,t	/m/ /ɪ/ /d/ /n/ /aɪ/ /t/
5	midyear	m,i,d,y,ea,r	/m/ /ɪ/ /d/ /j/ /i:/ /ə/

5	midweek	m,i,d,w,ee,k	/m/ /ɪ/ /d/ /w/ /i:/ /k/
5	midmorning	m,i,d,m,or,n,i,ng	/m/ /ɪ/ /d/ /m/ /ɔ:/ /n/ /ɪ/ /ŋ/
5	musician	m,u,s,i,c,ia,n	/m/ /u:/ /z/ /ɪ/ /ʃ/ /ə/ /n/
5	politician	p,o,l,i,t,i,c,ia,n	/p/ /ɒ/ /l/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
5	pedestrian	p,e,d,e,s,t,r,i,a,n	/p/ /ɪ/ /d/ /ɛ/ /s/ /t/ /r/ /ɪ/ /ə/ /n/
5	Australian	au,s,t,r,a,l,i,a,n	/ɒ/ /s/ /t/ /r/ /eɪ/ /l/ /j/ /ə/ /n/
5	librarian	l,i,b,r,a,r,i,a,n	/l/ /aɪ/ /b/ /r/ /eə/ /r/ /ɪ/ /ə/ /n/
5	tricky	t,r,i,ck,y	/t/ /r/ /ɪ/ /k/ /i:/
5	funny	f,u,nn,y	/f/ /ʌ/ /n/ /i:/
5	fizzy	f,i,zz,y	/f/ /ɪ/ /z/ /i:/
5	greasy	g,r,ea,s,y	/g/ /r/ /i:/ /z/ /i:/
5	greedy	g,r,ee,d,y	/g/ /r/ /i:/ /d/ /i:/
5	hungry	h,u,n,g,r,y	/h/ /ʌ/ /ŋ/ /g/ /r/ /i:/
5	speedy	s,p,ee,d,y	/s/ /p/ /i:/ /d/ /i:/
5	sunny	s,u,nn,y	/s/ /ʌ/ /n/ /i:/
5	shorten	sh,or,t,en	/ʃ/ /ɔ:/ /t/ /n/
5	straighten	s,t,r,aigh,t,en	/s/ /t/ /r/ /eɪ/ /t/ /n/
5	strengthen	s,t,r,e,ng,th,e,n	/s/ /t/ /r/ /ɛ/ /ŋ/ /θ/ /ə/ /n/
5	weaken	w,ea,k,e,n	/w/ /i:/ /k/ /ə/ /n/
5	widen	w,i,d,en	/w/ /aɪ/ /d/ /n/
5	flatten	f,l,a,tt,en	/f/ /l/ /æ/ /t/ /n/
5	golden	g,o,l,d,e,n	/g/ /əʊ/ /l/ /d/ /ə/ /n/
5	away	a,w,ay	/ə/ /w/ /eɪ/
5	alert	a,l,er,t	/ə/ /l/ /ɜ:/ /t/
5	aloud	a,l,ou,d	/ə/ /l/ /aʊ/ /d/
5	about	a,b,ou,t	/ə/ /b/ /aʊ/ /t/
5	agree	a,g,r,ee	/ə/ /g/ /r/ /i:/
5	assist	a,ss,i,s,t	/ə/ /s/ /ɪ/ /s/ /t/
5	amuse	a,m,u,se	/ə/ /m/ /y/ /z/
5	allow	a,ll,ow	/ə/ /l/ /aʊ/
5	attend	a,tt,e,n,d	/ə/ /t/ /ɛ/ /n/ /d/
5	amount	a,m,ou,n,t	/ə/ /m/ /aʊ/ /n/ /t/
5	begin	b,e,g,i,n	/b/ /ɪ/ /g/ /ɪ/ /n/
5	below	b,e,l,ow	/b/ /ɪ/ /l/ /əʊ/
5	beneath	b,e,n,ea,th	/b/ /ɪ/ /n/ /i:/ /θ/
5	before	b,e,f,ore	/b/ /ɪ/ /f/ /ɔ:/
5	behave	b,e,h,a,ve	/b/ /ɪ/ /h/ /eɪ/ /v/
5	believe	b,e,l,ie,ve	/b/ /ɪ/ /l/ /i:/ /v/
5	between	b,e,t,w,ee,n	/b/ /ɪ/ /t/ /w/ /i:/ /n/
5	belong	b,e,l,o,ng	/b/ /ɪ/ /l/ /ɒ/ /ŋ/
5	behind	b,e,h,i,n,d	/b/ /ɪ/ /h/ /aɪ/ /n/ /d/
5	beside	b,e,s,i,de	/b/ /ɪ/ /s/ /aɪ/ /d/
5	apron	a,p,r,o,n	/eɪ/ /p/ /r/ /ə/ /n/
5	basic	b,a,s,i,c	/b/ /eɪ/ /s/ /ɪ/ /k/

5	paper	p,a,p,er	/p/ /eɪ/ /p/ /ə/
5	table	t,a,b,le	/t/ /eɪ/ /b/ /l/
5	latest	l,a,t,e,s,t	/l/ /eɪ/ /t/ /ɪ/ /s/ /t/
5	bacon	b,a,c,o,n	/b/ /eɪ/ /k/ /ə/ /n/
5	even	e,v,e,n	/i:/ /v/ /ə/ /n/
5	lever	l,e,v,er	/l/ /i:/ /v/ /ə/
5	recent	r,e,c,en,t	/r/ /i:/ /s/ /n/ /t/
5	final	f,i,n,al	/f/ /aɪ/ /n/ /l/
5	tiger	t,i,g,er	/t/ /aɪ/ /g/ /ə/
5	over	o,v,er	/əʊ/ /v/ /ə/
5	local	l,o,c,a,l	/l/ /əʊ/ /k/ /ə/ /l/
5	hotel	h,o,t,e,l	/h/ /əʊ/ /t/ /ɛ/ /l/
5	motel	m,o,t,e,l	/m/ /əʊ/ /t/ /ɛ/ /l/
5	bonus	b,o,n,u,s	/b/ /əʊ/ /n/ /ə/ /s/
5	locate	l,o,c,a,te	/l/ /əʊ/ /k/ /eɪ/ /t/
5	moment	m,o,m,e,n,t	/m/ /əʊ/ /m/ /ə/ /n/ /t/
5	program	p,r,o,g,r,a,m	/p/ /r/ /əʊ/ /g/ /r/ /æ/ /m/
5	music	m,u,s,i,c	/m/ /y/ /z/ /ɪ/ /k/
5	letter	l,e,t,t,er	/l/ /ɛ/ /t/ /ə/
5	happen	h,a,p,p,e,n	/h/ /æ/ /p/ /ə/ /n/
5	kitten	k,i,t,t,en	/k/ /ɪ/ /t/ /n/
5	sudden	s,u,d,d,en	/s/ /ʌ/ /d/ /n/
5	possum	p,o,s,s,u,m	/p/ /ɒ/ /s/ /ə/ /m/
5	traffic	t,r,a,f,f,i,c	/t/ /r/ /æ/ /f/ /ɪ/ /k/
5	rubbish	r,u,b,b,i,sh	/r/ /ʌ/ /b/ /ɪ/ /ʃ/
5	button	b,u,t,t,on	/b/ /ʌ/ /t/ /n/
5	rabbit	r,a,b,b,i,t	/r/ /æ/ /b/ /ɪ/ /t/
5	yellow	y,e,l,l,ow	/j/ /ɛ/ /l/ /əʊ/
5	chicken	ch,i,c,k,e,n	/tʃ/ /ɪ/ /k/ /ɪ/ /n/
5	contact	c,o,n,t,a,c,t	/k/ /ɒ/ /n/ /t/ /æ/ /k/ /t/
5	contest	c,o,n,t,e,s,t	/k/ /ɒ/ /n/ /t/ /ɛ/ /s/ /t/
5	dentist	d,e,n,t,i,s,t	/d/ /ɛ/ /n/ /t/ /ɪ/ /s/ /t/
5	fabric	f,a,b,r,i,c	/f/ /æ/ /b/ /r/ /ɪ/ /k/
5	insect	i,n,s,e,c,t	/ɪ/ /n/ /s/ /ɛ/ /k/ /t/
5	pencil	p,e,n,c,il	/p/ /ɛ/ /n/ /s/ /l/
5	subject	s,u,b,j,e,c,t	/s/ /ʌ/ /b/ /dʒ/ /ɪ/ /k/ /t/
5	doctor	d,o,c,t,or	/d/ /ɒ/ /k/ /t/ /ə/
5	pumpkin	p,u,m,p,k,i,n	/p/ /ʌ/ /m/ /p/ /k/ /ɪ/ /n/
5	unsafe	u,n,s,a,fe	/ʌ/ /n/ /s/ /eɪ/ /f/
5	inhale	i,n,h,a,le	/ɪ/ /n/ /h/ /eɪ/ /l/
5	rename	r,e,n,a,me	/r/ /i:/ /n/ /eɪ/ /m/
5	mistake	m,i,s,t,a,ke	/m/ /ɪ/ /s/ /t/ /eɪ/ /k/
5	escape	e,s,c,a,pe	/ɪ/ /s/ /k/ /eɪ/ /p/
5	delete	d,e,l,e,te	/d/ /ɪ/ /l/ /i:/ /t/

5	complete	c,o,m,p,l,e,t	/k/ /ə/ /m/ /p/ /l/ /i:/ /t/
5	dislike	d,i,s,l,i,k	/d/ /ɪ/ /s/ /l/ /aɪ/ /k/
5	inside	i,n,s,i,d	/ɪ/ /n/ /s/ /aɪ/ /d/
5	invite	i,n,v,i,t	/ɪ/ /n/ /v/ /aɪ/ /t/
5	admire	a,d,m,i,r	/ə/ /d/ /m/ /aɪ/ /ə/
5	describe	d,e,s,c,r,i,b	/d/ /ɪ/ /s/ /k/ /r/ /aɪ/ /b/
5	remote	r,e,m,o,t	/r/ /ɪ/ /m/ /əʊ/ /t/
5	alone	a,l,o,n	/ə/ /l/ /əʊ/ /n/
5	tadpole	t,a,d,p,o,l	/t/ /æ/ /d/ /p/ /əʊ/ /l/
5	postpone	p,o,s,t,p,o,n	/p/ /əʊ/ /s/ /t/ /p/ /əʊ/ /n/
5	telephone	t,e,l,e,p,h,o,n	/t/ /ɛ/ /l/ /ɪ/ /f/ /əʊ/ /n/
5	telescope	t,e,l,e,s,c,o,p	/t/ /ɛ/ /l/ /ɪ/ /s/ /k/ /əʊ/ /p/
5	accuse	a,c,c,u,s	/ə/ /k/ /y/ /z/
5	costume	c,o,s,t,u,m	/k/ /ɒ/ /s/ /t/ /y/ /m/
5	tomb	t,o,m,b	/t/ /u:/ /m/
5	comb	c,o,m,b	/k/ /əʊ/ /m/
5	climb	c,l,i,m,b	/k/ /l/ /aɪ/ /m/
5	lamb	l,a,m,b	/l/ /æ/ /m/
5	thumb	th,u,m,b	/θ/ /ʌ/ /m/
5	numb	n,u,m,b	/n/ /ʌ/ /m/
5	crumb	c,r,u,m,b	/k/ /r/ /ʌ/ /m/
5	plumber	p,l,u,m,b,er	/p/ /l/ /ʌ/ /m/ /ə/
5	doubt	d,o,u,b,t	/d/ /aʊ/ /t/
5	debt	d,e,b,t	/d/ /ɛ/ /t/
5	dough	d,o,u,g,h	/d/ /əʊ/
5	alright	a,l,r,i,g,h,t	/ɔ:/ /l/ /r/ /aɪ/ /t/
5	midnight	m,i,d,n,i,g,h,t	/m/ /ɪ/ /d/ /n/ /aɪ/ /t/
5	knight	kn,i,g,h,t	/n/ /aɪ/ /t/
5	height	h,e,i,g,h,t	/h/ /aɪ/ /t/
5	eight	e,i,g,h,t	/eɪ/ /t/
5	freight	f,r,e,i,g,h,t	/f/ /r/ /eɪ/ /t/
5	weight	w,e,i,g,h,t	/w/ /eɪ/ /t/
5	thought	th,o,u,g,h,t	/θ/ /ɔ:/ /t/
5	bought	b,o,u,g,h,t	/b/ /ɔ:/ /t/
5	first	f,i,r,s,t	/f/ /ɜ:/ /s/ /t/
5	second	s,e,c,o,n,d	/s/ /ɛ/ /k/ /ə/ /n/ /d/
5	third	th,i,r,d	/θ/ /ɜ:/ /d/
5	fourth	f,o,u,r,t,h	/f/ /ɔ:/ /θ/
5	fifth	f,i,f,t,h	/f/ /ɪ/ /f/ /θ/
5	sixth	s,i,x,t,h	/s/ /ɪ/ /x/ /θ/
5	seventh	s,e,v,e,n,t,h	/s/ /ɛ/ /v/ /n/ /θ/
5	eighth	e,i,g,h,t,h	/eɪ/ /θ/
5	ninth	n,i,n,t,h	/n/ /aɪ/ /n/ /θ/
5	tenth	t,e,n,t,h	/t/ /ɛ/ /n/ /θ/

5	eleventh	e,l,e,v,en,th	/ə/ /l/ /ɛ/ /v/ /n/ /θ/
5	twelfth	t,w,e,l,f,th	/t/ /w/ /ɛ/ /l/ /f/ /θ/
5	thirteenth	th,ir,t,ee,n,th	/θ/ /ɜ:/ /t/ /i:/ /n/ /θ/
5	fourteenth	f,our,t,ee,n,th	/f/ /ɔ:/ /t/ /i:/ /n/ /θ/
5	fifteenth	f,i,f,t,ee,n,th	/f/ /ɪ/ /f/ /t/ /i:/ /n/ /θ/
5	sixteenth	s,i,x,t,ee,n,th	/s/ /ɪ/ /x/ /t/ /i:/ /n/ /θ/
5	seventeenth	s,e,v,en,t,ee,n,th	/s/ /ɛ/ /v/ /n/ /t/ /i:/ /n/ /θ/
5	eighteenth	eigh,t,ee,n,th	/eɪ/ /t/ /i:/ /n/ /θ/
5	nineteenth	n,i,ne,t,ee,n,th	/n/ /aɪ/ /n/ /t/ /i:/ /ŋ/ /θ/
5	twentieth	t,w,e,n,t,i,e,th	/t/ /w/ /ɛ/ /n/ /t/ /ɪ/ /ə/ /θ/
5	circle	c,ir,c,le	/s/ /ɜ:/ /k/ /l/
5	circus	c,ir,c,u,s	/s/ /ɜ:/ /k/ /ə/ /s/
5	circuit	c,ir,c,ui,t	/s/ /ɜ:/ /k/ /ɪ/ /t/
5	circular	c,ir,c,u,l,ar	/s/ /ɜ:/ /k/ /ɹ/ /l/ /ə/
5	octagon	o,c,t,a,g,o,n	/ɒ/ /k/ /t/ /ə/ /g/ /ə/ /n/
5	octopus	o,c,t,o,p,u,s	/ɒ/ /k/ /t/ /ə/ /p/ /ə/ /s/
5	octagonal	o,c,t,a,g,o,n,al	/ɒ/ /k/ /t/ /æ/ /g/ /ə/ /n/ /l/
5	October	o,c,t,o,b,er	/ɒ/ /k/ /t/ /əʊ/ /b/ /ə/
5	December	d,e,c,e,m,b,er	/d/ /ɪ/ /s/ /ɛ/ /m/ /b/ /ə/
5	decade	d,e,c,a,de	/d/ /ɛ/ /k/ /eɪ/ /d/
5	decagon	d,e,c,a,g,o,n	/d/ /ɛ/ /k/ /ə/ /g/ /ə/ /n/
5	cent	c,e,n,t	/s/ /ɛ/ /n/ /t/
5	century	c,e,n,t,u,r,y	/s/ /ɛ/ /n/ /tʃ/ /ɹ/ /i:/
5	centipede	c,e,n,t,i,p,e,de	/s/ /ɛ/ /n/ /t/ /ɪ/ /p/ /i:/ /d/
5	centimetre	c,e,n,t,i,m,e,t,re	/s/ /ɛ/ /n/ /t/ /ɪ/ /m/ /i:/ /t/ /ə/
5	centigrade	c,e,n,t,i,g,r,a,de	/s/ /ɛ/ /n/ /t/ /ɪ/ /g/ /r/ /eɪ/ /d/
5	recall	r,e,c,a,ll	/r/ /ɪ/ /k/ /ɔ:/ /l/
5	reset	r,e,s,e,t	/r/ /i:/ /s/ /ɛ/ /t/
5	repeat	r,e,p,e,a,t	/r/ /ɪ/ /p/ /i:/ /t/
5	reply	r,e,p,l,y	/r/ /ɪ/ /p/ /l/ /aɪ/
5	notepaper	n,o,t,e,p,a,p,er	/n/ /əʊ/ /t/ /p/ /eɪ/ /p/ /ə/
5	screwdriver	s,c,r,e,w,d,r,i,v,er	/s/ /k/ /r/ /u:/ /d/ /r/ /aɪ/ /v/ /ə/
5	fingerprint	f,i,n,g,e,r,p,r,i,n,t	/f/ /ɪ/ /ŋ/ /g/ /ə/ /p/ /r/ /ɪ/ /n/ /t/
5	dishwasher	d,i,sh,w,a,sh,er	/d/ /ɪ/ /ʃ/ /w/ /ə/ /ʃ/ /ə/
5	handwriting	h,a,n,d,w,r,i,t,i,ng	/h/ /æ/ /n/ /d/ /r/ /aɪ/ /t/ /ɪ/ /ŋ/
5	whenever	wh,e,n,e,v,er	/w/ /ɛ/ /n/ /ɛ/ /v/ /ə/
5	thunderstorm	th,u,n,d,e,r,s,t,or,m	/θ/ /ʌ/ /n/ /d/ /ə/ /s/ /t/ /ɔ:/ /m/
5	watermelon	w,a,t,e,r,m,e,l,o,n	/w/ /ɔ:/ /t/ /ə/ /m/ /ɛ/ /l/ /ə/ /n/
5	strawberry	s,t,r,aw,b,e,r,r,y	/s/ /t/ /r/ /ɔ:/ /b/ /ə/ /r/ /i:/
5	everywhere	e,v,e,r,y,w,h,e,r,e	/ɛ/ /v/ /r/ /ɪ/ /w/ /eə/
5	watercolour	w,a,t,e,r,c,o,l,our	/w/ /ɔ:/ /t/ /ə/ /k/ /ʌ/ /l/ /ə/
5	overview	o,v,e,r,v,i,ew	/əʊ/ /v/ /ə/ /v/ /j/ /u:/
5	understand	u,n,d,e,r,s,t,a,n,d	/ʌ/ /n/ /d/ /ə/ /s/ /t/ /æ/ /n/ /d/
5	butterflies	b,u,t,t,e,r,f,l,i,e,s	/b/ /ʌ/ /t/ /ə/ /f/ /l/ /aɪ/ /z/

5	peppermint	p,e,pp,er,m,i,n,t	/p/ /ε/ /p/ /ə/ /m/ /ɪ/ /n/ /t/
5	wheelbarrow	wh,ee,l,b,a,rr,ow	/w/ /i:/ /l/ /b/ /æ/ /r/ /əʊ/
5	whichever	wh,i,ch,e,v,er	/w/ /ɪ/ /tʃ/ /ε/ /v/ /ə/
5	takeaway	t,a,ke,a,w,ay	/t/ /eɪ/ /k/ /ə/ /w/ /eɪ/
5	throwaway	th,r,ow,a,w,ay	/θ/ /r/ /əʊ/ /ə/ /w/ /eɪ/
5	aftershock	a,f,t,er,sh,o,ck	/ɑ:/ /f/ /t/ /ə/ /ʃ/ /ɒ/ /k/
5	mice	m,i,ce	/m/ /aɪ/ /s/
5	indices	i,n,d,i,c,e,s	/ɪ/ /n/ /d/ /ɪ/ /s/ /i:/ /z/
5	deer	d,ee,r	/d/ /i:/ /ə/
5	geese	g,ee,se	/g/ /i:/ /s/
5	people	p,eo,p,le	/p/ /i:/ /p/ /l/
5	knives	kn,i,ve,s	/n/ /aɪ/ /v/ /z/
5	loaves	l,oa,ve,s	/l/ /əʊ/ /v/ /z/
5	thieves	th,ie,ve,s	/θ/ /i:/ /v/ /z/
5	videos	v,i,d,e,o,s	/v/ /ɪ/ /d/ /ɪ/ /əʊ/ /z/
5	photos	ph,o,t,o,s	/f/ /əʊ/ /t/ /əʊ/ /z/
5	shut	sh,u,t	/ʃ/ /ʌ/ /t/
5	took	t,oo,k	/t/ /ʊ/ /k/
5	buried	b,u,r,ie,d	/b/ /ε/ /r/ /i:/ /d/
5	knitted	kn,i,tt,e,d	/n/ /ɪ/ /t/ /ɪ/ /d/
5	said	s,ai,d	/s/ /ε/ /d/
5	heard	h,ear,d	/h/ /ɜ:/ /d/
5	felt	f,e,l,t	/f/ /ε/ /l/ /t/
5	found	f,ou,n,d	/f/ /aʊ/ /n/ /d/
5	lost	l,o,s,t	/l/ /ɒ/ /s/ /t/
5	told	t,o,l,d	/t/ /əʊ/ /l/ /d/
5	himself	h,i,m,s,e,l,f	/h/ /ɪ/ /m/ /s/ /ε/ /l/ /f/
5	herself	h,er,s,e,l,f	/h/ /ɜ:/ /s/ /ε/ /l/ /f/
5	yourself	y,our,s,e,l,f	/j/ /ɔ:/ /s/ /ε/ /l/ /f/
5	something	s,o,me,th,i,ng	/s/ /ʌ/ /m/ /θ/ /ɪ/ /ŋ/
5	playground	p,l,ay,g,r,ou,n,d	/p/ /l/ /eɪ/ /g/ /r/ /aʊ/ /n/ /d/
5	without	w,i,th,ou,t	/w/ /ɪ/ /ð/ /aʊ/ /t/
5	everyone	e,ve,r,y,o,ne	/ε/ /v/ /r/ /ɪ/ /o/ /n/
5	anywhere	a,n,y,wh,ere	/ε/ /n/ /ɪ/ /w/ /eə/
5	background	b,a,ck,g,r,ou,n,d	/b/ /æ/ /k/ /g/ /r/ /aʊ/ /n/ /d/
5	handwriting	h,a,n,d,wr,i,t,i,ng	/h/ /æ/ /n/ /d/ /r/ /aɪ/ /t/ /ɪ/ /ŋ/
5	everything	e,ve,r,y,th,i,ng	/ε/ /v/ /r/ /ɪ/ /θ/ /ɪ/ /ŋ/
5	highlight	h,igh,l,igh,t	/h/ /aɪ/ /l/ /aɪ/ /t/
5	overlook	o,v,er,l,oo,k	/əʊ/ /v/ /ə/ /l/ /ʊ/ /k/
5	classroom	c,l,a,ss,r,oo,m	/k/ /l/ /ɑ:/ /s/ /r/ /ʊ/ /m/
5	newspaper	n,ew,s,p,a,p,er	/n/ /y/ /z/ /p/ /eɪ/ /p/ /ə/
5	breakfast	b,r,ea,k,f,a,s,t	/b/ /r/ /ε/ /k/ /f/ /ə/ /s/ /t/
5	lunchbox	l,u,n,ch,b,o,x	/l/ /ʌ/ /n/ /tʃ/ /b/ /ɒ/ /x/
5	downstairs	d,ow,n,s,t,air,s	/d/ /aʊ/ /n/ /s/ /t/ /eə/ /z/

5	daylight	d,ay,l,igh,t	/d/ /eɪ/ /l/ /aɪ/ /t/
5	fortnight	f,or,t,n,igh,t	/f/ /ɔ:/ /t/ /n/ /aɪ/ /t/
5	running	r,u,nn,i,ng	/r/ /ʌ/ /n/ /ɪ/ /ŋ/
5	skipping	s,k,i,pp,i,ng	/s/ /k/ /ɪ/ /p/ /ɪ/ /ŋ/
5	swimming	s,w,i,mm,i,ng	/s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/
5	wrapping	wr,a,pp,i,ng	/r/ /æ/ /p/ /ɪ/ /ŋ/
5	shopping	sh,o,pp,i,ng	/ʃ/ /ɒ/ /p/ /ɪ/ /ŋ/
5	quitting	q,u,i,tt,i,ng	/k/ /w/ /ɪ/ /t/ /ɪ/ /ŋ/
5	dragged	d,r,a,gg,ed	/d/ /r/ /æ/ /g/ /d/
5	patted	p,a,tt,e,d	/p/ /æ/ /t/ /ɪ/ /d/
5	stopped	s,t,o,pp,ed	/s/ /t/ /ɒ/ /p/ /t/
5	grinned	g,r,i,nn,ed	/g/ /r/ /ɪ/ /n/ /d/
5	tripped	t,r,i,pp,ed	/t/ /r/ /ɪ/ /p/ /t/
5	rubbed	r,u,bb,ed	/r/ /ʌ/ /b/ /d/
5	trapped	t,r,a,pp,ed	/t/ /r/ /æ/ /p/ /t/
5	grabbed	g,r,a,bb,ed	/g/ /r/ /æ/ /b/ /d/
5	begged	b,e,gg,ed	/b/ /ɛ/ /g/ /d/
5	hottest	h,o,tt,e,s,t	/h/ /ɒ/ /t/ /ɪ/ /s/ /t/
5	bigger	b,i,gg,er	/b/ /ɪ/ /g/ /ə/
5	spotty	s,p,o,tt,y	/s/ /p/ /ɒ/ /t/ /i:/
5	sunny	s,u,nn,y	/s/ /ʌ/ /n/ /i:/
5	knotty	kn,o,tt,y	/n/ /ɒ/ /t/ /i:/
5	latch	l,a,tch	/l/ /æ/ /tʃ/
5	sketch	s,k,e,tch	/s/ /k/ /ɛ/ /tʃ/
5	stitch	s,t,i,tch	/s/ /t/ /ɪ/ /tʃ/
5	pitch	p,i,tch	/p/ /ɪ/ /tʃ/
5	catch	c,a,tch	/k/ /æ/ /tʃ/
5	hutch	h,u,tch	/h/ /ʌ/ /tʃ/
5	patch	p,a,tch	/p/ /æ/ /tʃ/
5	watch	w,a,tch	/w/ /ɒ/ /tʃ/
5	stretch	s,t,r,e,tch	/s/ /t/ /r/ /ɛ/ /tʃ/
5	which	wh,i,ch	/w/ /ɪ/ /tʃ/
5	approach	a,pp,r,oa,ch	/ə/ /p/ /r/ /əʊ/ /tʃ/
5	attach	a,tt,a,ch	/ə/ /t/ /æ/ /tʃ/
5	bench	b,e,n,ch	/b/ /ɛ/ /n/ /tʃ/
5	bleach	b,l,ea,ch	/b/ /l/ /i:/ /tʃ/
5	coach	c,oa,ch	/k/ /əʊ/ /tʃ/
5	lunch	l,u,n,ch	/l/ /ʌ/ /n/ /tʃ/
5	reach	r,ea,ch	/r/ /i:/ /tʃ/
5	sandwich	s,a,n,d,w,i,ch	/s/ /æ/ /n/ /d/ /w/ /ɪ/ /tʃ/
5	speech	s,p,ee,ch	/s/ /p/ /i:/ /tʃ/
5	search	s,ear,ch	/s/ /ɜ:/ /tʃ/
5	gnash	gn,a,sh	/n/ /æ/ /ʃ/
5	gnashed	gn,a,sh,ed	/n/ /æ/ /ʃ/ /t/

5	gnashing	gn,a,sh,i,ng	/n/ /æ/ /ʃ/ /ɪ/ /ŋ/
5	gnarled	gn,ar,l,ed	/n/ /ɑ:/ /l/ /d/
5	gnocchi	gn,o,cch,i	/ŋ/ /ɒ/ /k/ /i:/
5	gnome	gn,o,me	/n/ /əʊ/ /m/
5	wrist	wr,i,s,t	/r/ /ɪ/ /s/ /t/
5	wring	wr,i,ng	/r/ /ɪ/ /ŋ/
5	wreck	wr,e,ck	/r/ /ɛ/ /k/
5	wrench	wr,e,n,ch	/r/ /ɛ/ /n/ /tʃ/
5	wrinkle	wr,i,n,k,le	/r/ /ɪ/ /ŋ/ /k/ /l/
5	wrapped	wr,a,pp,ed	/r/ /æ/ /p/ /t/
5	knead	kn,ea,d	/n/ /i:/ /d/
5	kneel	kn,ee,l	/n/ /i:/ /l/
5	knoll	kn,o,ll	/n/ /əʊ/ /l/
5	known	kn,ow,n	/n/ /əʊ/ /n/
5	knotted	kn,o,tt,e,d	/n/ /ɒ/ /t/ /ɪ/ /d/
5	knitting	kn,i,tt,i,ng	/n/ /ɪ/ /t/ /ɪ/ /ŋ/
5	knuckle	kn,u,ck,le	/n/ /ʌ/ /k/ /l/
5	knowledge	kn,ow,l,e,dʒe	/n/ /ɒ/ /l/ /ɪ/ /dʒ/
5	voice	v,oi,ce	/v/ /ɔɪ/ /s/
5	avoid	a,v,oi,d	/ə/ /v/ /ɔɪ/ /d/
5	noise	n,oi,se	/n/ /ɔɪ/ /z/
5	point	p,oi,n,t	/p/ /ɔɪ/ /n/ /t/
5	choice	ch,oi,ce	/tʃ/ /ɔɪ/ /s/
5	moisture	m,oi,s,t,ure	/m/ /ɔɪ/ /s/ /tʃ/ /ə/
5	employ	e,m,p,l,oy	/ɪ/ /m/ /p/ /l/ /ɔɪ/
5	annoy	a,nn,oy	/ə/ /n/ /ɔɪ/
5	destroy	d,e,s,t,r,oy	/d/ /ɪ/ /s/ /t/ /r/ /ɔɪ/
5	voyage	v,oy,a,ge	/v/ /ɔɪ/ /ɪ/ /dʒ/
5	enjoy	e,n,j,oy	/ɪ/ /n/ /dʒ/ /ɔɪ/
5	allow	a,ll,ow	/ə/ /l/ /əʊ/
5	prowl	p,r,ow,l	/p/ /r/ /əʊ/ /l/
5	power	p,ow,er	/p/ /əʊ/ /ə/
5	towel	t,ow,e,l	/t/ /əʊ/ /ə/ /l/
5	amount	a,m,ou,n,t	/ə/ /m/ /əʊ/ /n/ /t/
5	doubt	d,ou,bt	/d/ /əʊ/ /t/
5	sound	s,ou,n,d	/s/ /əʊ/ /n/ /d/
5	scout	s,c,ou,t	/s/ /k/ /əʊ/ /t/
5	ground	g,r,ou,n,d	/g/ /r/ /əʊ/ /n/ /d/
5	bracelet	b,r,a,ce,l,e,t	/b/ /r/ /eɪ/ /s/ /l/ /ɪ/ /t/
5	escape	e,s,c,a,pe	/ɪ/ /s/ /k/ /eɪ/ /p/
5	baseball	b,a,se,b,a,ll	/b/ /eɪ/ /s/ /b/ /ɔ:/ /l/
5	essay	e,ss,ay	/ɛ/ /s/ /eɪ/
5	crayon	c,r,ay,o,n	/k/ /r/ /eɪ/ /ə/ /n/
5	player	p,l,ay,er	/p/ /l/ /eɪ/ /ə/

5	rainbow	r,ai,n,b,ow	/r/ /eɪ/ /n/ /b/ /əʊ/
5	painter	p,ai,n,t,er	/p/ /eɪ/ /n/ /t/ /ə/
5	contain	c,o,n,t,ai,n	/k/ /ə/ /n/ /t/ /eɪ/ /n/
5	explain	e,x,p,l,ai,n	/ɪ/ /x/ /p/ /l/ /eɪ/ /n/
5	ninety	n,i,ne,t,y	/n/ /aɪ/ /n/ /t/ /i:/
5	higher	h,igh,er	/h/ /aɪ/ /ə/
5	frighten	f,r,igh,t,en	/f/ /r/ /aɪ/ /t/ /n/
5	tonight	t,o,n,igh,t	/t/ /ə/ /n/ /aɪ/ /t/
5	remind	r,e,m,i,n,d	/r/ /ɪ/ /m/ /aɪ/ /n/ /d/
5	lonely	l,o,ne,l,y	/l/ /əʊ/ /n/ /l/ /i:/
5	almost	a,l,m,o,s,t	/ɔ:/ /l/ /m/ /əʊ/ /s/ /t/
5	below	b,e,l,ow	/b/ /ɪ/ /l/ /əʊ/
5	owner	ow,n,er	/əʊ/ /n/ /ə/
5	toaster	t,oa,s,t,er	/t/ /əʊ/ /s/ /t/ /ə/
5	knew	kn,ew	/n/ /y/
5	tutor	t,u,t,or	/t/ /y/ /t/ /ə/
5	skewer	s,k,ew,er	/s/ /k/ /y/ /ə/
5	amuse	a,m,u,se	/ə/ /m/ /y/ /z/
5	student	s,t,u,d,e,n,t	/s/ /t/ /y/ /d/ /ə/ /n/ /t/
5	useful	u,se,f,u,l	/y/ /s/ /f/ /ʊ/ /l/
5	perfume	p,er,f,u,me	/p/ /ɜ:/ /f/ /y/ /m/
5	confuse	c,o,n,f,u,se	/k/ /ə/ /n/ /f/ /y/ /z/
5	avenue	a,v,e,n,ue	/æ/ /v/ /ɪ/ /n/ /y/
5	statue	s,t,a,t,ue	/s/ /t/ /æ/ /t/ /y/
5	ideal	i,d,ea,l	/aɪ/ /d/ /i:/ /l/
5	season	s,ea,s,on	/s/ /i:/ /z/ /n/
5	peanut	p,ea,n,u,t	/p/ /i:/ /n/ /ʌ/ /t/
5	disease	d,i,s,ea,se	/d/ /ɪ/ /z/ /i:/ /z/
5	compete	c,o,m,p,e,te	/k/ /ə/ /m/ /p/ /i:/ /t/
5	supreme	s,u,p,r,e,me	/s/ /u:/ /p/ /r/ /i:/ /m/
5	agree	a,g,r,ee	/ə/ /g/ /r/ /i:/
5	beetle	b,ee,t,le	/b/ /i:/ /t/ /l/
5	needle	n,ee,d,le	/n/ /i:/ /d/ /l/
5	succeed	s,u,c,c,ee,d	/s/ /ə/ /k/ /s/ /i:/ /d/
5	cries	c,r,ie,s	/k/ /r/ /aɪ/ /z/
5	replies	r,e,p,l,ie,s	/r/ /ɪ/ /p/ /l/ /aɪ/ /z/
5	carries	c,a,rr,ie,s	/k/ /æ/ /r/ /i:/ /z/
5	ladies	l,a,d,ie,s	/l/ /eɪ/ /d/ /ɪ/ /z/
5	parties	p,ar,t,ie,s	/p/ /ɑ:/ /t/ /i:/ /z/
5	activities	a,c,t,i,v,i,t,ie,s	/æ/ /k/ /t/ /ɪ/ /v/ /ɪ/ /t/ /i:/ /z/
5	angrily	a,n,g,r,i,l,y	/æ/ /ŋ/ /g/ /r/ /ɪ/ /l/ /i:/
5	easily	ea,s,i,l,y	/i:/ /z/ /ɪ/ /l/ /i:/
5	easiest	ea,s,i,e,s,t	/i:/ /z/ /ɪ/ /ε/ /s/ /t/
5	funniest	f,u,nn,i,e,s,t	/f/ /ʌ/ /n/ /ɪ/ /ε/ /s/ /t/

5	heaviest	h,ea,v,i,e,s,t	/h/ /ɛ/ /v/ /ɪ/ /ɛ/ /s/ /t/
5	studious	s,t,u,d,i,ou,s	/s/ /t/ /y/ /d/ /ɪ/ /ʌ/ /s/
5	happiness	h,a,pp,i,n,e,ss	/h/ /æ/ /p/ /ɪ/ /n/ /ɪ/ /s/
5	beginning	b,e,g,i,nn,i,ng	/b/ /ɪ/ /g/ /ɪ/ /n/ /ɪ/ /ŋ/
5	admitting	a,d,m,i,tt,i,ng	/ə/ /d/ /m/ /ɪ/ /t/ /ɪ/ /ŋ/
5	controlling	c,o,n,t,r,o,ll,i,ng	/k/ /ə/ /n/ /t/ /r/ /əʊ/ /l/ /ɪ/ /ŋ/
5	admitted	a,d,m,i,tt,e,d	/ə/ /d/ /m/ /ɪ/ /t/ /ɪ/ /d/
5	permitted	p,er,m,i,tt,e,d	/p/ /ə/ /m/ /ɪ/ /t/ /ɪ/ /d/
5	referred	r,e,f,err,ed	/r/ /ɪ/ /f/ /ɜ:/ /d/
5	committed	c,o,mm,i,tt,e,d	/k/ /ə/ /m/ /ɪ/ /t/ /ɪ/ /d/
5	present	p,r,e,s,en,t	/p/ /r/ /ɛ/ /z/ /n/ /t/
5	object	o,b,j,e,c,t	/ɒ/ /b/ /dʒ/ /ɪ/ /k/ /t/
5	content	c,o,n,t,e,n,t	/k/ /ɒ/ /n/ /t/ /ɛ/ /n/ /t/
5	export	e,x,p,or,t	/ɛ/ /x/ /p/ /ɔ:/ /t/
5	complex	c,o,m,p,l,e,x	/k/ /ɒ/ /m/ /p/ /l/ /ɛ/ /x/
5	protest	p,r,o,t,e,s,t	/p/ /r/ /əʊ/ /t/ /ɛ/ /s/ /t/
5	produce	p,r,o,d,u,ce	/p/ /r/ /ɒ/ /d/ /y/ /s/
5	refuse	r,e,f,u,se	/r/ /i:/ /f/ /y/ /z/
5	conduct	c,o,n,d,u,c,t	/k/ /ɒ/ /n/ /d/ /ʌ/ /k/ /t/
5	record	r,e,c,or,d	/r/ /ɛ/ /k/ /ɔ:/ /d/
5	principle	p,r,i,n,c,i,p,le	/p/ /r/ /ɪ/ /n/ /s/ /ə/ /p/ /l/
5	candle	c,a,n,d,le	/k/ /æ/ /n/ /d/ /l/
5	example	e,x,a,m,p,le	/ɪ/ /x/ /ɑ:/ /m/ /p/ /l/
5	double	d,ou,b,le	/d/ /ʌ/ /b/ /l/
5	miracle	m,i,r,a,c,le	/m/ /ɪ/ /r/ /ə/ /k/ /l/
5	staple	s,t,a,p,le	/s/ /t/ /eɪ/ /p/ /l/
5	handle	h,a,n,d,le	/h/ /æ/ /n/ /d/ /l/
5	vehicle	v,e,h,i,c,le	/v/ /i:/ /ɪ/ /k/ /l/
5	couple	c,ou,p,le	/k/ /ʌ/ /p/ /l/
5	tremble	t,r,e,m,b,le	/t/ /r/ /ɛ/ /m/ /b/ /l/
5	jewel	j,ew,e,l	/dʒ/ /u:/ /ə/ /l/
5	fuel	f,u,e,l	/f/ /u:/ /ə/ /l/
5	caramel	c,a,r,a,m,e,l	/k/ /æ/ /r/ /ə/ /m/ /ɛ/ /l/
5	level	l,e,v,e,l	/l/ /ɛ/ /v/ /l/
5	quarrel	q,u,a,r,r,e,l	/k/ /w/ /ɒ/ /r/ /ə/ /l/
5	novel	n,o,v,e,l	/n/ /ɒ/ /v/ /ə/ /l/
5	hotel	h,o,t,e,l	/h/ /əʊ/ /t/ /ɛ/ /l/
5	tunnel	t,u,nn,el	/t/ /ʌ/ /n/ /l/
5	cancel	c,a,n,c,e,l	/k/ /æ/ /n/ /s/ /ə/ /l/
5	funnel	f,u,nn,el	/f/ /ʌ/ /n/ /l/
5	council	c,ou,n,c,i,l	/k/ /aʊ/ /n/ /s/ /ə/ /l/
5	pencil	p,e,n,c,il	/p/ /ɛ/ /n/ /s/ /l/
5	nostril	n,o,s,t,r,i,l	/n/ /ɒ/ /s/ /t/ /r/ /ɪ/ /l/
5	April	a,p,r,i,l	/eɪ/ /p/ /r/ /ə/ /l/

5	civil	c,i,v,il	/s/ /ɪ/ /v/ /l/
5	tonsil	t,o,n,s,il	/t/ /ɒ/ /n/ /s/ /l/
5	stencil	s,t,e,n,c,il	/s/ /t/ /ɛ/ /n/ /s/ /l/
5	pupil	p,u,p,il	/p/ /y/ /p/ /l/
5	fossil	f,o,ss,il	/f/ /ɒ/ /s/ /l/
5	principal	p,r,i,n,c,i,p,a,l	/p/ /r/ /ɪ/ /n/ /s/ /ə/ /p/ /ə/ /l/
5	normal	n,or,m,a,l	/n/ /ɔ:/ /m/ /ə/ /l/
5	journal	j,our,n,al	/dʒ/ /ɜ:/ /n/ /l/
5	animal	a,n,i,m,a,l	/æ/ /n/ /ɪ/ /m/ /ə/ /l/
5	material	m,a,t,e,r,i,a,l	/m/ /ə/ /t/ /ɪə/ /r/ /ɪ/ /ə/ /l/
5	social	s,o,c,i,a,l	/s/ /əʊ/ /ʃ/ /ə/ /l/
5	equal	e,q,u,a,l	/i:/ /k/ /w/ /ə/ /l/
5	festival	f,e,s,t,i,v,a,l	/f/ /ɛ/ /s/ /t/ /ə/ /v/ /ə/ /l/
5	special	s,p,e,c,i,a,l	/s/ /p/ /ɛ/ /ʃ/ /ə/ /l/
5	dental	d,e,n,t,al	/d/ /ɛ/ /n/ /t/ /l/
5	hospital	h,o,s,p,i,t,al	/h/ /ɒ/ /s/ /p/ /ɪ/ /t/ /l/
5	unusual	u,n,u,s,u,a,l	/ʌ/ /n/ /y/ /z/ /ʊ/ /ə/ /l/
5	unclean	u,n,c,l,e,a,n	/ʌ/ /n/ /k/ /l/ /i:/ /n/
5	unable	u,n,a,b,l,e	/ʌ/ /n/ /eɪ/ /b/ /l/
5	unhappy	u,n,h,a,p,p,y	/ʌ/ /n/ /h/ /æ/ /p/ /i:/
5	uncommon	u,n,c,o,m,m,o,n	/ʌ/ /n/ /k/ /ɒ/ /m/ /ə/ /n/
5	research	r,e,s,e,a,r,c,h	/r/ /ɪ/ /s/ /ɜ:/ /tʃ/
5	recharge	r,e,c,h,a,r,g,e	/r/ /i:/ /tʃ/ /ɑ:/ /dʒ/
5	recycle	r,e,c,y,c,l,e	/r/ /i:/ /s/ /aɪ/ /k/ /l/
5	refill	r,e,f,i,l,l	/r/ /i:/ /f/ /ɪ/ /l/
5	remind	r,e,m,i,n,d	/r/ /ɪ/ /m/ /aɪ/ /n/ /d/
5	disagree	d,i,s,a,g,r,e,e	/d/ /ɪ/ /s/ /ə/ /g/ /r/ /i:/
5	dishonest	d,i,s,h,o,n,e,s,t	/d/ /ɪ/ /s/ /ɒ/ /n/ /ɪ/ /s/ /t/
5	discovery	d,i,s,c,o,v,e,r,y	/d/ /ɪ/ /s/ /k/ /ʌ/ /v/ /ə/ /r/ /i:/
5	disappear	d,i,s,a,p,p,e,a,r	/d/ /ɪ/ /s/ /ə/ /p/ /ɪə/
5	disobey	d,i,s,o,b,e,y	/d/ /ɪ/ /s/ /ə/ /b/ /eɪ/
5	mistrust	m,i,s,t,r,u,s,t	/m/ /ɪ/ /s/ /t/ /r/ /ʌ/ /s/ /t/
5	mistook	m,i,s,t,o,o,k	/m/ /ɪ/ /s/ /t/ /ʊ/ /k/
5	misspell	m,i,s,s,p,e,l,l	/m/ /ɪ/ /s/ /s/ /p/ /ɛ/ /l/
5	misprint	m,i,s,p,r,i,n,t	/m/ /ɪ/ /s/ /p/ /r/ /ɪ/ /n/ /t/
5	misbehave	m,i,s,b,e,h,a,v,e	/m/ /ɪ/ /s/ /b/ /ɪ/ /h/ /eɪ/ /v/
5	calm	c,a,l,m	/k/ /ɑ:/ /m/
5	calmer	c,a,l,m,e,r	/k/ /ɑ:/ /m/ /ə/
5	calmest	c,a,l,m,e,s,t	/k/ /ɑ:/ /m/ /ɪ/ /s/ /t/
5	large	l,a,r,g,e	/l/ /ɑ:/ /dʒ/
5	larger	l,a,r,g,e,r	/l/ /ɑ:/ /dʒ/ /ə/
5	largest	l,a,r,g,e,s,t	/l/ /ɑ:/ /dʒ/ /ɪ/ /s/ /t/
5	few	f,e,w	/f/ /y/
5	fewer	f,e,w,e,r	/f/ /y/ /ə/

5	fewest	f,ew,e,s,t	/f/ /y/ /ɪ/ /s/ /t/
5	close	c,l,o,se	/k/ /l/ /əʊ/ /s/
5	closer	c,l,o,s,er	/k/ /l/ /əʊ/ /s/ /ə/
5	closest	c,l,o,s,e,s,t	/k/ /l/ /əʊ/ /s/ /ɪ/ /s/ /t/
5	bright	b,r,igh,t	/b/ /r/ /aɪ/ /t/
5	brighter	b,r,igh,t,er	/b/ /r/ /aɪ/ /t/ /ə/
5	brightest	b,r,igh,t,e,s,t	/b/ /r/ /aɪ/ /t/ /ɪ/ /s/ /t/
5	weak	w,ea,k	/w/ /i:/ /k/
5	weaker	w,ea,k,er	/w/ /i:/ /k/ /ə/
5	weakest	w,ea,k,e,s,t	/w/ /i:/ /k/ /ɪ/ /s/ /t/
5	ate	a,te	/ɛ/ /t/
5	eight	eigh,t	/eɪ/ /t/
5	one	o,ne	/o/ /n/
5	won	w,o,n	/w/ /ʌ/ /n/
5	sail	s,ai,l	/s/ /eɪ/ /l/
5	sale	s,a,le	/s/ /eɪ/ /l/
5	break	b,r,ea,k	/b/ /r/ /eɪ/ /k/
5	brake	b,r,a,ke	/b/ /r/ /eɪ/ /k/
5	way	w,ay	/w/ /eɪ/
5	weigh	w,eigh	/w/ /eɪ/
5	right	r,igh,t	/r/ /aɪ/ /t/
5	write	wr,i,te	/r/ /aɪ/ /t/
5	new	n,ew	/n/ /y/
5	knew	kn,ew	/n/ /y/
5	there	th,ere	/ð/ /eə/
5	their	th,eir	/ð/ /eə/
5	by	b,y	/b/ /aɪ/
5	buy	b,uy	/b/ /aɪ/
5	bye	b,ye	/b/ /aɪ/
5	another	a,n,o,th,er	/ə/ /n/ /ʌ/ /ð/ /ə/
5	border	b,or,d,er	/b/ /ɔ:/ /d/ /ə/
5	answer	a,n,sw,er	/ɑ:/ /n/ /s/ /ə/
5	reporter	r,e,p,or,t,er	/r/ /ɪ/ /p/ /ɔ:/ /t/ /ə/
5	gather	g,a,th,er	/g/ /æ/ /ð/ /ə/
5	whether	wh,e,th,er	/w/ /ɛ/ /ð/ /ə/
5	rather	r,a,th,er	/r/ /ɑ:/ /ð/ /ə/
5	burglar	b,ur,g,l,ar	/b/ /ɜ:/ /g/ /l/ /ə/
5	collar	c,o,ll,ar	/k/ /ɒ/ /l/ /ə/
5	lunar	l,u,n,ar	/l/ /u:/ /n/ /ə/
5	solar	s,o,l,ar	/s/ /əʊ/ /l/ /ə/
5	popular	p,o,p,u,l,ar	/p/ /ɒ/ /p/ /y/ /l/ /ə/
5	regular	r,e,g,u,l,ar	/r/ /ɛ/ /g/ /y/ /l/ /ə/
5	similar	s,i,m,i,l,ar	/s/ /ɪ/ /m/ /ɪ/ /l/ /ə/
5	familiar	f,a,m,i,l,i,ar	/f/ /ə/ /m/ /ɪ/ /l/ /j/ /ə/

5	mirror	m,i,rr,or	/m/ /ɪ/ /r/ /ə/
5	meteor	m,e,t,e,or	/m/ /i:/ /t/ /i:/ /ɔ:/
5	cursor	c,ur,s,or	/k/ /ɜ:/ /s/ /ə/
5	editor	e,d,i,t,or	/ɛ/ /d/ /ɪ/ /t/ /ə/
5	visitor	v,i,s,i,t,or	/v/ /ɪ/ /z/ /ɪ/ /t/ /ə/
5	education	e,d,u,c,a,t,i,o,n	/ɛ/ /d/ /y/ /k/ /eɪ/ /ʃ/ /ə/ /n/
5	collection	c,o,ll,e,c,t,i,o,n	/k/ /ə/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	illustration	i,ll,u,s,t,r,a,t,i,o,n	/ɪ/ /l/ /ə/ /s/ /t/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	concentration	c,o,n,c,e,n,t,r,a,t,i,o,n	/k/ /ɒ/ /n/ /s/ /ə/ /n/ /t/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	separation	s,e,p,a,r,a,t,i,o,n	/s/ /ɛ/ /p/ /ə/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	anxious	a,n,x,iou,s	/æ/ /ŋ/ /ʃ/ /ʌ/ /s/
5	famous	f,a,m,ou,s	/f/ /eɪ/ /m/ /ə/ /s/
5	jealous	j,ea,l,ou,s	/dʒ/ /ɛ/ /l/ /ə/ /s/
5	disastrous	d,i,s,a,s,t,r,ou,s	/d/ /ɪ/ /z/ /ɑ:/ /s/ /t/ /r/ /ə/ /s/
5	dirty	d,ir,t,y	/d/ /ɜ:/ /t/ /i:/
5	cloudy	c,l,ou,d,y	/k/ /l/ /aʊ/ /d/ /i:/
5	thirsty	th,ir,s,t,y	/θ/ /ɜ:/ /s/ /t/ /i:/
5	hungry	h,u,n,g,r,y	/h/ /ʌ/ /ŋ/ /g/ /r/ /i:/
5	fussy	f,u,ss,y	/f/ /ʌ/ /s/ /i:/
5	nosey	n,o,s,ey	/n/ /əʊ/ /z/ /i:/
5	childish	ch,i,l,d,i,sh	/tʃ/ /aɪ/ /l/ /d/ /ɪ/ /ʃ/
5	foolish	f,oo,l,i,sh	/f/ /u:/ /l/ /ɪ/ /ʃ/
5	stylish	s,t,y,l,i,sh	/s/ /t/ /aɪ/ /l/ /ɪ/ /ʃ/
5	longish	l,o,n,g,i,sh	/l/ /ɒ/ /ŋ/ /ɪ/ /ʃ/
5	selfish	s,e,l,f,i,sh	/s/ /ɛ/ /l/ /f/ /ɪ/ /ʃ/
5	pedal	p,e,d,al	/p/ /ɛ/ /d/ /l/
5	peddle	p,e,dd,le	/p/ /ɛ/ /d/ /l/
5	higher	h,igh,er	/h/ /aɪ/ /ə/
5	hire	h,i,re	/h/ /aɪ/ /ə/
5	weather	w,ea,th,er	/w/ /ɛ/ /ð/ /ə/
5	whether	wh,e,th,er	/w/ /ɛ/ /ð/ /ə/
5	chilly	ch,i,ll,y	/tʃ/ /ɪ/ /l/ /i:/
5	chilli	ch,i,ll,i	/tʃ/ /ɪ/ /l/ /i:/
5	patients	p,a,t,i,e,n,t,s	/p/ /eɪ/ /ʃ/ /ɛ/ /n/ /t/ /s/
5	patience	p,a,t,i,e,n,ce	/p/ /eɪ/ /ʃ/ /ɛ/ /n/ /s/
5	bury	b,u,r,y	/b/ /ɛ/ /r/ /i:/
5	berry	b,e,rr,y	/b/ /ɛ/ /r/ /i:/
5	allowed	a,ll,ow,ed	/ə/ /l/ /aʊ/ /d/
5	aloud	a,l,ou,d	/ə/ /l/ /aʊ/ /d/
5	manor	m,a,n,or	/m/ /æ/ /n/ /ə/
5	manner	m,a,nn,er	/m/ /æ/ /n/ /ə/
5	carat	c,a,r,a,t	/k/ /æ/ /r/ /ə/ /t/
5	carrot	c,a,rr,o,t	/k/ /æ/ /r/ /ə/ /t/
5	flower	f,l,ow,er	/f/ /l/ /aʊ/ /ə/

5	flour	f,l,ou,r	/f/ /l/ /aʊ/ /ə/
5	overtime	o,v,er,t,i,me	/əʊ/ /v/ /ə/ /t/ /aɪ/ /m/
5	overlook	o,v,er,l,oo,k	/əʊ/ /v/ /ə/ /l/ /ʊ/ /k/
5	overcast	o,v,er,c,a,s,t	/əʊ/ /v/ /ə/ /k/ /ɑ:/ /s/ /t/
5	overload	o,v,er,l,oa,d	/əʊ/ /v/ /ə/ /l/ /əʊ/ /d/
5	overtake	o,v,er,t,a,ke	/əʊ/ /v/ /ə/ /t/ /eɪ/ /k/
5	overboard	o,v,er,b,oa,r,d	/əʊ/ /v/ /ə/ /b/ /ɔ:/ /d/
5	overseas	o,v,er,s,ea,s	/əʊ/ /v/ /ə/ /s/ /i:/ /z/
5	underneath	u,n,d,er,n,ea,th	/ʌ/ /n/ /d/ /ə/ /n/ /i:/ /θ/
5	undercover	u,n,d,er,c,o,v,er	/ʌ/ /n/ /d/ /ə/ /k/ /ʌ/ /v/ /ə/
5	underground	u,n,d,er,g,r,ou,n,d	/ʌ/ /n/ /d/ /ə/ /g/ /r/ /aʊ/ /n/ /d/
5	underarm	u,n,d,er,ar,m	/ʌ/ /n/ /d/ /ə/ /ɑ:/ /m/
5	underwear	u,n,d,er,w,ear	/ʌ/ /n/ /d/ /ə/ /w/ /eə/
5	undercook	u,n,d,er,c,oo,k	/ʌ/ /n/ /d/ /ə/ /k/ /ʊ/ /k/
5	toward	t,o,w,ar,d	/t/ /ə/ /w/ /ɔ:/ /d/
5	backward	b,a,ck,w,ar,d	/b/ /æ/ /k/ /w/ /ə/ /d/
5	forward	f,or,w,ar,d	/f/ /ɔ:/ /w/ /ə/ /d/
5	upward	u,p,w,ar,d	/ʌ/ /p/ /w/ /ə/ /d/
5	homeward	h,o,me,w,ar,d	/h/ /əʊ/ /m/ /w/ /ə/ /d/
5	inward	i,n,w,ar,d	/ɪ/ /n/ /w/ /ə/ /d/
5	outward	ou,t,w,ar,d	/aʊ/ /t/ /w/ /ə/ /d/
5	edge	e,dge	/ɛ/ /dʒ/
5	badge	b,a,dge	/b/ /æ/ /dʒ/
5	bridge	b,r,i,dge	/b/ /r/ /ɪ/ /dʒ/
5	judge	j,u,dge	/dʒ/ /ʌ/ /dʒ/
5	knowledge	kn,ow,l,e,dge	/n/ /ɒ/ /l/ /ɪ/ /dʒ/
5	huge	h,u,ge	/h/ /ɹ/ /dʒ/
5	page	p,a,ge	/p/ /eɪ/ /dʒ/
5	stage	s,t,a,ge	/s/ /t/ /eɪ/ /dʒ/
5	average	a,v,e,r,a,ge	/æ/ /v/ /ə/ /r/ /ɪ/ /dʒ/
5	message	m,e,ss,a,ge	/m/ /ɛ/ /s/ /ɪ/ /dʒ/
5	poet	p,o,e,t	/p/ /əʊ/ /ɪ/ /t/
5	magnet	m,a,g,n,e,t	/m/ /æ/ /g/ /n/ /ɪ/ /t/
5	planet	p,l,a,n,e,t	/p/ /l/ /æ/ /n/ /ɪ/ /t/
5	cricket	c,r,i,ck,e,t	/k/ /r/ /ɪ/ /k/ /ɪ/ /t/
5	toilet	t,oi,l,e,t	/t/ /ɔɪ/ /l/ /ɪ/ /t/
5	habit	h,a,b,i,t	/h/ /æ/ /b/ /ɪ/ /t/
5	digit	d,i,g,i,t	/d/ /ɪ/ /dʒ/ /ɪ/ /t/
5	exit	e,x,i,t	/ɛ/ /x/ /ɪ/ /t/
5	visit	v,i,s,i,t	/v/ /ɪ/ /z/ /ɪ/ /t/
5	permit	p,er,m,i,t	/p/ /ɜ:/ /m/ /ɪ/ /t/
5	feature	f,ea,t,ure	/f/ /i:/ /tʃ/ /ə/
5	fracture	f,r,a,c,t,ure	/f/ /r/ /æ/ /k/ /tʃ/ /ə/
5	picture	p,i,c,t,ure	/p/ /ɪ/ /k/ /tʃ/ /ə/

5	nature	n,a,t,ure	/n/ /eɪ/ /tʃ/ /ə/
5	future	f,u,t,ure	/f/ /ʌ/ /tʃ/ /ə/
5	mixture	m,i,x,t,ure	/m/ /ɪ/ /x/ /tʃ/ /ə/
5	moisture	m,oi,s,t,ure	/m/ /ɔɪ/ /s/ /tʃ/ /ə/
5	culture	c,u,l,t,ure	/k/ /ʌ/ /l/ /tʃ/ /ə/
5	texture	t,e,x,t,ure	/t/ /ɛ/ /x/ /tʃ/ /ə/
5	capture	c,a,p,t,ure	/k/ /æ/ /p/ /tʃ/ /ə/
5	pleasure	p,l,ea,s,ure	/p/ /l/ /ɛ/ /z/ /ə/
5	measure	m,ea,s,ure	/m/ /ɛ/ /z/ /ə/
5	treasure	t,r,ea,s,ure	/t/ /r/ /ɛ/ /z/ /ə/
5	leisure	l,ei,s,ure	/l/ /ɛ/ /z/ /ə/
5	reassure	r,e,a,ss,ure	/r/ /i:/ /ə/ /ʃ/ /ʊə/
5	closure	c,l,o,s,ure	/k/ /l/ /əʊ/ /z/ /ə/
5	pressure	p,r,e,ss,ure	/p/ /r/ /ɛ/ /ʃ/ /ə/
5	exposure	e,x,p,o,s,ure	/ɪ/ /x/ /p/ /əʊ/ /z/ /ə/
5	insure	i,n,s,ure	/ɪ/ /n/ /ʃ/ /ʊə/
5	unsure	u,n,s,ure	/ʌ/ /n/ /ʃ/ /ʊə/
5	expression	e,x,p,r,e,ss,i,o,n	/ɪ/ /x/ /p/ /r/ /ɛ/ /ʃ/ /ə/ /n/
5	profession	p,r,o,f,e,ss,i,o,n	/p/ /r/ /ə/ /f/ /ɛ/ /ʃ/ /ə/ /n/
5	impression	i,m,p,r,e,ss,i,o,n	/ɪ/ /m/ /p/ /r/ /ɛ/ /ʃ/ /ə/ /n/
5	progression	p,r,o,g,r,e,ss,i,o,n	/p/ /r/ /əʊ/ /g/ /r/ /ɛ/ /ʃ/ /ə/ /n/
5	discussion	d,i,s,c,u,ss,i,o,n	/d/ /ɪ/ /s/ /k/ /ʌ/ /ʃ/ /ə/ /n/
5	confession	c,o,n,f,e,ss,i,o,n	/k/ /ə/ /n/ /f/ /ɛ/ /ʃ/ /ə/ /n/
5	admission*	a,d,m,i,ss,i,o,n	/ə/ /d/ /m/ /ɪ/ /ʃ/ /ə/ /n/
5	permission*	p,e,r,m,i,ss,i,o,n	/p/ /ə/ /m/ /ɪ/ /ʃ/ /ə/ /n/
5	action	a,c,t,i,o,n	/æ/ /k/ /ʃ/ /ə/ /n/
5	selection	s,e,l,e,c,t,i,o,n	/s/ /ɪ/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	subtraction	s,u,b,t,r,a,c,t,i,o,n	/s/ /ə/ /b/ /t/ /r/ /æ/ /k/ /ʃ/ /ə/ /n/
5	direction	d,i,r,e,c,t,i,o,n	/d/ /ɪ/ /r/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	election	e,l,e,c,t,i,o,n	/ɪ/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	production	p,r,o,d,u,c,t,i,o,n	/p/ /r/ /ə/ /d/ /ʌ/ /k/ /ʃ/ /ə/ /n/
5	introduction	i,n,t,r,o,d,u,c,t,i,o,n	/ɪ/ /n/ /t/ /r/ /ə/ /d/ /ʌ/ /k/ /ʃ/ /ə/ /n/
5	correction	c,o,r,r,e,c,t,i,o,n	/k/ /ə/ /r/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	instruction	i,n,s,t,r,u,c,t,i,o,n	/ɪ/ /n/ /s/ /t/ /r/ /ʌ/ /k/ /ʃ/ /ə/ /n/
5	construction	c,o,n,s,t,r,u,c,t,i,o,n	/k/ /ə/ /n/ /s/ /t/ /r/ /ʌ/ /k/ /ʃ/ /ə/ /n/
5	reaction	r,e,a,c,t,i,o,n	/r/ /i:/ /æ/ /k/ /ʃ/ /ə/ /n/
5	prediction	p,r,e,d,i,c,t,i,o,n	/p/ /r/ /ɪ/ /d/ /ɪ/ /k/ /ʃ/ /ə/ /n/
5	capital	c,a,p,i,t,al	/k/ /æ/ /p/ /ɪ/ /t/ /l/
5	coast	c,oa,s,t	/k/ /əʊ/ /s/ /t/
5	curve	c,ur,ve	/k/ /ɜ:/ /v/
5	cinema	c,i,n,e,m,a	/s/ /ɪ/ /n/ /ə/ /m/ /ə/
5	circus	c,i,r,c,u,s	/s/ /ɜ:/ /k/ /ə/ /s/
5	raced	r,a,ce,d	/r/ /eɪ/ /s/ /t/
5	cycle	c,y,c,le	/s/ /aɪ/ /k/ /l/

5	cereal	c,e,r,e,a,l	/s/ /ɪə/ /r/ /ɪ/ /ə/ /l/
5	centimetre	c,e,n,t,i,m,e,t,r,e	/s/ /ɛ/ /n/ /t/ /ɪ/ /m/ /i:/ /t/ /ə/
5	piece	p,i,e,c,e	/p/ /i:/ /s/
5	peace	p,e,a,c,e	/p/ /i:/ /s/
5	plane	p,l,a,n,e	/p/ /l/ /eɪ/ /n/
5	plain	p,l,a,i,n	/p/ /l/ /eɪ/ /n/
5	scents	s,c,e,n,t,s	/s/ /ɛ/ /n/ /t/ /s/
5	cents	c,e,n,t,s	/s/ /ɛ/ /n/ /t/ /s/
5	sense	s,e,n,s,e	/s/ /ɛ/ /n/ /s/
5	guessed	g,u,e,s,s,e,d	/g/ /ɛ/ /s/ /t/
5	guest	g,u,e,s,t	/g/ /ɛ/ /s/ /t/
5	your	y,o,u,r	/j/ /ɔ:/
5	garden	g,a,r,d,e,n	/g/ /ɑ:/ /d/ /n/
5	guard	g,u,a,r,d	/g/ /ɑ:/ /d/
5	guide	g,u,i,d,e	/g/ /aɪ/ /d/
5	guess	g,u,e,s,s	/g/ /ɛ/ /s/
5	engine	e,n,g,i,n,e	/ɛ/ /n/ /dʒ/ /ɪ/ /n/
5	large	l,a,r,g,e	/l/ /ɑ:/ /dʒ/
5	general	g,e,n,e,r,a,l	/dʒ/ /ɛ/ /n/ /ə/ /r/ /ə/ /l/
5	gentle	g,e,n,t,l,e	/dʒ/ /ɛ/ /n/ /t/ /l/
5	orange	o,r,a,n,g,e	/o/ /r/ /ɪ/ /n/ /dʒ/
5	giant	g,i,a,n,t	/dʒ/ /aɪ/ /ə/ /n/ /t/
5	medal	m,e,d,a,l	/m/ /ɛ/ /d/ /l/
5	meddle	m,e,d,d,l,e	/m/ /ɛ/ /d/ /l/
5	dear	d,e,a,r	/d/ /i:/ /ə/
5	deer	d,e,e,r	/d/ /i:/ /ə/
5	hire	h,i,r,e	/h/ /aɪ/ /ə/
5	higher	h,i,g,h,e,r	/h/ /aɪ/ /ə/
5	presence	p,r,e,s,e,n,c,e	/p/ /r/ /ɛ/ /z/ /ə/ /n/ /s/
5	presents	p,r,e,s,e,n,t,s	/p/ /r/ /ɛ/ /z/ /ə/ /n/ /t/ /s/
5	berry	b,e,r,r,y	/b/ /ɛ/ /r/ /i:/
5	bury	b,u,r,y	/b/ /ɛ/ /r/ /i:/
5	incomplete	i,n,c,o,m,p,l,e,t,e	/ɪ/ /n/ /k/ /ə/ /m/ /p/ /l/ /i:/ /t/
5	incorrect	i,n,c,o,r,r,e,c,t	/ɪ/ /n/ /k/ /ə/ /r/ /ɛ/ /k/ /t/
5	injustice	i,n,j,u,s,t,i,c,e	/ɪ/ /n/ /dʒ/ /ʌ/ /s/ /t/ /ɪ/ /s/
5	informal	i,n,f,o,r,m,a,l	/ɪ/ /n/ /f/ /ɔ:/ /m/ /l/
5	invisible	i,n,v,i,s,i,b,l,e	/ɪ/ /n/ /v/ /ɪ/ /z/ /ə/ /b/ /l/
5	inappropriate	i,n,a,p,p,r,o,p,r,i,a,t,e	/ɪ/ /n/ /ə/ /p/ /r/ /əʊ/ /p/ /r/ /ɪ/ /ə/ /t/
5	incredible	i,n,c,r,e,d,i,b,l,e	/ɪ/ /n/ /k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
5	immature	i,m,m,a,t,u,r,e	/ɪ/ /m/ /ə/ /t/ /ʊə/
5	impatient	i,m,p,a,t,i,e,n,t	/ɪ/ /m/ /p/ /eɪ/ /ʃ/ /ɛ/ /n/ /t/
5	impossible	i,m,p,o,s,s,i,b,l,e	/ɪ/ /m/ /p/ /o/ /s/ /ə/ /b/ /l/
5	immobile	i,m,m,o,b,i,l,e	/ɪ/ /m/ /əʊ/ /b/ /aɪ/ /l/
5	forearm	f,o,r,e,a,r,m	/f/ /ɔ:/ /r/ /ɑ:/ /m/

5	forecast	f,ore,c,a,s,t	/f/ /ɔ:/ /k/ /ɑ:/ /s/ /t/
5	forehead	f,o,re,hea,d	/f/ /ɒ/ /r/ /ɛ/ /d/
5	forehand	f,ore,h,a,n,d	/f/ /ɔ:/ /h/ /æ/ /n/ /d/
5	foreground	f,ore,g,r,ou,n,d	/f/ /ɔ:/ /g/ /r/ /aʊ/ /n/ /d/
5	enforce	e,n,f,or,ce	/ɪ/ /n/ /f/ /ɔ:/ /s/
5	enable	e,n,a,b,le	/ɪ/ /n/ /eɪ/ /b/ /l/
5	encourage	e,n,c,ou,r,a,ge	/ɪ/ /n/ /k/ /ʌ/ /r/ /ɪ/ /dʒ/
5	enlighten	e,n,l,igh,t,en	/ɪ/ /n/ /l/ /aɪ/ /t/ /n/
5	careful	c,are,f,u,l	/k/ /eə/ /f/ /ʊ/ /l/
5	colourful	c,o,l,our,f,u,l	/k/ /ʌ/ /l/ /ə/ /f/ /ʊ/ /l/
5	hopeful	h,o,p,e,f,u,l	/h/ /əʊ/ /p/ /f/ /ʊ/ /l/
5	useful	u,se,f,u,l	/y/ /s/ /f/ /ʊ/ /l/
5	painful	p,ai,n,f,u,l	/p/ /eɪ/ /n/ /f/ /ʊ/ /l/
5	helpful	h,e,l,p,f,u,l	/h/ /ɛ/ /l/ /p/ /f/ /ʊ/ /l/
5	peaceful	p,ea,ce,f,u,l	/p/ /i:/ /s/ /f/ /ʊ/ /l/
5	thoughtful	th,ough,t,f,u,l	/θ/ /ɔ:/ /t/ /f/ /ʊ/ /l/
5	closely	c,l,o,se,l,y	/k/ /l/ /əʊ/ /s/ /l/ /i:/
5	badly	b,a,d,l,y	/b/ /æ/ /d/ /l/ /i:/
5	daily	d,ai,l,y	/d/ /eɪ/ /l/ /i:/
5	lately	l,a,te,l,y	/l/ /eɪ/ /t/ /l/ /i:/
5	quietly	q,u,i,e,t,l,y	/k/ /w/ /aɪ/ /ə/ /t/ /l/ /i:/
5	slowly	s,l,ow,l,y	/s/ /l/ /əʊ/ /l/ /i:/
5	loudly	l,ou,d,l,y	/l/ /aʊ/ /d/ /l/ /i:/
5	darkness	d,ar,k,n,e,ss	/d/ /ɑ:/ /k/ /n/ /ɪ/ /s/
5	sickness	s,i,ck,n,e,ss	/s/ /ɪ/ /k/ /n/ /ɪ/ /s/
5	awareness	a,w,are,n,e,ss	/ə/ /w/ /eə/ /n/ /ə/ /s/
5	goodness	g,oo,d,n,e,ss	/g/ /ʊ/ /d/ /n/ /ɪ/ /s/
5	weakness	w,ea,k,n,e,ss	/w/ /i:/ /k/ /n/ /ɪ/ /s/
5	doubt	d,ou,bt	/d/ /aʊ/ /t/
5	house	h,ou,se	/h/ /aʊ/ /s/
5	mouth	m,ou,th	/m/ /aʊ/ /θ/
5	allow	a,ll,ow	/ə/ /l/ /aʊ/
5	towel	t,ow,e,l	/t/ /aʊ/ /ə/ /l/
5	powerful	p,ow,er,f,u,l	/p/ /aʊ/ /ə/ /f/ /ʊ/ /l/
5	flower	f,l,ow,er	/f/ /l/ /aʊ/ /ə/
5	thrown	th,r,ow,n	/θ/ /r/ /əʊ/ /n/
5	follow	f,o,ll,ow	/f/ /ɒ/ /l/ /əʊ/
5	window	w,i,n,d,ow	/w/ /ɪ/ /n/ /d/ /əʊ/
5	elbow	e,l,b,ow	/ɛ/ /l/ /b/ /əʊ/
5	plough	p,l,ough	/p/ /l/ /aʊ/
5	although	a,l,th,ough	/ɔ:/ /l/ /ð/ /əʊ/
5	pause	p,au,se	/p/ /ɔ:/ /z/
5	because	b,e,c,au,se	/b/ /ɪ/ /k/ /ɒ/ /z/
5	caught	c,augh,t	/k/ /ɔ:/ /t/

5	daughter	d,augh,t,er	/d/ /ɔ:/ /t/ /ə/
5	draw	d,r,aw	/d/ /r/ /ɔ:/
5	crawl	c,r,aw,l	/k/ /r/ /ɔ:/ /l/
5	yawn	y,aw,n	/j/ /ɔ:/ /n/
5	lazy	l,a,z,y	/l/ /eɪ/ /z/ /i:/
5	paper	p,a,p,er	/p/ /eɪ/ /p/ /ə/
5	basic	b,a,s,i,c	/b/ /eɪ/ /s/ /ɪ/ /k/
5	erase	e,r,a,se	/ɪ/ /r/ /eɪ/ /z/
5	local	l,o,c,a,l	/l/ /əʊ/ /k/ /ə/ /l/
5	frozen	f,r,o,z,en	/f/ /r/ /əʊ/ /z/ /n/
5	hotel	h,o,t,e,l	/h/ /əʊ/ /t/ /e/ /l/
5	modem	m,o,d,e,m	/m/ /əʊ/ /d/ /ə/ /m/
5	robot	r,o,b,o,t	/r/ /əʊ/ /b/ /ɒ/ /t/
5	photo	ph,o,t,o	/f/ /əʊ/ /t/ /əʊ/
5	supper	s,u,pp,er	/s/ /ʌ/ /p/ /ə/
5	dinner	d,i,nn,er	/d/ /ɪ/ /n/ /ə/
5	pillow	p,i,ll,ow	/p/ /ɪ/ /l/ /əʊ/
5	pattern	p,a,tt,er,n	/p/ /æ/ /t/ /ə/ /n/
5	mammal	m,a,mm,a,l	/m/ /æ/ /m/ /ə/ /l/
5	river	r,i,v,er	/r/ /ɪ/ /v/ /ə/
5	level	l,e,v,el	/l/ /e/ /v/ /l/
5	never	n,e,v,er	/n/ /e/ /v/ /ə/
5	second	s,e,c,o,n,d	/s/ /e/ /k/ /ə/ /n/ /d/
5	children	ch,i,l,d,r,e,n	/tʃ/ /ɪ/ /l/ /d/ /r/ /ə/ /n/
5	apron	a,p,r,o,n	/eɪ/ /p/ /r/ /ə/ /n/
5	famous	f,a,m,ou,s	/f/ /eɪ/ /m/ /ə/ /s/
5	native	n,a,t,i,ve	/n/ /eɪ/ /t/ /ɪ/ /v/
5	legal	l,e,g,a,l	/l/ /i:/ /g/ /ə/ /l/
5	pilot	p,i,l,o,t	/p/ /aɪ/ /l/ /ə/ /t/
5	omit	o,m,i,t	/ə/ /m/ /ɪ/ /t/
5	notice	n,o,t,i,ce	/n/ /əʊ/ /t/ /ɪ/ /s/
5	broken	b,r,o,k,e,n	/b/ /r/ /əʊ/ /k/ /ə/ /n/
5	student	s,t,u,d,e,n,t	/s/ /t/ /y/ /d/ /ə/ /n/ /t/
5	music	m,u,s,i,c	/m/ /y/ /z/ /ɪ/ /k/
5	happen	h,a,pp,e,n	/h/ /æ/ /p/ /ə/ /n/
5	better	b,e,tt,er	/b/ /e/ /t/ /ə/
5	blossom	b,l,o,ss,o,m	/b/ /l/ /ɒ/ /s/ /ə/ /m/
5	sister	s,i,s,t,er	/s/ /ɪ/ /s/ /t/ /ə/
5	winter	w,i,n,t,er	/w/ /ɪ/ /n/ /t/ /ə/
5	seven	s,e,v,en	/s/ /e/ /v/ /n/
5	model	m,o,d,el	/m/ /ɒ/ /d/ /l/
5	planet	p,l,a,n,e,t	/p/ /l/ /æ/ /n/ /ɪ/ /t/
5	minute	m,i,n,u,te	/m/ /ɪ/ /n/ /ɪ/ /t/
5	lemon	l,e,m,o,n	/l/ /e/ /m/ /ə/ /n/

5	vibrate	v,i,b,r,a,te	/v/ /aɪ/ /b/ /r/ /eɪ/ /t/
5	imitate	i,m,i,t,a,te	/ɪ/ /m/ /ɪ/ /t/ /eɪ/ /t/
5	complete	c,o,m,p,l,e,te	/k/ /ə/ /m/ /p/ /l/ /i:/ /t/
5	extreme	e,x,t,r,e,me	/ɪ/ /x/ /t/ /r/ /i:/ /m/
5	athlete	a,th,l,e,te	/æ/ /θ/ /l/ /i:/ /t/
5	supreme	s,u,p,r,e,me	/s/ /u:/ /p/ /r/ /i:/ /m/
5	ice-cream	i,ce,c,r,ea,m	/aɪ/ /s/ /k/ /r/ /i:/ /m/
5	ninety	n,i,ne,t,y	/n/ /aɪ/ /n/ /t/ /i:/
5	retire	r,e,t,i,re	/r/ /ɪ/ /t/ /aɪ/ /ə/
5	likeable	l,i,ke,a,b,le	/l/ /aɪ/ /k/ /ə/ /b/ /l/
5	describe	d,e,s,c,r,i,be	/d/ /ɪ/ /s/ /k/ /r/ /aɪ/ /b/
5	surprise	s,ur,p,r,i,se	/s/ /ə/ /p/ /r/ /aɪ/ /z/
5	wireless	w,i,re,l,e,ss	/w/ /aɪ/ /ə/ /l/ /ɪ/ /s/
5	lonely	l,o,ne,l,y	/l/ /əʊ/ /n/ /l/ /i:/
5	envelope	e,n,v,e,l,o,pe	/ɛ/ /n/ /v/ /ə/ /l/ /əʊ/ /p/
5	tadpole	t,a,d,p,o,le	/t/ /æ/ /d/ /p/ /əʊ/ /l/
5	useful	u,se,f,u,l	/y/ /s/ /f/ /ʊ/ /l/
5	amuse	a,m,u,se	/ə/ /m/ /y/ /z/
5	refuse	r,e,f,u,se	/r/ /i:/ /f/ /y/ /z/
5	umpire	u,m,p,i,re	/ʌ/ /m/ /p/ /aɪ/ /ə/
5	autumn	au,t,u,mn	/ɔ:/ /t/ /ə/ /m/
5	column	c,o,l,u,mn	/k/ /ɒ/ /l/ /ə/ /m/
5	solemn	s,o,l,e,mn	/s/ /ɒ/ /l/ /ə/ /m/
5	condemn	c,o,n,d,e,mn	/k/ /ə/ /n/ /d/ /ɛ/ /m/
5	hymn	h,y,mn	/h/ /ɪ/ /m/
5	sign	s,i,gn	/s/ /aɪ/ /n/
5	resign	r,e,s,i,gn	/r/ /ɪ/ /z/ /aɪ/ /n/
5	design	d,e,s,i,gn	/d/ /ɪ/ /z/ /aɪ/ /n/
5	designer	d,e,s,i,gn,er	/d/ /ɪ/ /z/ /aɪ/ /n/ /ə/
5	campaign	c,a,m,p,ai,gn	/k/ /æ/ /m/ /p/ /eɪ/ /n/
5	reign	r,ei,gn	/r/ /eɪ/ /n/
5	foreign	f,o,r,ei,gn	/f/ /ɒ/ /r/ /ɛ/ /n/
5	listen	l,i,st,en	/l/ /ɪ/ /s/ /n/
5	fasten	f,a,st,en	/f/ /ɑ:/ /s/ /n/
5	castle	c,a,st,le	/k/ /ɑ:/ /s/ /l/
5	whistle	wh,i,st,le	/w/ /ɪ/ /s/ /l/
5	wrestle	wr,e,st,le	/r/ /ɛ/ /s/ /l/
5	thistle	th,i,st,le	/θ/ /ɪ/ /s/ /l/
5	mistletoe	m,i,st,le,t,oe	/m/ /ɪ/ /s/ /l/ /t/ /əʊ/
5	Christmas	ch,r,i,st,m,a,s	/k/ /r/ /ɪ/ /s/ /m/ /ə/ /s/
5	millimetre	m,i,ll,i,m,e,t,re	/m/ /ɪ/ /l/ /ɪ/ /m/ /i:/ /t/ /ə/
5	millilitre	m,i,ll,i,l,i,t,re	/m/ /ɪ/ /l/ /ɪ/ /l/ /i:/ /t/ /ə/
5	milligram	m,i,ll,i,g,r,a,m	/m/ /ɪ/ /l/ /ɪ/ /g/ /r/ /æ/ /m/
5	millipede	m,i,ll,i,p,e,de	/m/ /ɪ/ /l/ /ɪ/ /p/ /i:/ /d/

5	million	m,i,l,l,i,o,n	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/
5	millionaire	m,i,l,l,i,o,n,aire	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/ /eə/
5	kilogram	k,i,l,o,g,r,a,m	/k/ /ɪ/ /l/ /əʊ/ /g/ /r/ /æ/ /m/
5	kilometre	k,i,l,o,m,e,t,re	/k/ /ɪ/ /l/ /əʊ/ /m/ /i:/ /t/ /ə/
5	century	c,e,n,t,u,r,y	/s/ /ɛ/ /n/ /tʃ/ /ɔ/ /r/ /i:/
5	centimetre	c,e,n,t,i,m,e,t,re	/s/ /ɛ/ /n/ /t/ /ɪ/ /m/ /i:/ /t/ /ə/
5	centenary	c,e,n,t,e,n,a,r,y	/s/ /ɛ/ /n/ /t/ /i:/ /n/ /ə/ /r/ /i:/
5	centennial	c,e,n,t,e,n,n,i,a,l	/s/ /ɛ/ /n/ /t/ /ɛ/ /n/ /ɪ/ /ə/ /l/
5	duo	d,u,o	/d/ /y/ /əʊ/
5	dual	d,u,a,l	/d/ /y/ /ə/ /l/
5	duality	d,u,a,l,i,t,y	/d/ /y/ /æ/ /l/ /ɪ/ /t/ /i:/
5	multiple	m,u,l,t,i,p,l,e	/m/ /ʌ/ /l/ /t/ /ɪ/ /p/ /l/
5	multiplication	m,u,l,t,i,p,l,i,c,a,t,i,o,n	/m/ /ʌ/ /l/ /t/ /ɪ/ /p/ /l/ /ɪ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
5	multiply	m,u,l,t,i,p,l,y	/m/ /ʌ/ /l/ /t/ /ɪ/ /p/ /l/ /aɪ/
5	multicultural	m,u,l,t,i,c,u,l,t,u,r,a,l	/m/ /ʌ/ /l/ /t/ /ɪ/ /k/ /ʌ/ /l/ /tʃ/ /ə/ /r/ /ə/ /l/
5	multistorey	m,u,l,t,i,s,t,o,r,e,y	/m/ /ʌ/ /l/ /t/ /ɪ/ /s/ /t/ /ɔ:/ /r/ /i:/
5	dental	d,e,n,t,a,l	/d/ /ɛ/ /n/ /t/ /l/
5	dentist	d,e,n,t,i,s,t	/d/ /ɛ/ /n/ /t/ /ɪ/ /s/ /t/
5	denture	d,e,n,t,ure	/d/ /ɛ/ /n/ /tʃ/ /ə/
5	dentistry	d,e,n,t,i,s,t,r,y	/d/ /ɛ/ /n/ /t/ /ɪ/ /s/ /t/ /r/ /i:/
5	orthodontist	or,th,o,d,o,n,t,i,s,t	/ɔ:/ /θ/ /ə/ /d/ /ɒ/ /n/ /t/ /ɪ/ /s/ /t/
5	magnify	m,a,g,n,i,f,y	/m/ /æ/ /g/ /n/ /ɪ/ /f/ /aɪ/
5	magnification	m,a,g,n,i,f,i,c,a,t,i,o,n	/m/ /æ/ /g/ /n/ /ɪ/ /f/ /ɪ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
5	magnitude	m,a,g,n,i,t,u,de	/m/ /æ/ /g/ /n/ /ɪ/ /t/ /y/ /d/
5	magnificent	m,a,g,n,i,f,i,c,e,n,t	/m/ /æ/ /g/ /n/ /ɪ/ /f/ /ɪ/ /s/ /n/ /t/
5	audible	au,d,i,b,l,e	/ɔ:/ /d/ /ə/ /b/ /l/
5	audience	au,d,i,e,n,ce	/ɔ:/ /d/ /ɪ/ /ə/ /n/ /s/
5	audition	au,d,i,t,i,o,n	/ɔ:/ /d/ /ɪ/ /ʃ/ /ə/ /n/
5	audiovisual	au,d,i,o,v,i,s,u,a,l	/ɔ:/ /d/ /ɪ/ /əʊ/ /v/ /ɪ/ /z/ /ɔ/ /ə/ /l/
5	auditor	au,d,i,t,or	/ɔ:/ /d/ /ɪ/ /t/ /ə/
5	audio	au,d,i,o	/ɔ:/ /d/ /ɪ/ /əʊ/
5	auditorium	au,d,i,t,o,r,i,u,m	/ɔ:/ /d/ /ɪ/ /t/ /ɔ:/ /r/ /ɪ/ /ə/ /m/
5	telephone	t,e,l,e,ph,o,ne	/t/ /ɛ/ /l/ /ɪ/ /f/ /əʊ/ /n/
5	television	t,e,l,e,v,i,s,i,o,n	/t/ /ɛ/ /l/ /ɪ/ /v/ /ɪ/ /z/ /ə/ /n/
5	telescope	t,e,l,e,s,c,o,p,e	/t/ /ɛ/ /l/ /ɪ/ /s/ /k/ /əʊ/ /p/
5	teleconference	t,e,l,e,c,o,n,f,e,r,e,n,ce	/t/ /ɛ/ /l/ /ɪ/ /k/ /ɒ/ /n/ /f/ /r/ /ə/ /n/ /s/
5	misjudge	m,i,s,j,u,dge	/m/ /ɪ/ /s/ /dʒ/ /ʌ/ /dʒ/
5	mismatch	m,i,s,m,a,tch	/m/ /ɪ/ /s/ /m/ /æ/ /tʃ/
5	uncertain	u,n,c,e,r,t,a,i,n	/ʌ/ /n/ /s/ /z:/ /t/ /ɛ/ /n/
5	uncommon	u,n,c,o,m,m,o,n	/ʌ/ /n/ /k/ /ɒ/ /m/ /ə/ /n/
5	unbelievable	u,n,b,e,l,i,e,v,a,b,l,e	/ʌ/ /n/ /b/ /ɪ/ /l/ /i:/ /v/ /ə/ /b/ /l/
5	disagree	d,i,s,a,g,r,ee	/d/ /ɪ/ /s/ /ə/ /g/ /r/ /i:/
5	disappear	d,i,s,a,p,p,e,a,r	/d/ /ɪ/ /s/ /ə/ /p/ /i:/ /ə/
5	incomplete	i,n,c,o,m,p,l,e,t,e	/ɪ/ /n/ /k/ /ə/ /m/ /p/ /l/ /i:/ /t/

5	incorrect	i,n,c,o,rr,e,c,t	/ɪ/ /n/ /k/ /ə/ /r/ /ɛ/ /k/ /t/
5	informal	i,n,f,or,m,al	/ɪ/ /n/ /f/ /ɔ:/ /m/ /l/
5	nonsense	n,o,n,s,e,n,se	/n/ /ɒ/ /n/ /s/ /ə/ /n/ /s/
5	nonfiction	n,o,n,f,i,c,t,i,o,n	/n/ /ɒ/ /n/ /f/ /ɪ/ /k/ /ʃ/ /ə/ /n/
5	rainy	r,ai,n,y	/r/ /eɪ/ /n/ /i:/
5	hungry	h,u,n,g,r,y	/h/ /ʌ/ /ŋ/ /g/ /r/ /i:/
5	closely	c,l,o,se,l,y	/k/ /l/ /əʊ/ /s/ /l/ /i:/
5	finally	f,i,n,a,ll,y	/f/ /aɪ/ /n/ /ə/ /l/ /i:/
5	previously	p,r,e,v,i,ou,s,l,y	/p/ /r/ /i:/ /v/ /ɪ/ /ʌ/ /s/ /l/ /i:/
5	happily	h,a,pp,i,l,y	/h/ /æ/ /p/ /ɪ/ /l/ /i:/
5	busily	b,u,s,i,l,y	/b/ /ɪ/ /z/ /ɪ/ /l/ /i:/
5	noisily	n,oi,s,i,l,y	/n/ /ɔɪ/ /z/ /ɪ/ /l/ /i:/
5	better	b,e,tt,er	/b/ /ɛ/ /t/ /ə/
5	best	b,e,s,t	/b/ /ɛ/ /s/ /t/
5	earlier	ear,l,i,er	/ɜ:/ /l/ /ɪ/ /ə/
5	earliest	ear,l,i,e,s,t	/ɜ:/ /l/ /ɪ/ /ɛ/ /s/ /t/
5	smaller	s,m,a,ll,er	/s/ /m/ /ɔ:/ /l/ /ə/
5	smallest	s,m,a,ll,e,s,t	/s/ /m/ /ɔ:/ /l/ /ɪ/ /s/ /t/
5	littler	l,i,tt,l,er	/l/ /ɪ/ /t/ /l/ /ə/
5	littlest	l,i,tt,l,e,s,t	/l/ /ɪ/ /t/ /l/ /ɪ/ /s/ /t/
5	thoughtful	th,ough,t,f,u,l	/θ/ /ɔ:/ /t/ /f/ /ʊ/ /l/
5	playful	p,l,ay,f,u,l	/p/ /l/ /eɪ/ /f/ /ʊ/ /l/
5	beautiful	b,eau,t,i,f,u,l	/b/ /y/ /t/ /ə/ /f/ /ʊ/ /l/
5	pointless	p,oi,n,t,l,e,ss	/p/ /ɔɪ/ /n/ /t/ /l/ /ɪ/ /s/
5	careless	c,are,l,e,ss	/k/ /eə/ /l/ /ɪ/ /s/
5	restless	r,e,s,t,l,e,ss	/r/ /ɛ/ /s/ /t/ /l/ /ɪ/ /s/
5	likeness	l,i,ke,n,e,ss	/l/ /aɪ/ /k/ /n/ /ɪ/ /s/
5	closeness	c,l,o,se,n,e,ss	/k/ /l/ /əʊ/ /s/ /n/ /ɪ/ /s/
5	awareness	a,w,are,n,e,ss	/ə/ /w/ /eə/ /n/ /ə/ /s/
5	employment	e,m,p,l,oy,m,e,n,t	/ɪ/ /m/ /p/ /l/ /ɔɪ/ /m/ /ə/ /n/ /t/
5	environment	e,n,v,i,r,o,n,m,e,n,t	/ɪ/ /n/ /v/ /aɪ/ /r/ /ə/ /n/ /m/ /ə/ /n/ /t/
5	management	m,a,n,a,g,e,m,e,n,t	/m/ /æ/ /n/ /ɪ/ /dʒ/ /m/ /ə/ /n/ /t/
5	know	kn,ow	/n/ /əʊ/
5	knew	kn,ew	/n/ /y/
5	sign	s,i,gn	/s/ /aɪ/ /n/
5	reign	r,ei,gn	/r/ /eɪ/ /n/
5	foreign	f,o,r,ei,gn	/f/ /ɒ/ /r/ /ɛ/ /n/
5	although	a,l,th,ough	/ɔ:/ /l/ /ð/ /əʊ/
5	through	th,r,ough	/θ/ /r/ /u:/
5	thorough	th,o,r,ough	/θ/ /ʌ/ /r/ /ə/
5	write	wr,i,te	/r/ /aɪ/ /t/
5	wreck	wr,e,ck	/r/ /ɛ/ /k/
5	rhyme	rh,y,me	/r/ /aɪ/ /m/
5	rhythm	rh,y,th,m	/r/ /ɪ/ /ð/ /m/

5	design	d,e,s,i,gn	/d/ /ɪ/ /z/ /aɪ/ /n/
5	resign	r,e,s,i,gn	/r/ /ɪ/ /z/ /aɪ/ /n/
5	height	h,eigh,t	/h/ /aɪ/ /t/
5	weight	w,eigh,t	/w/ /eɪ/ /t/
5	fright	f,r,igh,t	/f/ /r/ /aɪ/ /t/
5	answer	a,n,sw,er	/ɑ:/ /n/ /s/ /ə/
5	castle	c,a,st,le	/k/ /ɑ:/ /s/ /l/
5	listen	l,i,st,en	/l/ /ɪ/ /s/ /n/
5	example	e,x,a,m,p,le	/ɪ/ /x/ /ɑ:/ /m/ /p/ /l/
5	believable	b,e,l,ie,v,a,b,le	/b/ /ɪ/ /l/ /i:/ /v/ /ə/ /b/ /l/
5	miserable	m,i,s,e,r,a,b,le	/m/ /ɪ/ /z/ /ə/ /r/ /ə/ /b/ /l/
5	enviable	e,n,v,i,a,b,le	/ɛ/ /n/ /v/ /ɪ/ /ə/ /b/ /l/
5	people	p,eo,p,le	/p/ /i:/ /p/ /l/
5	compel	c,o,m,p,e,l	/k/ /ə/ /m/ /p/ /ɛ/ /l/
5	dispel	d,i,s,p,e,l	/d/ /ɪ/ /s/ /p/ /ɛ/ /l/
5	propel	p,r,o,p,e,l	/p/ /r/ /ə/ /p/ /ɛ/ /l/
5	expel	e,x,p,e,l	/ɪ/ /x/ /p/ /ɛ/ /l/
5	travel	t,r,a,v,el	/t/ /r/ /æ/ /v/ /l/
5	civil	c,i,v,il	/s/ /ɪ/ /v/ /l/
5	pupil	p,u,p,il	/p/ /y/ /p/ /l/
5	peril	p,e,r,i,l	/p/ /ɛ/ /r/ /ɪ/ /l/
5	council	c,ou,n,c,i,l	/k/ /aʊ/ /n/ /s/ /ə/ /l/
5	pencil	p,e,n,c,il	/p/ /ɛ/ /n/ /s/ /l/
5	several	s,e,v,er,a,l	/s/ /ɛ/ /v/ /r/ /ə/ /l/
5	identical	i,d,e,n,t,i,c,a,l	/aɪ/ /d/ /ɛ/ /n/ /t/ /ɪ/ /k/ /ə/ /l/
5	vertical	v,er,t,i,c,a,l	/v/ /z:/ /t/ /ɪ/ /k/ /ə/ /l/
5	material	m,a,t,e,r,i,a,l	/m/ /ə/ /t/ /ɪə/ /r/ /ɪ/ /ə/ /l/
5	social	s,o,c,ia,l	/s/ /əʊ/ /ʃ/ /ə/ /l/
5	sign	s,i,gn	/s/ /aɪ/ /n/
5	design	d,e,s,i,gn	/d/ /ɪ/ /z/ /aɪ/ /n/
5	resign	r,e,s,i,gn	/r/ /ɪ/ /z/ /aɪ/ /n/
5	campaign	c,a,m,p,ai,gn	/k/ /æ/ /m/ /p/ /eɪ/ /n/
5	castle	c,a,st,le	/k/ /ɑ:/ /s/ /l/
5	listen	l,i,st,en	/l/ /ɪ/ /s/ /n/
5	whistle	wh,i,st,le	/w/ /ɪ/ /s/ /l/
5	crumb	c,r,u,mb	/k/ /r/ /ʌ/ /m/
5	climber	c,l,i,mb,er	/k/ /l/ /aɪ/ /m/ /ə/
5	thumb	th,u,mb	/θ/ /ʌ/ /m/
5	plumber	p,l,u,mb,er	/p/ /l/ /ʌ/ /m/ /ə/
5	debt	d,e,bt	/d/ /ɛ/ /t/
5	doubtful	d,ou,bt,f,u,l	/d/ /aʊ/ /t/ /f/ /ʊ/ /l/
5	subtle	s,u,bt,le	/s/ /ʌ/ /t/ /l/
5	eight	eigh,t	/eɪ/ /t/
5	night	n,igh,t	/n/ /aɪ/ /t/

5	caught	c,augh,t	/k/ /ɔ:/ /t/
5	bought	b,ough,t	/b/ /ɔ:/ /t/
5	thought	th,ough,t	/θ/ /ɔ:/ /t/
5	yacht	y,ach,t	/j/ /ɒ/ /t/
5	audio	au,d,i,o	/ɔ:/ /d/ /ɪ/ /əʊ/
5	author	au,th,or	/ɔ:/ /θ/ /ə/
5	auditory	au,d,i,t,o,r,y	/ɔ:/ /d/ /ɪ/ /t/ /ɔ:/ /r/ /i:/
5	audience	au,d,i,e,n,ce	/ɔ:/ /d/ /ɪ/ /ə/ /n/ /s/
5	sauce	s,au,ce	/s/ /ɔ:/ /s/
5	daughter	d,augh,t,er	/d/ /ɔ:/ /t/ /ə/
5	naughty	n,augh,t,y	/n/ /ɔ:/ /t/ /i:/
5	authority	au,th,o,r,i,t,y	/ɔ:/ /θ/ /p/ /r/ /ɪ/ /t/ /i:/
5	awful	aw,f,u,l	/ɔ:/ /f/ /ʊ/ /l/
5	awkward	aw,k,w,ar,d	/ɔ:/ /k/ /w/ /ə/ /d/
5	awesome	awe,s,o,me	/ɔ:/ /s/ /ə/ /m/
5	lawful	l,aw,f,u,l	/l/ /ɔ:/ /f/ /ʊ/ /l/
5	drawn	d,r,aw,n	/d/ /r/ /ɔ:/ /n/
5	also	a,l,s,o	/ɔ:/ /l/ /s/ /əʊ/
5	almost	a,l,m,o,s,t	/ɔ:/ /l/ /m/ /əʊ/ /s/ /t/
5	always	a,l,w,ay,s	/ɔ:/ /l/ /w/ /eɪ/ /z/
5	although	a,l,th,ough	/ɔ:/ /l/ /ð/ /əʊ/
5	altogether	a,l,t,o,g,e,th,er	/ɔ:/ /l/ /t/ /ə/ /g/ /ɛ/ /ð/ /ə/
5	alternatively	a,l,t,e,r,n,a,t,i,v,e,l,y	/ə/ /l/ /t/ /z:/ /n/ /ə/ /t/ /ɪ/ /v/ /l/ /i:/
5	called	c,a,ll,ed	/k/ /ɔ:/ /l/ /d/
5	introduction	i,n,t,r,o,d,u,c,t,i,o,n	/ɪ/ /n/ /t/ /r/ /ə/ /d/ /ɹ/ /k/ /ʃ/ /ə/ /n/
5	direction	d,i,r,e,c,t,i,o,n	/d/ /ɪ/ /r/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	selection	s,e,l,e,c,t,i,o,n	/s/ /ɪ/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	correction	c,o,r,r,e,c,t,i,o,n	/k/ /ə/ /r/ /ɛ/ /k/ /ʃ/ /ə/ /n/
5	instruction	i,n,s,t,r,u,c,t,i,o,n	/ɪ/ /n/ /s/ /t/ /r/ /ɹ/ /k/ /ʃ/ /ə/ /n/
5	expression	e,x,p,r,e,s,s,i,o,n	/ɪ/ /x/ /p/ /r/ /ɛ/ /ʃ/ /ə/ /n/
5	submission	s,u,b,m,i,s,s,i,o,n	/s/ /ə/ /b/ /m/ /ɪ/ /ʃ/ /ə/ /n/
5	transmission	t,r,a,n,s,m,i,s,s,i,o,n	/t/ /r/ /æ/ /n/ /z/ /m/ /ɪ/ /ʃ/ /ə/ /n/
5	discussion	d,i,s,c,u,s,s,i,o,n	/d/ /ɪ/ /s/ /k/ /ɹ/ /ʃ/ /ə/ /n/
5	profession	p,r,o,f,e,s,s,i,o,n	/p/ /r/ /ə/ /f/ /ɛ/ /ʃ/ /ə/ /n/
5	interruption	i,n,t,e,r,r,u,p,t,i,o,n	/ɪ/ /n/ /t/ /ə/ /r/ /ɹ/ /p/ /ʃ/ /ə/ /n/
5	suggestion	s,u,g,g,e,s,t,i,o,n	/s/ /ə/ /dʒ/ /ɛ/ /s/ /tʃ/ /ə/ /n/
5	prevention	p,r,e,v,e,n,t,i,o,n	/p/ /r/ /ɪ/ /v/ /ɛ/ /n/ /ʃ/ /ə/ /n/
5	exception	e,x,c,e,p,t,i,o,n	/ɪ/ /k/ /s/ /ɛ/ /p/ /ʃ/ /ə/ /n/
5	communication	c,o,m,m,u,n,i,c,a,t,i,o,n	/k/ /ə/ /m/ /y/ /n/ /ɪ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
5	illustration	i,ll,u,s,t,r,a,t,i,o,n	/ɪ/ /l/ /ə/ /s/ /t/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	location	l,o,c,a,t,i,o,n	/l/ /əʊ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
5	frustration	f,r,u,s,t,r,a,t,i,o,n	/f/ /r/ /ɹ/ /s/ /t/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	decoration	d,e,c,o,r,a,t,i,o,n	/d/ /ɛ/ /k/ /ə/ /r/ /eɪ/ /ʃ/ /ə/ /n/
5	pollution	p,o,ll,u,t,i,o,n	/p/ /ə/ /l/ /u:/ /ʃ/ /ə/ /n/

5	vein	v,eɪ,n	/v/ /eɪ/ /n/
5	weigh	w,eɪg	/w/ /eɪ/
5	weird	w,e,ɪr,d	/w/ /i:/ /ɜ:/ /d/
5	their	θ,eɪr	/ð/ /eə/
5	reign	r,eɪ,gn	/r/ /eɪ/ /n/
5	seize	s,eɪ,zeɪ	/s/ /i:/ /z/
5	either	eɪ,θ,eɪr	/aɪ/ /ð/ /ə/
5	neither	n,eɪ,θ,eɪr	/n/ /aɪ/ /ð/ /ə/
5	height	h,eɪg,t	/h/ /aɪ/ /t/
5	weight	w,eɪg,t	/w/ /eɪ/ /t/
5	freight	f,r,eɪg,t	/f/ /r/ /eɪ/ /t/
5	neighbour	n,eɪg,b,ʊr	/n/ /eɪ/ /b/ /ə/
5	leisure	l,eɪ,s,ʊr	/l/ /ɛ/ /z/ /ə/
5	foreign	f,o,r,eɪ,gn	/f/ /ɒ/ /r/ /ɛ/ /n/
5	caffeine	k,æ,f,eɪ,n	/k/ /æ/ /f/ /i:/ /n/
5	species	s,p,eɪ,s,i,ɪs	/s/ /p/ /i:/ /ʃ/ /i:/ /z/
5	ancient	æ,n,t,i,ɪ,n,t	/eɪ/ /n/ /ʃ/ /ɛ/ /n/ /t/
5	science	s,aɪ,n,s	/s/ /aɪ/ /ɛ/ /n/ /s/
5	society	s,oʊ,s,i,ɪ,t,i	/s/ /ə/ /s/ /aɪ/ /ɛ/ /t/ /i:/
5	sufficient	s,ʌ,f,i,ɪ,s,i,ɪ,n,t	/s/ /ə/ /f/ /ɪ/ /ʃ/ /ɛ/ /n/ /t/
5	accept	æ,k,s,e,p,t	/ə/ /k/ /s/ /ɛ/ /p/ /t/
5	except	ɪk,s,e,p,t	/ɪ/ /k/ /s/ /ɛ/ /p/ /t/
5	advise	æd,v,i,ʒ	/ə/ /d/ /v/ /aɪ/ /z/
5	advice	æd,v,i,ʒ	/ə/ /d/ /v/ /aɪ/ /s/
5	affect	æf,e,k,t	/ə/ /f/ /ɛ/ /k/ /t/
5	effect	ɪf,e,k,t	/ɪ/ /f/ /ɛ/ /k/ /t/
5	bought	b,ɔ:t	/b/ /ɔ:/ /t/
5	brought	b,r,ɔ:t	/b/ /r/ /ɔ:/ /t/
5	loose	l,u:s	/l/ /u:/ /s/
5	lose	l,u:z	/l/ /u:/ /z/
5	quite	kwaɪt	/k/ /w/ /aɪ/ /t/
5	quiet	kwaiet	/k/ /w/ /aɪ/ /ə/ /t/
5	practise	præktɪs	/p/ /r/ /æ/ /k/ /t/ /ɪ/ /s/
5	practice	præktɪs	/p/ /r/ /æ/ /k/ /t/ /ɪ/ /s/
5	stationary	stæʃənəri	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
5	stationery	stæʃənəri	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /r/ /i:/
5	of	ɒf	/ɒ/ /v/
5	off	ɒf	/ɒ/ /f/
5	aloud	əlaʊd	/ə/ /l/ /aʊ/ /d/
5	allowed	əlaʊd	/ə/ /l/ /aʊ/ /d/
5	present	preznt	/p/ /r/ /ɛ/ /z/ /n/ /t/
5	object	ɒbʃekt	/ɒ/ /b/ /dʒ/ /ɛ/ /k/ /t/
5	content	kntent	/k/ /ɒ/ /n/ /t/ /ɛ/ /n/ /t/
5	export	ɪksprt	/ɛ/ /x/ /p/ /ɔ:/ /t/

5	complex	c,o,m,p,l,e,x	/k/ /ɒ/ /m/ /p/ /l/ /ɛ/ /x/
5	protest	p,r,o,t,e,s,t	/p/ /r/ /əʊ/ /t/ /ɛ/ /s/ /t/
5	produce	p,r,o,d,u,ce	/p/ /r/ /ɒ/ /d/ /y/ /s/
5	refuse	r,e,f,u,se	/r/ /i:/ /f/ /y/ /z/
5	conduct	c,o,n,d,u,c,t	/k/ /ɒ/ /n/ /d/ /ʌ/ /k/ /t/
5	record	r,e,c,or,d	/r/ /ɛ/ /k/ /ɔ:/ /d/
5	desert	d,e,s,e,r,t	/d/ /ɛ/ /z/ /ə/ /t/
5	subject	s,u,b,j,e,c,t	/s/ /ʌ/ /b/ /dʒ/ /ɛ/ /k/ /t/
5	insert	i,n,s,e,r,t	/ɪ/ /n/ /s/ /z:/ /t/
5	extract	e,x,t,r,a,c,t	/ɛ/ /x/ /t/ /r/ /æ/ /k/ /t/
5	project	p,r,o,j,e,c,t	/p/ /r/ /ɒ/ /dʒ/ /ɛ/ /k/ /t/
5	minute	m,i,n,u,te	/m/ /ɪ/ /n/ /ɪ/ /t/
5	perfect	p,e,r,f,e,c,t	/p/ /z:/ /f/ /ɪ/ /k/ /t/
5	reject	r,e,j,e,c,t	/r/ /i:/ /dʒ/ /ɛ/ /k/ /t/
5	research	r,e,s,e,a,r,c,h	/r/ /ɪ/ /s/ /z:/ /tʃ/
5	conflict	c,o,n,f,l,i,c,t	/k/ /ɒ/ /n/ /f/ /l/ /ɪ/ /k/ /t/
5	laugh	l,a,u,gh	/l/ /ɑ:/ /f/
5	tough	t,o,u,gh	/t/ /ʌ/ /f/
5	rough	r,o,u,gh	/r/ /ʌ/ /f/
5	enough	e,n,o,u,gh	/ɪ/ /n/ /ʌ/ /f/
5	draught	d,r,a,u,gh,t	/d/ /r/ /ɑ:/ /f/ /t/
5	laughter	l,a,u,gh,t,e,r	/l/ /ɑ:/ /f/ /t/ /ə/
5	graphics	g,r,a,p,h,i,c,s	/g/ /r/ /æ/ /f/ /ɪ/ /k/ /s/
5	alphabet	a,l,p,h,a,b,e,t	/æ/ /l/ /f/ /ə/ /b/ /ɛ/ /t/
5	photograph	ph,o,t,o,g,r,a,ph	/f/ /əʊ/ /t/ /ə/ /g/ /r/ /ɑ:/ /f/
5	digraph	d,i,g,r,a,ph	/d/ /aɪ/ /g/ /r/ /ɑ:/ /f/
5	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
5	biography	b,i,o,g,r,a,ph,y	/b/ /aɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
5	equator	e,q,u,a,t,or	/ɪ/ /k/ /w/ /eɪ/ /t/ /ə/
5	equal	e,q,u,a,l	/i:/ /k/ /w/ /ə/ /l/
5	conquer	c,o,n,q,u,e,r	/k/ /ɒ/ /ŋ/ /k/ /ə/
5	quarter	q,u,a,r,t,e,r	/k/ /w/ /ɔ:/ /t/ /ə/
5	question	q,u,e,s,t,i,o,n	/k/ /w/ /ɛ/ /s/ /tʃ/ /ə/ /n/
5	equation	e,q,u,a,t,i,o,n	/ɪ/ /k/ /w/ /eɪ/ /ʃ/ /ə/ /n/
5	equipment	e,q,u,i,p,m,e,n,t	/ɪ/ /k/ /w/ /ɪ/ /p/ /m/ /ə/ /n/ /t/
5	inquiry	i,n,q,u,i,r,y	/ɪ/ /n/ /k/ /w/ /aɪ/ /r/ /i:/
5	inlet	i,n,l,e,t	/ɪ/ /n/ /l/ /ɛ/ /t/
5	piglet	p,i,g,l,e,t	/p/ /ɪ/ /g/ /l/ /ə/ /t/
5	booklet	b,o,o,k,l,e,t	/b/ /ʊ/ /k/ /l/ /ɪ/ /t/
5	droplet	d,r,o,p,l,e,t	/d/ /r/ /ɒ/ /p/ /l/ /ɪ/ /t/
5	leaflet	l,e,a,f,l,e,t	/l/ /i:/ /f/ /l/ /ɪ/ /t/
5	duckling	d,u,c,k,l,i,n,g	/d/ /ʌ/ /k/ /l/ /ɪ/ /ŋ/
5	gosling	g,o,s,l,i,n,g	/g/ /ɒ/ /z/ /l/ /ɪ/ /ŋ/
5	sibling	s,i,b,l,i,n,g	/s/ /ɪ/ /b/ /l/ /ɪ/ /ŋ/

5	pedestrian	p,e,d,e,s,t,r,i,a,n	/p/ /ɪ/ /d/ /ɛ/ /s/ /t/ /r/ /ɪ/ /ə/ /n/
5	librarian	l,i,b,r,a,r,i,a,n	/l/ /aɪ/ /b/ /r/ /eə/ /r/ /ɪ/ /ə/ /n/
5	musician	m,u,s,i,c,i,a,n	/m/ /y/ /z/ /ɪ/ /ʃ/ /ə/ /n/
5	electrician	e,l,e,c,t,r,i,c,i,a,n	/ɪ/ /l/ /ɛ/ /k/ /t/ /r/ /ɪ/ /ʃ/ /ə/ /n/
5	politician	p,o,l,i,t,i,c,i,a,n	/p/ /o/ /l/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
5	citizenship	c,i,t,i,z,en,sh,i,p	/s/ /ɪ/ /t/ /ɪ/ /z/ /n/ /ʃ/ /ɪ/ /p/
5	relationship	r,e,l,a,t,i,o,n,sh,i,p	/r/ /ɪ/ /l/ /eɪ/ /ʃ/ /ə/ /n/ /ʃ/ /ɪ/ /p/
5	friendship	f,r,i,e,n,d,sh,i,p	/f/ /r/ /ɛ/ /n/ /d/ /ʃ/ /ɪ/ /p/
5	leadership	l,e,a,d,e,r,sh,i,p	/l/ /i:/ /d/ /ə/ /ʃ/ /ɪ/ /p/
5	childhood	ch,i,l,d,h,o,o,d	/tʃ/ /aɪ/ /l/ /d/ /h/ /ʊ/ /d/
5	parenthood	p,a,r,e,n,t,h,o,o,d	/p/ /eə/ /r/ /ə/ /n/ /t/ /h/ /ʊ/ /d/
5	likelihood	l,i,k,e,l,i,h,o,o,d	/l/ /aɪ/ /k/ /l/ /ɪ/ /h/ /ʊ/ /d/
5	dissect	d,i,s,s,e,c,t	/d/ /aɪ/ /s/ /ɛ/ /k/ /t/
5	dilate	d,i,l,a,t,e	/d/ /aɪ/ /l/ /eɪ/ /t/
5	digest	d,i,g,e,s,t	/d/ /aɪ/ /dʒ/ /ɛ/ /s/ /t/
5	direct	d,i,r,e,c,t	/d/ /ɪ/ /r/ /ɛ/ /k/ /t/
5	divert	d,i,v,e,r,t	/d/ /aɪ/ /v/ /ɜ:/ /t/
5	diameter	d,i,a,m,e,t,e,r	/d/ /aɪ/ /æ/ /m/ /ɪ/ /t/ /ə/
5	diagonal	d,i,a,g,o,n,a,l	/d/ /aɪ/ /æ/ /g/ /ə/ /n/ /l/
5	diagram	d,i,a,g,r,a,m	/d/ /aɪ/ /ə/ /g/ /r/ /æ/ /m/
5	diagnosis	d,i,a,g,n,o,s,i,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /ɪ/ /s/
5	dialogue	d,i,a,l,o,gue	/d/ /aɪ/ /ə/ /l/ /o/ /g/
5	dialect	d,i,a,l,e,c,t	/d/ /aɪ/ /ə/ /l/ /ɛ/ /k/ /t/
5	decay	d,e,c,a,y	/d/ /ɪ/ /k/ /eɪ/
5	decide	d,e,c,i,d,e	/d/ /ɪ/ /s/ /aɪ/ /d/
5	deport	d,e,p,o,r,t	/d/ /ɪ/ /p/ /ɔ:/ /t/
5	delay	d,e,l,a,y	/d/ /ɪ/ /l/ /eɪ/
5	depend	d,e,p,e,n,d	/d/ /ɪ/ /p/ /ɛ/ /n/ /d/
5	debrief	d,e,b,r,i,e,f	/d/ /i:/ /b/ /r/ /i:/ /f/
5	develop	d,e,v,e,l,o,p	/d/ /ɪ/ /v/ /ɛ/ /l/ /ə/ /p/
5	depress	d,e,p,r,e,s,s	/d/ /ɪ/ /p/ /r/ /ɛ/ /s/
5	deploy	d,e,p,l,o,y	/d/ /ɪ/ /p/ /l/ /ɔɪ/
5	healthy	h,e,a,l,t,h,y	/h/ /ɛ/ /l/ /θ/ /i:/
5	healthier	h,e,a,l,t,h,i,e,r	/h/ /ɛ/ /l/ /θ/ /ɪ/ /ə/
5	healthiest	h,e,a,l,t,h,i,e,s,t	/h/ /ɛ/ /l/ /θ/ /ɪ/ /ɛ/ /s/ /t/
5	funny	f,u,n,n,y	/f/ /ʌ/ /n/ /i:/
5	funnier	f,u,n,n,i,e,r	/f/ /ʌ/ /n/ /ɪ/ /ə/
5	funniest	f,u,n,n,i,e,s,t	/f/ /ʌ/ /n/ /ɪ/ /ɛ/ /s/ /t/
5	friendly	f,r,i,e,n,d,l,y	/f/ /r/ /ɛ/ /n/ /d/ /l/ /i:/
5	friendlier	f,r,i,e,n,d,l,i,e,r	/f/ /r/ /ɛ/ /n/ /d/ /l/ /ɪ/ /ə/
5	friendliest	f,r,i,e,n,d,l,i,e,s,t	/f/ /r/ /ɛ/ /n/ /d/ /l/ /ɪ/ /ɛ/ /s/ /t/
5	lazy	l,a,z,y	/l/ /eɪ/ /z/ /i:/
5	lazier	l,a,z,i,e,r	/l/ /eɪ/ /z/ /ɪ/ /ə/
5	laziest	l,a,z,i,e,s,t	/l/ /eɪ/ /z/ /ɪ/ /ɛ/ /s/ /t/

5	wealthy	w,ea,l,th,y	/w/ /ε/ /l/ /θ/ /i:/
5	wealthier	w,ea,l,th,i,er	/w/ /ε/ /l/ /θ/ /ɪ/ /ə/
5	wealthiest	w,ea,l,th,i,e,s,t	/w/ /ε/ /l/ /θ/ /ɪ/ /ε/ /s/ /t/
5	pretty	p,r,e,tt,y	/p/ /r/ /ɪ/ /t/ /i:/
5	prettier	p,r,e,tt,i,er	/p/ /r/ /ɪ/ /t/ /ɪ/ /ə/
5	prettiest	p,r,e,tt,i,e,s,t	/p/ /r/ /ɪ/ /t/ /ɪ/ /ε/ /s/ /t/
5	axis	a,x,i,s	/æ/ /x/ /ɪ/ /s/
5	axes	a,x,e,s	/æ/ /x/ /ɪ/ /z/
5	crisis	c,r,i,s,i,s	/k/ /r/ /aɪ/ /s/ /ɪ/ /s/
5	crises	c,r,i,s,e,s	/k/ /r/ /aɪ/ /s/ /i:/ /z/
5	diagnosis	d,i,a,g,n,o,s,i,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /ɪ/ /s/
5	diagnoses	d,i,a,g,n,o,s,e,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /i:/ /z/
5	analysis	a,n,a,l,y,s,i,s	/ə/ /n/ /æ/ /l/ /ɪ/ /s/ /ɪ/ /s/
5	analyses	a,n,a,l,y,s,e,s	/ə/ /n/ /æ/ /l/ /ɪ/ /s/ /i:/ /z/
5	radius	r,a,d,i,u,s	/r/ /eɪ/ /d/ /ɪ/ /ʌ/ /s/
5	radii	r,a,d,i,i	/r/ /eɪ/ /d/ /ɪ/ /aɪ/
5	focus	f,o,c,u,s	/f/ /əʊ/ /k/ /ʌ/ /s/
5	foci	f,o,c,i	/f/ /əʊ/ /s/ /aɪ/
5	fungus	f,u,n,g,u,s	/f/ /ʌ/ /ŋ/ /g/ /ə/ /s/
5	fungi	f,u,n,g,i	/f/ /ʌ/ /ŋ/ /g/ /aɪ/
5	index	i,n,d,e,x	/ɪ/ /n/ /d/ /ε/ /x/
5	indices	i,n,d,i,c,e,s	/ɪ/ /n/ /d/ /ɪ/ /s/ /i:/ /z/
5	appendix	a,p,p,e,n,d,i,x	/ə/ /p/ /ε/ /n/ /d/ /ɪ/ /x/
5	appendices	a,p,p,e,n,d,i,c,e,s	/ə/ /p/ /ε/ /n/ /d/ /ɪ/ /s/ /i:/ /z/
5	matrix	m,a,t,r,i,x	/m/ /eɪ/ /t/ /r/ /ɪ/ /x/
5	matrices	m,a,t,r,i,c,e,s	/m/ /eɪ/ /t/ /r/ /ɪ/ /s/ /i:/ /z/
5	dental	d,e,n,t,al	/d/ /ε/ /n/ /t/ /l/
5	final	f,i,n,al	/f/ /aɪ/ /n/ /l/
5	signal	s,i,g,n,al	/s/ /ɪ/ /g/ /n/ /l/
5	regional	r,e,g,i,o,n,al	/r/ /i:/ /dʒ/ /ə/ /n/ /l/
5	personal	p,e,r,s,o,n,al	/p/ /ɜ:/ /s/ /n/ /l/
5	coastal	c,o,a,s,t,a,l	/k/ /əʊ/ /s/ /t/ /ə/ /l/
5	circular	c,i,r,c,u,l,ar	/s/ /ɜ:/ /k/ /y/ /l/ /ə/
5	popular	p,o,p,u,l,ar	/p/ /ɒ/ /p/ /y/ /l/ /ə/
5	similar	s,i,m,i,l,ar	/s/ /ɪ/ /m/ /ɪ/ /l/ /ə/
5	angular	a,n,g,u,l,ar	/æ/ /ŋ/ /g/ /y/ /l/ /ə/
5	familiar	f,a,m,i,l,i,ar	/f/ /ə/ /m/ /ɪ/ /l/ /j/ /ə/
5	solar	s,o,l,ar	/s/ /əʊ/ /l/ /ə/
5	shorten	sh,o,r,t,en	/ʃ/ /ɔ:/ /t/ /n/
5	flatten	f,l,a,t,t,en	/f/ /l/ /æ/ /t/ /n/
5	stiffen	s,t,i,f,f,en	/s/ /t/ /ɪ/ /f/ /n/
5	broken	b,r,o,k,e,n	/b/ /r/ /əʊ/ /k/ /ə/ /n/
5	weaken	w,e,a,k,e,n	/w/ /i:/ /k/ /ə/ /n/
5	strengthen	s,t,r,e,n,g,t,h,e,n	/s/ /t/ /r/ /ε/ /ŋ/ /θ/ /ə/ /n/

5	liken	l,i,k,e,n	/l/ /aɪ/ /k/ /ə/ /n/
5	lengthen	l,e,nɡ,θ,e,n	/l/ /ɛ/ /ŋ/ /θ/ /ə/ /n/
5	active	a,c,t,i,və	/æ/ /k/ /t/ /ɪ/ /v/
5	sensitive	s,e,n,s,i,t,i,və	/s/ /ɛ/ /n/ /s/ /ɪ/ /t/ /ɪ/ /v/
5	automotive	au,t,o,m,o,t,i,və	/ɔ:/ /t/ /ə/ /m/ /əʊ/ /t/ /ɪ/ /v/
5	relative	r,e,l,a,t,i,və	/r/ /ɛ/ /l/ /ə/ /t/ /ɪ/ /v/
5	creative	c,r,e,a,t,i,və	/k/ /r/ /i:/ /eɪ/ /t/ /ɪ/ /v/
5	cherish	ch,e,r,i,ʃ	/tʃ/ /ɛ/ /r/ /ɪ/ /ʃ/
5	flourish	f,l,oʊ,r,i,ʃ	/f/ /l/ /ʌ/ /r/ /ɪ/ /ʃ/
5	feverish	f,e,v,e,r,i,ʃ	/f/ /i:/ /v/ /ə/ /r/ /ɪ/ /ʃ/
5	lavish	l,a,v,i,ʃ	/l/ /æ/ /v/ /ɪ/ /ʃ/
5	always	a,l,w,aɪ,s	/ɔ:/ /l/ /w/ /eɪ/ /z/
5	sideways	s,i,d,e,w,aɪ,s	/s/ /aɪ/ /d/ /w/ /eɪ/ /z/
5	lengthways	l,e,nɡ,θ,w,aɪ,s	/l/ /ɛ/ /ŋ/ /θ/ /w/ /eɪ/ /z/
5	bikeway	b,i,k,e,w,aɪ	/b/ /aɪ/ /k/ /w/ /eɪ/
5	highway	h,iɡ,w,aɪ	/h/ /aɪ/ /w/ /eɪ/
5	upwards	u,p,w,aɪ,d,s	/ʌ/ /p/ /w/ /ə/ /d/ /z/
5	forward	f,ɔ:w,aɪ,d	/f/ /ɔ:/ /w/ /ə/ /d/
5	backwards	b,a,ck,w,aɪ,d,s	/b/ /æ/ /k/ /w/ /ə/ /d/ /z/
5	inward	i,n,w,aɪ,d	/ɪ/ /n/ /w/ /ə/ /d/
5	outward	oʊ,t,w,aɪ,d	/aʊ/ /t/ /w/ /ə/ /d/
5	towards	t,o,w,aɪ,d,s	/t/ /ə/ /w/ /ɔ:/ /d/ /z/
7	practise	p,r,a,c,t,i,se	/p/ /r/ /æ/ /k/ /t/ /ɪ/ /s/
7	practice	p,r,a,c,t,i,ce	/p/ /r/ /æ/ /k/ /t/ /ɪ/ /s/
7	weather	w,e,a,θ,er	/w/ /ɛ/ /ð/ /ə/
7	whether	w,h,e,θ,er	/w/ /ɛ/ /ð/ /ə/
7	hire	h,i,er	/h/ /aɪ/ /ə/
7	higher	h,iɡ,er	/h/ /aɪ/ /ə/
7	allowed	a,l,l,oʊ,d	/ə/ /l/ /aʊ/ /d/
7	aloud	a,l,oʊ,d	/ə/ /l/ /aʊ/ /d/
7	idle	i,d,l	/aɪ/ /d/ /l/
7	idol	i,d,ɒl	/aɪ/ /d/ /l/
7	hour	hʊ,r	/aʊ/ /ə/
7	our	oʊ,r	/aʊ/ /ə/
7	wonder	w,o,n,d,er	/w/ /ʌ/ /n/ /d/ /ə/
7	wander	w,a,n,d,er	/w/ /ɒ/ /n/ /d/ /ə/
7	ceiling	s,eɪ,l,i,ŋ	/s/ /i:/ /l/ /ɪ/ /ŋ/
7	sealing	s,i:l,i,ŋ	/s/ /i:/ /l/ /ɪ/ /ŋ/
7	muscle	m,u,s,cl	/m/ /ʌ/ /s/ /l/
7	mussel	m,u,s,sl	/m/ /ʌ/ /s/ /l/
7	bridal	b,r,i,d,əl	/b/ /r/ /aɪ/ /d/ /l/
7	bridle	b,r,i,d,l	/b/ /r/ /aɪ/ /d/ /l/
7	semicircle	s,e,m,i,c,ɪr,kl	/s/ /ɛ/ /m/ /ɪ/ /s/ /z:/ /k/ /l/
7	semifinal	s,e,m,i,f,i,n,əl	/s/ /ɛ/ /m/ /ɪ/ /f/ /aɪ/ /n/ /l/

7	semitrailer	s,e,m,i,t,r,ai,l,er	/s/ /ɛ/ /m/ /ɪ/ /t/ /r/ /eɪ/ /l/ /ə/
7	multiply	m,u,l,t,i,p,l,y	/m/ /ʌ/ /l/ /t/ /ɪ/ /p/ /l/ /aɪ/
7	multiple	m,u,l,t,i,p,le	/m/ /ʌ/ /l/ /t/ /ɪ/ /p/ /l/
7	multitask	m,u,l,t,i,t,a,s,k	/m/ /ʌ/ /l/ /t/ /ɪ/ /t/ /ɑ:/ /s/ /k/
7	multicultural	m,u,l,t,i,c,u,l,t,u,r,a,l	/m/ /ʌ/ /l/ /t/ /ɪ/ /k/ /ʌ/ /l/ /tʃ/ /ə/ /r/ /ə/ /l/
7	multigrain	m,u,l,t,i,g,r,ai,n	/m/ /ʌ/ /l/ /t/ /ɪ/ /g/ /r/ /eɪ/ /n/
7	perimeter	p,e,r,i,m,e,t,er	/p/ /ə/ /r/ /ɪ/ /m/ /ɪ/ /t/ /ə/
7	periscope	p,e,r,i,s,c,o,pe	/p/ /ɛ/ /r/ /ɪ/ /s/ /k/ /əʊ/ /p/
7	circle	c,ir,c,le	/s/ /ɜ:/ /k/ /l/
7	circus	c,ir,c,u,s	/s/ /ɜ:/ /k/ /ə/ /s/
7	circuit	c,ir,c,ui,t	/s/ /ɜ:/ /k/ /ɪ/ /t/
7	circular	c,ir,c,u,l,ar	/s/ /ɜ:/ /k/ /ɹ/ /l/ /ə/
7	circulate	c,ir,c,u,l,a,te	/s/ /ɜ:/ /k/ /ɹ/ /l/ /eɪ/ /t/
7	circumference	c,ir,c,u,m,f,er,e,n,ce	/s/ /ɜ:/ /k/ /ʌ/ /m/ /f/ /r/ /ə/ /n/ /s/
7	transport	t,r,a,n,s,p,or,t	/t/ /r/ /æ/ /n/ /s/ /p/ /ɔ:/ /t/
7	translate	t,r,a,n,s,l,a,te	/t/ /r/ /æ/ /n/ /s/ /l/ /eɪ/ /t/
7	transfer	t,r,a,n,s,f,er	/t/ /r/ /æ/ /n/ /s/ /f/ /ɜ:/
7	transit	t,r,a,n,s,i,t	/t/ /r/ /æ/ /n/ /s/ /ɪ/ /t/
7	topic	t,o,p,i,c	/t/ /ɒ/ /p/ /ɪ/ /k/
7	clinic	c,l,i,n,i,c	/k/ /l/ /ɪ/ /n/ /ɪ/ /k/
7	comic	c,o,m,i,c	/k/ /ɒ/ /m/ /ɪ/ /k/
7	classic	c,l,a,ss,i,c	/k/ /l/ /æ/ /s/ /ɪ/ /k/
7	elastic	e,l,a,s,t,i,c	/ɪ/ /l/ /æ/ /s/ /t/ /ɪ/ /k/
7	athletic	a,th,l,e,t,i,c	/æ/ /θ/ /l/ /ɛ/ /t/ /ɪ/ /k/
7	fabric	f,a,b,r,i,c	/f/ /æ/ /b/ /r/ /ɪ/ /k/
7	picnic	p,i,c,n,i,c	/p/ /ɪ/ /k/ /n/ /ɪ/ /k/
7	panic	p,a,n,i,c	/p/ /æ/ /n/ /ɪ/ /k/
7	autograph	au,t,o,g,r,a,ph	/ɔ:/ /t/ /ə/ /g/ /r/ /ɑ:/ /f/
7	photograph	ph,o,t,o,g,r,a,ph	/f/ /əʊ/ /t/ /ə/ /g/ /r/ /ɑ:/ /f/
7	graphics	g,r,a,ph,i,c,s	/g/ /r/ /æ/ /f/ /ɪ/ /k/ /s/
7	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
7	phrase	ph,r,a,se	/f/ /r/ /eɪ/ /z/
7	paragraph	p,a,r,a,g,r,a,ph	/p/ /æ/ /r/ /ə/ /g/ /r/ /ɑ:/ /f/
7	equator	e,q,u,a,t,or	/ɪ/ /k/ /w/ /eɪ/ /t/ /ə/
7	equation	e,q,u,a,t,io,n	/ɪ/ /k/ /w/ /eɪ/ /ʃ/ /ə/ /n/
7	question	q,u,e,s,t,io,n	/k/ /w/ /ɛ/ /s/ /tʃ/ /ə/ /n/
7	equipment	e,q,u,i,p,m,e,n,t	/ɪ/ /k/ /w/ /ɪ/ /p/ /m/ /ə/ /n/ /t/
7	quarter	q,u,ar,t,er	/k/ /w/ /ɔ:/ /t/ /ə/
7	outnumber	ou,t,n,u,m,b,er	/aʊ/ /t/ /n/ /ʌ/ /m/ /b/ /ə/
7	outdoors	ou,t,d,oor,s	/aʊ/ /t/ /d/ /ɔ:/ /z/
7	outrun	ou,t,r,u,n	/aʊ/ /t/ /r/ /ʌ/ /n/
7	outspoken	ou,t,s,p,o,k,e,n	/aʊ/ /t/ /s/ /p/ /əʊ/ /k/ /ə/ /n/
7	outback	ou,t,b,a,ck	/aʊ/ /t/ /b/ /æ/ /k/
7	outside	ou,t,s,i,de	/aʊ/ /t/ /s/ /aɪ/ /d/

7	supervise	s,u,p,e,r,v,i,s,e	/s/ /u:/ /p/ /ə/ /v/ /aɪ/ /z/
7	superhuman	s,u,p,e,r,h,u,m,a,n	/s/ /u:/ /p/ /ə/ /h/ /ɹ/ /m/ /ə/ /n/
7	superior	s,u,p,e,r,i,o,r	/s/ /u:/ /p/ /ɪə/ /r/ /ɪ/ /ə/
7	superhero	s,u,p,e,r,h,e,r,o	/s/ /u:/ /p/ /ə/ /h/ /ɪə/ /r/ /əʊ/
7	supersonic	s,u,p,e,r,s,o,n,i,c	/s/ /u:/ /p/ /ə/ /s/ /p/ /n/ /ɪ/ /k/
7	different	d,i,f,f,e,r,e,n,t	/d/ /ɪ/ /f/ /r/ /ə/ /n/ /t/
7	difficult	d,i,f,f,i,c,u,l,t	/d/ /ɪ/ /f/ /ɪ/ /k/ /ə/ /l/ /t/
7	difficulty	d,i,f,f,i,c,u,l,t,y	/d/ /ɪ/ /f/ /ɪ/ /k/ /ə/ /l/ /t/ /i:/
7	dispute	d,i,s,p,u,t,e	/d/ /ɪ/ /s/ /p/ /ɹ/ /t/
7	disloyal	d,i,s,l,o,y,a,l	/d/ /ɪ/ /s/ /l/ /ɔɪ/ /ə/ /l/
7	disagree	d,i,s,a,g,r,e,e	/d/ /ɪ/ /s/ /ə/ /g/ /r/ /i:/
7	disapprove	d,i,s,a,p,p,r,o,v,e	/d/ /ɪ/ /s/ /ə/ /p/ /r/ /u:/ /v/
7	disconnect	d,i,s,c,o,n,n,e,c,t	/d/ /ɪ/ /s/ /k/ /ə/ /n/ /ɛ/ /k/ /t/
7	disrespect	d,i,s,r,e,s,p,e,c,t	/d/ /ɪ/ /s/ /r/ /ɪ/ /s/ /p/ /ɛ/ /k/ /t/
7	impractical	i,m,p,r,a,c,t,i,c,a,l	/ɪ/ /m/ /p/ /r/ /æ/ /k/ /t/ /ɪ/ /k/ /ə/ /l/
7	impossible	i,m,p,o,s,s,i,b,l,e	/ɪ/ /m/ /p/ /p/ /s/ /ə/ /b/ /l/
7	immature	i,m,m,a,t,u,r,e	/ɪ/ /m/ /ə/ /tʃ/ /ʊə/
7	immobile	i,m,m,o,b,i,l,e	/ɪ/ /m/ /əʊ/ /b/ /aɪ/ /l/
7	immoral	i,m,m,o,r,a,l	/ɪ/ /m/ /p/ /r/ /ə/ /l/
7	imperfect	i,m,p,e,r,f,e,c,t	/ɪ/ /m/ /p/ /z:/ /f/ /ɪ/ /k/ /t/
7	impatient	i,m,p,a,t,i,e,n,t	/ɪ/ /m/ /p/ /eɪ/ /ʃ/ /ɛ/ /n/ /t/
7	illegal	i,l,l,e,g,a,l	/ɪ/ /l/ /i:/ /g/ /ə/ /l/
7	illogical	i,l,l,o,g,i,c,a,l	/ɪ/ /l/ /p/ /dʒ/ /ɪ/ /k/ /ə/ /l/
7	illiterate	i,l,l,i,t,e,r,a,t,e	/ɪ/ /l/ /ɪ/ /t/ /ə/ /r/ /ɪ/ /t/
7	invisible	i,n,v,i,s,i,b,l,e	/ɪ/ /n/ /v/ /ɪ/ /z/ /ə/ /b/ /l/
7	incredible	i,n,c,r,e,d,i,b,l,e	/ɪ/ /n/ /k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
7	invalid	i,n,v,a,l,i,d	/ɪ/ /n/ /v/ /ə/ /l/ /ɪ/ /d/
7	irrational	i,r,r,a,t,i,o,n,a,l	/ɪ/ /r/ /æ/ /ʃ/ /ə/ /n/ /l/
7	irregular	i,r,r,e,g,u,l,a,r	/ɪ/ /r/ /ɛ/ /g/ /ɹ/ /l/ /ə/
7	irresistible	i,r,r,e,s,i,s,t,i,b,l,e	/ɪ/ /r/ /ɪ/ /z/ /ɪ/ /s/ /t/ /ə/ /b/ /l/
7	irreversible	i,r,r,e,v,e,r,s,i,b,l,e	/ɪ/ /r/ /ɪ/ /v/ /z:/ /s/ /ə/ /b/ /l/
7	irrelevant	i,r,r,e,l,e,v,a,n,t	/ɪ/ /r/ /ɛ/ /l/ /ɪ/ /v/ /ə/ /n/ /t/
7	irreplaceable	i,r,r,e,p,l,a,c,e,a,b,l,e	/ɪ/ /r/ /ɪ/ /p/ /l/ /eɪ/ /s/ /ə/ /b/ /l/
7	irresponsible	i,r,r,e,s,p,o,n,s,i,b,l,e	/ɪ/ /r/ /ɪ/ /s/ /p/ /p/ /n/ /s/ /ə/ /b/ /l/
7	convinced	c,o,n,v,i,n,c,e,d	/k/ /ə/ /n/ /v/ /ɪ/ /n/ /s/ /t/
7	competition	c,o,m,p,e,t,i,t,i,o,n	/k/ /p/ /m/ /p/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
7	cursive	c,u,r,s,i,v,e	/k/ /z:/ /s/ /ɪ/ /v/
7	category	c,a,t,e,g,o,r,y	/k/ /æ/ /t/ /ɪ/ /g/ /ə/ /r/ /i:/
7	cancelled	c,a,n,c,e,l,l,e,d	/k/ /æ/ /n/ /s/ /ə/ /l/ /d/
7	colony	c,o,l,o,n,y	/k/ /p/ /l/ /ə/ /n/ /i:/
7	column	c,o,l,u,m,n	/k/ /p/ /l/ /ə/ /m/
7	construction	c,o,n,s,t,r,u,c,t,i,o,n	/k/ /ə/ /n/ /s/ /t/ /r/ /ʌ/ /k/ /ʃ/ /ə/ /n/
7	conversation	c,o,n,v,e,r,s,a,t,i,o,n	/k/ /p/ /n/ /v/ /ə/ /s/ /eɪ/ /ʃ/ /ə/ /n/
7	conservation	c,o,n,s,e,r,v,a,t,i,o,n	/k/ /p/ /n/ /s/ /z:/ /v/ /eɪ/ /ʃ/ /ə/ /n/

7	certainty	c,er,t,ai,n,t,y	/s/ /ɜ:/ /t/ /ɛ/ /n/ /t/ /i:/
7	percent	p,er,c,e,n,t	/p/ /ə/ /s/ /ɛ/ /n/ /t/
7	ceiling	c,ei,l,i,ŋ	/s/ /i:/ /l/ /ɪ/ /ŋ/
7	celebration	c,e,l,e,b,r,a,t,i,o,n	/s/ /ɛ/ /l/ /ɪ/ /b/ /r/ /eɪ/ /ʃ/ /ə/ /n/
7	cemetery	c,e,m,e,t,e,r,y	/s/ /ɛ/ /m/ /ɪ/ /t/ /r/ /i:/
7	century	c,e,n,t,u,r,y	/s/ /ɛ/ /n/ /tʃ/ /ʊ/ /r/ /i:/
7	circuit	c,ir,c,u,i,t	/s/ /ɜ:/ /k/ /ɪ/ /t/
7	cyclone	c,y,c,l,o,n,e	/s/ /aɪ/ /k/ /l/ /əʊ/ /n/
7	cease	c,ea,se	/s/ /i:/ /s/
7	cyst	c,y,s,t	/s/ /ɪ/ /s/ /t/
7	plague	p,l,a,gue	/p/ /l/ /eɪ/ /g/
7	gorilla	g,o,r,i,ll,a	/g/ /ə/ /r/ /ɪ/ /l/ /ə/
7	guest	gu,e,s,t	/g/ /ɛ/ /s/ /t/
7	guidance	gu,i,d,a,n,ce	/g/ /aɪ/ /d/ /ə/ /n/ /s/
7	guarantee	gu,a,r,a,n,t,ee	/g/ /æ/ /r/ /ə/ /n/ /t/ /i:/
7	gallery	g,a,ll,e,r,y	/g/ /æ/ /l/ /ə/ /r/ /i:/
7	argument	ar,g,u,m,e,n,t	/ɑ:/ /g/ /ɹ/ /m/ /ə/ /n/ /t/
7	guilty	gu,i,l,t,y	/g/ /ɪ/ /l/ /t/ /i:/
7	guesswork	gu,e,ss,w,or,k	/g/ /ɛ/ /s/ /w/ /ɜ:/ /k/
7	genius	g,e,n,i,u,s	/dʒ/ /i:/ /n/ /ɪ/ /ʌ/ /s/
7	giraffe	g,i,r,a,ffe	/dʒ/ /ɪ/ /r/ /ɑ:/ /f/
7	generous	g,e,n,e,r,ou,s	/dʒ/ /ɛ/ /n/ /ə/ /r/ /ə/ /s/
7	gesture	g,e,s,t,ure	/dʒ/ /ɛ/ /s/ /tʃ/ /ə/
7	language	l,a,n,g,u,a,ge	/l/ /æ/ /ŋ/ /g/ /w/ /ɪ/ /dʒ/
7	percentage	p,er,c,e,n,t,a,ge	/p/ /ə/ /s/ /ɛ/ /n/ /t/ /ɪ/ /dʒ/
7	heritage	h,e,r,i,t,a,ge	/h/ /ɛ/ /r/ /ɪ/ /t/ /ɪ/ /dʒ/
7	gentleman	g,e,n,t,l,e,m,a,n	/dʒ/ /ɛ/ /n/ /t/ /l/ /m/ /ə/ /n/
7	genuine	g,e,n,u,i,ne	/dʒ/ /ɛ/ /n/ /ɹ/ /ɪ/ /n/
7	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
7	Germany	g,er,m,a,n,y	/dʒ/ /ɜ:/ /m/ /ə/ /n/ /i:/
7	indoors	i,n,d,oor,s	/ɪ/ /n/ /d/ /ɔ:/ /z/
7	income	i,n,c,o,me	/ɪ/ /n/ /k/ /ʌ/ /m/
7	inside	i,n,s,i,de	/ɪ/ /n/ /s/ /aɪ/ /d/
7	insert	i,n,s,e,r,t	/ɪ/ /n/ /s/ /ə/ /t/
7	nonsense	n,o,n,s,e,n,se	/n/ /ɒ/ /n/ /s/ /ə/ /n/ /s/
7	nonviolent	n,o,n,v,i,o,l,e,n,t	/n/ /ɒ/ /n/ /v/ /ɪ/ /ə/ /l/ /ə/ /n/ /t/
7	nonfiction	n,o,n,f,i,c,t,i,o,n	/n/ /ɒ/ /n/ /f/ /ɪ/ /k/ /ʃ/ /ə/ /n/
7	prepare	p,r,e,p,are	/p/ /r/ /ɪ/ /p/ /eə/
7	preface	p,r,e,f,a,ce	/p/ /r/ /ɛ/ /f/ /ɪ/ /s/
7	prefix	p,r,e,f,i,x	/p/ /r/ /i:/ /f/ /ɪ/ /x/
7	unicycle	u,n,i,c,y,c,le	/u:/ /n/ /ɪ/ /s/ /aɪ/ /k/ /l/
7	uniform	u,n,i,f,or,m	/ɹ/ /n/ /ɪ/ /f/ /ɔ:/ /m/
7	unique	u,n,i,que	/ɹ/ /n/ /i:/ /k/
7	bicycle	b,i,c,y,c,le	/b/ /aɪ/ /s/ /ɪ/ /k/ /l/

7	bicentenary	b,i,c,e,n,t,e,n,a,r,y	/b/ /aɪ/ /s/ /ɛ/ /n/ /t/ /ɛ/ /n/ /ə/ /r/ /i:/
7	bilingual	b,i,l,i,n,g,u,a,l	/b/ /aɪ/ /l/ /ɪ/ /ŋ/ /g/ /w/ /ə/ /l/
7	tricycle	t,r,i,c,y,c,l,e	/t/ /r/ /aɪ/ /s/ /ɪ/ /k/ /l/
7	triangle	t,r,i,a,n,g,l,e	/t/ /r/ /aɪ/ /æ/ /ŋ/ /g/ /l/
7	trilogy	t,r,i,l,o,g,y	/t/ /r/ /ɪ/ /l/ /ə/ /dʒ/ /i:/
7	triplets	t,r,i,p,l,e,t,s	/t/ /r/ /ɪ/ /p/ /l/ /ɪ/ /t/ /s/
7	registrar	r,e,g,i,s,t,r,a,r	/r/ /ɛ/ /dʒ/ /ɪ/ /s/ /t/ /r/ /ɑ:/
7	scholar	s,ch,o,l,a,r	/s/ /k/ /ɒ/ /l/ /ə/
7	burglar	b,u,r,g,l,a,r	/b/ /ɜ:/ /g/ /l/ /ə/
7	baker	b,a,k,e,r	/b/ /eɪ/ /k/ /ə/
7	builder	b,u,i,l,d,e,r	/b/ /ɪ/ /l/ /d/ /ə/
7	teacher	t,e,a,c,h,e,r	/t/ /i:/ /tʃ/ /ə/
7	painter	p,a,i,n,t,e,r	/p/ /eɪ/ /n/ /t/ /ə/
7	actor	a,c,t,o,r	/æ/ /k/ /t/ /ə/
7	author	au,t,h,o,r	/ɔ:/ /θ/ /ə/
7	doctor	d,o,c,t,o,r	/d/ /ɒ/ /k/ /t/ /ə/
7	visitor	v,i,s,i,t,o,r	/v/ /ɪ/ /z/ /ɪ/ /t/ /ə/
7	dictionary	d,i,c,t,i,o,n,a,r,y	/d/ /ɪ/ /k/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
7	stationary	s,t,a,t,i,o,n,a,r,y	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
7	temporary	t,e,m,p,o,r,a,r,y	/t/ /ɛ/ /m/ /p/ /ə/ /r/ /eə/ /r/ /i:/
7	primary	p,r,i,m,a,r,y	/p/ /r/ /aɪ/ /m/ /ə/ /r/ /i:/
7	scenery	sc,e,n,e,r,y	/s/ /i:/ /n/ /ə/ /r/ /i:/
7	nursery	n,u,r,s,e,r,y	/n/ /ɜ:/ /s/ /ə/ /r/ /i:/
7	factory	f,a,c,t,o,r,y	/f/ /æ/ /k/ /t/ /ə/ /r/ /i:/
7	territory	t,e,r,r,i,t,o,r,y	/t/ /ɛ/ /r/ /ɪ/ /t/ /ɔ:/ /r/ /i:/
7	laboratory	l,a,b,o,r,a,t,o,r,y	/l/ /ə/ /b/ /ɒ/ /r/ /ə/ /t/ /ɔ:/ /r/ /i:/
7	library	l,i,b,r,a,r,y	/l/ /aɪ/ /b/ /r/ /eə/ /r/ /i:/
7	cylinder	c,y,l,i,n,d,e,r	/s/ /ɪ/ /l/ /ɪ/ /n/ /d/ /ə/
7	perimeter	p,e,r,i,m,e,t,e,r	/p/ /ə/ /r/ /ɪ/ /m/ /ɪ/ /t/ /ə/
7	vacuum	v,a,c,u,u,m	/v/ /æ/ /k/ /j/ /u:/ /m/
7	mosquito	m,o,s,q,u,i,t,o	/m/ /ə/ /s/ /k/ /i:/ /t/ /əʊ/
7	dangerous	d,a,n,g,e,r,o,u,s	/d/ /eɪ/ /n/ /dʒ/ /r/ /ə/ /s/
7	oxygen	o,x,y,g,e,n	/ɒ/ /x/ /ɪ/ /dʒ/ /ə/ /n/
7	muscle	m,u,s,c,l,e	/m/ /ʌ/ /s/ /l/
7	address	a,d,d,r,e,s,s	/ə/ /d/ /r/ /ɛ/ /s/
7	special	s,p,e,c,i,a,l	/s/ /p/ /ɛ/ /ʃ/ /ə/ /l/
7	sausage	s,a,u,s,a,g,e	/s/ /ɒ/ /s/ /ɪ/ /dʒ/
7	recognise	r,e,c,o,g,n,i,s,e	/r/ /ɛ/ /k/ /ə/ /g/ /n/ /aɪ/ /z/
7	miniature	m,i,n,i,a,t,u,r,e	/m/ /ɪ/ /n/ /ə/ /tʃ/ /ə/
7	preference	p,r,e,f,e,r,e,n,c,e	/p/ /r/ /ɛ/ /f/ /ə/ /r/ /ə/ /n/ /s/
7	scissors	sc,i,s,s,o,r,s	/s/ /ɪ/ /z/ /ə/ /z/
7	apologise	a,p,o,l,o,g,i,s,e	/ə/ /p/ /ɒ/ /l/ /ə/ /dʒ/ /aɪ/ /z/
7	beautiful	b,eau,t,i,f,u,l	/b/ /y/ /t/ /ə/ /f/ /ʊ/ /l/
7	behaviour	b,e,h,a,v,i,o,u,r	/b/ /ɪ/ /h/ /eɪ/ /v/ /j/ /ə/

7	discipline	d,i,s,c,i,p,l,i,n,e	/d/ /ɪ/ /s/ /ɪ/ /p/ /l/ /ɪ/ /n/
7	since	s,i,n,c,e	/s/ /ɪ/ /n/ /s/
7	lady	l,a,d,y	/l/ /eɪ/ /d/ /i:/
7	flavour	f,l,a,v,oʊr	/f/ /l/ /eɪ/ /v/ /ə/
7	secret	s,e,c,r,e,t	/s/ /i:/ /k/ /r/ /ɪ/ /t/
7	private	p,r,i,v,a,t,e	/p/ /r/ /aɪ/ /v/ /ɪ/ /t/
7	advisor*	a,d,v,i,s,oʊr	/ə/ /d/ /v/ /aɪ/ /z/ /ə/
7	silent	s,i,l,e,n,t	/s/ /aɪ/ /l/ /ə/ /n/ /t/
7	stolen	s,t,o,l,e,n	/s/ /t/ /əʊ/ /l/ /ə/ /n/
7	gigantic	g,i,g,a,n,t,i,c	/dʒ/ /aɪ/ /g/ /æ/ /n/ /t/ /ɪ/ /k/
7	human	h,u,m,a,n	/h/ /y/ /m/ /ə/ /n/
7	humid	h,u,m,i,d	/h/ /y/ /m/ /ɪ/ /d/
7	fossil	f,o,s,s,i,l	/f/ /ɒ/ /s/ /l/
7	sudden	s,u,d,d,e,n	/s/ /ʌ/ /d/ /n/
7	traffic	t,r,a,f,f,i,c	/t/ /r/ /æ/ /f/ /ɪ/ /k/
7	message	m,e,s,s,a,g,e	/m/ /ɛ/ /s/ /ɪ/ /dʒ/
7	follow	f,o,l,l,oʊ	/f/ /ɒ/ /l/ /əʊ/
7	clever	c,l,e,v,e,r	/k/ /l/ /ɛ/ /v/ /ə/
7	custard	c,u,s,t,a,r,d	/k/ /ʌ/ /s/ /t/ /ə/ /d/
7	holiday	h,o,l,i,d,eɪ	/h/ /ɒ/ /l/ /ə/ /d/ /eɪ/
7	pencil	p,e,n,c,i,l	/p/ /ɛ/ /n/ /s/ /l/
7	Saturday	s,a,t,u,r,d,eɪ	/s/ /æ/ /t/ /ə/ /d/ /eɪ/
7	cappuccino	c,a,p,p,u,c,c,i,n,o	/k/ /æ/ /p/ /ʊ/ /tʃ/ /i:/ /n/ /əʊ/
7	macaroni	m,a,c,a,r,o,n,i	/m/ /æ/ /k/ /ə/ /r/ /əʊ/ /n/ /i:/
7	spaghetti	s,p,a,g,h,e,t,t,i	/s/ /p/ /ə/ /g/ /ɛ/ /t/ /i:/
7	confetti	c,o,n,f,e,t,t,i	/k/ /ə/ /n/ /f/ /ɛ/ /t/ /i:/
7	lasagne	l,a,s,a,g,n,e	/l/ /ə/ /z/ /æ/ /ŋ/ /ə/
7	restaurant	r,e,s,t,aʊ,r,a,n,t	/r/ /ɛ/ /s/ /t/ /ɒ/ /r/ /ɒ/ /n/ /t/
7	ballet	b,a,l,l,e,t	/b/ /æ/ /l/ /eɪ/
7	encore	e,n,c,oʊr	/ɒ/ /n/ /k/ /ɔ:/
7	bouquet	b,oʊ,kw,e,t	/b/ /u:/ /k/ /eɪ/
7	résumé	r,e,s,y,m,e	/r/ /ɛ/ /z/ /y/ /m/ /eɪ/
7	café	c,a,f,e	/k/ /æ/ /f/ /eɪ/
7	barbecue	b,a,r,b,e,c,y	/b/ /ɑ:/ /b/ /ɪ/ /k/ /y/
7	avocado	a,v,o,c,a,d,o	/æ/ /v/ /əʊ/ /k/ /ɑ:/ /d/ /əʊ/
7	chocolate	ch,o,c,o,l,a,t,e	/tʃ/ /ɒ/ /k/ /ə/ /l/ /ɪ/ /t/
7	kindergarten	k,i,n,d,eɪ,r,g,a,r,t,e,n	/k/ /ɪ/ /n/ /d/ /ə/ /g/ /ɑ:/ /t/ /n/
7	banana	b,a,n,a,n,a	/b/ /ə/ /n/ /ɑ:/ /n/ /ə/
7	avatar	a,v,a,t,a,r	/æ/ /v/ /ə/ /t/ /ɑ:/
7	safari	s,a,f,a,r,i	/s/ /ə/ /f/ /ɑ:/ /r/ /i:/
7	shampoo	sh,a,m,p,u	/ʃ/ /æ/ /m/ /p/ /u:/
7	gladly	g,l,a,d,l,y	/g/ /l/ /æ/ /d/ /l/ /i:/
7	lonely	l,o,n,e,l,y	/l/ /əʊ/ /n/ /l/ /i:/
7	honestly	h,o,n,e,s,t,l,y	/ɒ/ /n/ /ɪ/ /s/ /t/ /l/ /i:/

7	thoroughly	th,o,r,ough,l,y	/θ/ /ʌ/ /r/ /ə/ /l/ /i:/
7	sincerely	s,i,n,c,ere,l,y	/s/ /ɪ/ /n/ /s/ /ɪə/ /l/ /i:/
7	lately	l,a,te,l,y	/l/ /eɪ/ /t/ /l/ /i:/
7	suddenly	s,u,dd,en,l,y	/s/ /ʌ/ /d/ /n/ /l/ /i:/
7	usually	u,s,u,a,ll,y	/y/ /z/ /ʊ/ /ə/ /l/ /i:/
7	quietly	q,u,i,e,t,l,y	/k/ /w/ /aɪ/ /ə/ /t/ /l/ /i:/
7	reluctantly	r,e,l,u,c,t,a,n,t,l,y	/r/ /ɪ/ /l/ /ʌ/ /k/ /t/ /ə/ /n/ /t/ /l/ /i:/
7	happily	h,a,pp,i,l,y	/h/ /æ/ /p/ /ɪ/ /l/ /i:/
7	noisy	n,oi,s,y	/n/ /ɔɪ/ /z/ /i:/
7	courtesy	c,our,t,e,s,y	/k/ /ə:/ /t/ /ɪ/ /s/ /i:/
7	enquiry	e,n,q,u,i,r,y	/ɪ/ /n/ /k/ /w/ /aɪ/ /r/ /i:/
7	entirety	e,n,t,i,r,e,t,y	/ɪ/ /n/ /t/ /aɪ/ /r/ /ə/ /t/ /i:/
7	speciality	s,p,e,c,i,a,l,i,t,y	/s/ /p/ /ɛ/ /ʃ/ /ɪ/ /æ/ /l/ /ɪ/ /t/ /i:/
7	generosity	g,e,n,e,r,o,s,i,t,y	/dʒ/ /ɛ/ /n/ /ə/ /r/ /ɒ/ /s/ /ɪ/ /t/ /i:/
7	security	s,e,c,u,r,i,t,y	/s/ /ɪ/ /k/ /y/ /r/ /ɪ/ /t/ /i:/
7	similarity	s,i,m,i,l,a,r,i,t,y	/s/ /ɪ/ /m/ /ɪ/ /l/ /æ/ /r/ /ɪ/ /t/ /i:/
7	humidity	h,u,m,i,d,i,t,y	/h/ /y/ /m/ /ɪ/ /d/ /ɪ/ /t/ /i:/
7	fashionable	f,a,sh,io,n,a,b,le	/f/ /æ/ /ʃ/ /ə/ /n/ /ə/ /b/ /l/
7	suitable	s,ui,t,a,b,le	/s/ /u:/ /t/ /ə/ /b/ /l/
7	comfortable	c,o,m,f,or,t,a,b,le	/k/ /ʌ/ /m/ /f/ /ə/ /t/ /ə/ /b/ /l/
7	favourable	f,a,v,ou,r,a,b,le	/f/ /eɪ/ /v/ /ə/ /r/ /ə/ /b/ /l/
7	agreeable	a,g,r,ee,a,b,le	/ə/ /g/ /r/ /i:/ /ə/ /b/ /l/
7	changeable	ch,a,n,ge,a,b,le	/tʃ/ /eɪ/ /n/ /dʒ/ /ə/ /b/ /l/
7	responsible	r,e,s,p,o,n,s,i,b,le	/r/ /ɪ/ /s/ /p/ /ɒ/ /n/ /s/ /ə/ /b/ /l/
7	horrible	h,o,r,r,i,b,le	/h/ /ɒ/ /r/ /ə/ /b/ /l/
7	eligible	e,l,i,g,i,b,le	/ɛ/ /l/ /ɪ/ /dʒ/ /ə/ /b/ /l/
7	incredible	i,n,c,r,e,d,i,b,le	/ɪ/ /n/ /k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
7	possible	p,o,ss,i,b,le	/p/ /ɒ/ /s/ /ə/ /b/ /l/
7	edible	e,d,i,b,le	/ɛ/ /d/ /ɪ/ /b/ /l/
7	visible	v,i,s,i,b,le	/v/ /ɪ/ /z/ /ə/ /b/ /l/
7	joyous	j,oy,ou,s	/dʒ/ /ɔɪ/ /ə/ /s/
7	dangerous	d,a,n,g,er,ou,s	/d/ /eɪ/ /n/ /dʒ/ /r/ /ə/ /s/
7	mysterious	m,y,s,t,e,r,i,ou,s	/m/ /ɪ/ /s/ /t/ /ɪə/ /r/ /ɪ/ /ə/ /s/
7	humorous	h,u,m,o,r,ou,s	/h/ /y/ /m/ /ə/ /r/ /ə/ /s/
7	famous	f,a,m,ou,s	/f/ /eɪ/ /m/ /ə/ /s/
7	gorgeous	g,or,ge,ou,s	/g/ /ɔ:/ /dʒ/ /ə/ /s/
7	courteous	c,our,t,e,ou,s	/k/ /ə:/ /t/ /i:/ /ʌ/ /s/
7	briefly	b,r,ie,f,l,y	/b/ /r/ /i:/ /f/ /l/ /i:/
7	abbreviate	a,bb,r,e,v,i,a,te	/ə/ /b/ /r/ /i:/ /v/ /ɪ/ /eɪ/ /t/
7	abbreviation	a,bb,r,e,v,i,a,t,i,o,n	/ə/ /b/ /r/ /i:/ /v/ /ɪ/ /eɪ/ /ʃ/ /ə/ /n/
7	proceed	p,r,o,c,ee,d	/p/ /r/ /ə/ /s/ /i:/ /d/
7	precede	p,r,e,c,e,de	/p/ /r/ /i:/ /s/ /i:/ /d/
7	recede	r,e,c,e,de	/r/ /i:/ /s/ /i:/ /d/
7	succeed	s,u,c,c,ee,d	/s/ /ə/ /k/ /s/ /i:/ /d/

7	malformation	m,a,l,f,or,m,a,t,io,n	/m/ /æ/ /l/ /f/ /ɔ:/ /m/ /eɪ/ /ʃ/ /ə/ /n/
7	malfunction	m,a,l,f,u,n,c,t,io,n	/m/ /æ/ /l/ /f/ /ʌ/ /ŋ/ /k/ /ʃ/ /ə/ /n/
7	perimeter	p,e,r,i,m,e,t,er	/p/ /ə/ /r/ /ɪ/ /m/ /ɪ/ /t/ /ə/
7	barometer	b,a,r,o,m,e,t,er	/b/ /ə/ /r/ /ɒ/ /m/ /ɪ/ /t/ /ə/
7	kilometre	k,i,l,o,m,e,t,er	/k/ /ɪ/ /l/ /əʊ/ /m/ /i:/ /t/ /ə/
7	thermometer	th,er,m,o,m,e,t,er	/θ/ /ə/ /m/ /ɒ/ /m/ /ɪ/ /t/ /ə/
7	pedometer	p,e,d,o,m,e,t,er	/p/ /ɪ/ /d/ /ɒ/ /m/ /ɪ/ /t/ /ə/
7	metric	m,e,t,r,i,c	/m/ /ɛ/ /t/ /r/ /ɪ/ /k/
7	beneficial	b,e,n,e,f,i,c,i,a,l	/b/ /ɛ/ /n/ /ɪ/ /f/ /ɪ/ /ʃ/ /ə/ /l/
7	benefit	b,e,n,e,f,i,t	/b/ /ɛ/ /n/ /ɪ/ /f/ /ɪ/ /t/
7	pedal	p,e,d,al	/p/ /ɛ/ /d/ /l/
7	pedestrian	p,e,d,e,s,t,r,i,a,n	/p/ /ɪ/ /d/ /ɛ/ /s/ /t/ /r/ /ɪ/ /ə/ /n/
7	pedicure	p,e,d,i,c,ure	/p/ /ɛ/ /d/ /ɪ/ /k/ /ʊə/
7	database	d,a,t,a,b,a,se	/d/ /eɪ/ /t/ /ə/ /b/ /eɪ/ /s/
7	eyewitness	eye,w,i,t,n,e,ss	/aɪ/ /w/ /ɪ/ /t/ /n/ /ɪ/ /s/
7	granddaughter	g,r,a,n,dd,augh,t,er	/g/ /r/ /æ/ /n/ /d/ /ɔ:/ /t/ /ə/
7	outnumber	ou,t,n,u,m,b,er	/aʊ/ /t/ /n/ /ʌ/ /m/ /b/ /ə/
7	supermarket	s,u,p,er,m,ar,k,e,t	/s/ /u:/ /p/ /ə/ /m/ /ɑ:/ /k/ /ɪ/ /t/
7	weatherproof	w,ea,th,er,p,r,oo,f	/w/ /ɛ/ /ð/ /ə/ /p/ /r/ /u:/ /f/
7	chairperson	ch,air,p,er,s,o,n	/tʃ/ /eə/ /p/ /z:/ /s/ /ə/ /n/
7	countryside	c,ou,n,t,r,y,s,i,de	/k/ /ʌ/ /n/ /t/ /r/ /ɪ/ /s/ /aɪ/ /d/
7	analysis	a,n,a,l,y,s,i,s	/ə/ /n/ /æ/ /l/ /ɪ/ /s/ /ɪ/ /s/
7	analyses	a,n,a,l,y,s,e,s	/ə/ /n/ /æ/ /l/ /ɪ/ /s/ /i:/ /z/
7	diagnosis	d,i,a,g,n,o,s,i,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /ɪ/ /s/
7	diagnoses	d,i,a,g,n,o,s,e,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /i:/ /z/
7	focus	f,o,c,u,s	/f/ /əʊ/ /k/ /ʌ/ /s/
7	foci	f,o,c,i	/f/ /əʊ/ /s/ /aɪ/
7	fungus	f,u,n,g,u,s	/f/ /ʌ/ /ŋ/ /g/ /ə/ /s/
7	fungi	f,u,n,g,i	/f/ /ʌ/ /ŋ/ /g/ /aɪ/
7	matrix	m,a,t,r,i,x	/m/ /eɪ/ /t/ /r/ /ɪ/ /x/
7	matrices	m,a,t,r,i,c,e,s	/m/ /eɪ/ /t/ /r/ /ɪ/ /s/ /i:/ /z/
7	phenomenon	ph,e,n,o,m,e,n,o,n	/f/ /ɪ/ /n/ /ɒ/ /m/ /ɪ/ /n/ /ə/ /n/
7	phenomena	ph,e,n,o,m,e,n,a	/f/ /ɪ/ /n/ /ɒ/ /m/ /ɪ/ /n/ /ə/
7	queue	q,ue,ue	/k/ /j/ /u:/
7	cue	c,ue	/k/ /y/
7	cent	c,e,n,t	/s/ /ɛ/ /n/ /t/
7	sent	s,e,n,t	/s/ /ɛ/ /n/ /t/
7	guest	gu,e,s,t	/g/ /ɛ/ /s/ /t/
7	guessed	gu,e,ss,ed	/g/ /ɛ/ /s/ /t/
7	reign	r,e,i,gn	/r/ /eɪ/ /n/
7	rain	r,a,i,n	/r/ /eɪ/ /n/
7	course	c,our,se	/k/ /ɔ:/ /s/
7	coarse	c,oar,se	/k/ /ɔ:/ /s/
7	acceptance	a,c,c,e,p,t,a,n,ce	/ə/ /k/ /s/ /ɛ/ /p/ /t/ /ə/ /n/ /s/

7	appearance	a,pp,ea,r,a,n,ce	/ə/ /p/ /ɪə/ /r/ /ə/ /n/ /s/
7	guidance	gu,i,d,a,n,ce	/g/ /aɪ/ /d/ /ə/ /n/ /s/
7	defiance	d,e,f,i,a,n,ce	/d/ /ɪ/ /f/ /aɪ/ /ə/ /n/ /s/
7	instance	i,n,s,t,a,n,ce	/ɪ/ /n/ /s/ /t/ /ə/ /n/ /s/
7	dependence	d,e,p,e,n,d,e,n,ce	/d/ /ɪ/ /p/ /ɛ/ /n/ /d/ /ɛ/ /n/ /s/
7	confidence	c,o,n,f,i,d,e,n,ce	/k/ /ɒ/ /n/ /f/ /ɪ/ /d/ /ɛ/ /n/ /s/
7	patience	p,a,t,i,e,n,ce	/p/ /eɪ/ /ʃ/ /ɛ/ /n/ /s/
7	intelligence	i,n,t,e,l,l,i,g,e,n,ce	/ɪ/ /n/ /t/ /ɛ/ /l/ /ɪ/ /dʒ/ /ɛ/ /n/ /s/
7	difference	d,i,f,f,e,r,e,n,ce	/d/ /ɪ/ /f/ /r/ /ɛ/ /n/ /s/
7	although	a,l,th,ough	/ɔ:/ /l/ /ð/ /əʊ/
7	thorough	th,o,r,ough	/θ/ /ɹ/ /r/ /ə/
7	brought	b,r,ough,t	/b/ /r/ /ɔ:/ /t/
7	bought	b,ough,t	/b/ /ɔ:/ /t/
7	tonight	t,o,n,igh,t	/t/ /ə/ /n/ /aɪ/ /t/
7	physician	ph,y,s,i,c,i,a,n	/f/ /ɪ/ /z/ /ɪ/ /ʃ/ /ə/ /n/
7	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
7	symphony	s,y,m,ph,o,n,y	/s/ /ɪ/ /m/ /f/ /ə/ /n/ /i:/
7	trophy	t,r,o,ph,y	/t/ /r/ /əʊ/ /f/ /i:/
7	alphabet	a,l,ph,a,b,e,t	/æ/ /l/ /f/ /ə/ /b/ /ɪ/ /t/
7	production	p,r,o,d,u,c,t,i,o,n	/p/ /r/ /ə/ /d/ /ɹ/ /k/ /ʃ/ /ə/ /n/
7	reduction	r,e,d,u,c,t,i,o,n	/r/ /ɪ/ /d/ /ɹ/ /k/ /ʃ/ /ə/ /n/
7	competition	c,o,m,p,e,t,i,t,i,o,n	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
7	explanation	e,x,p,l,a,n,a,t,i,o,n	/ɛ/ /x/ /p/ /l/ /ə/ /n/ /eɪ/ /ʃ/ /ə/ /n/
7	comprehension	c,o,m,p,r,e,h,e,n,s,i,o,n	/k/ /ɒ/ /m/ /p/ /r/ /ɪ/ /h/ /ɛ/ /n/ /ʃ/ /ə/ /n/
7	persuasion	p,e,r,s,u,a,s,i,o,n	/p/ /ə/ /s/ /w/ /eɪ/ /z/ /ə/ /n/
7	conclusion	c,o,n,c,l,u,s,i,o,n	/k/ /ə/ /n/ /k/ /l/ /u:/ /z/ /ə/ /n/
7	impression	i,m,p,r,e,s,s,i,o,n	/ɪ/ /m/ /p/ /r/ /ɛ/ /ʃ/ /ə/ /n/
7	apprehension	a,p,p,r,e,h,e,n,s,i,o,n	/æ/ /p/ /r/ /ɪ/ /h/ /ɛ/ /n/ /ʃ/ /ə/ /n/
7	decision	d,e,c,i,s,i,o,n	/d/ /ɪ/ /s/ /ɪ/ /z/ /ə/ /n/
7	gallery	g,a,l,l,e,r,y	/g/ /æ/ /l/ /ə/ /r/ /i:/
7	argument	ar,g,u,m,e,n,t	/ɑ:/ /g/ /y/ /m/ /ə/ /n/ /t/
7	guilty	gu,i,l,t,y	/g/ /ɪ/ /l/ /t/ /i:/
7	guarantee	gu,a,r,a,n,t,ee	/g/ /æ/ /r/ /ə/ /n/ /t/ /i:/
7	governed	g,o,v,e,r,n,e,d	/g/ /ɹ/ /v/ /ə/ /n/ /d/
7	genius	g,e,n,i,u,s	/dʒ/ /i:/ /n/ /ɪ/ /ɹ/ /s/
7	generosity	g,e,n,e,r,o,s,i,t,y	/dʒ/ /ɛ/ /n/ /ə/ /r/ /ɒ/ /s/ /ɪ/ /t/ /i:/
7	gesture	g,e,s,t,u,r,e	/dʒ/ /ɛ/ /s/ /tʃ/ /ə/
7	sergeant	s,e,r,g,e,a,n,t	/s/ /ɑ:/ /dʒ/ /ɛ/ /n/ /t/
7	manager	m,a,n,a,g,e,r	/m/ /æ/ /n/ /ɪ/ /dʒ/ /ə/
7	campus	c,a,m,p,u,s	/k/ /æ/ /m/ /p/ /ə/ /s/
7	candle	c,a,n,d,l,e	/k/ /æ/ /n/ /d/ /l/
7	country	c,o,u,n,t,r,y	/k/ /ɹ/ /n/ /t/ /r/ /i:/
7	concert	c,o,n,c,e,r,t	/k/ /ɒ/ /n/ /s/ /ɜ:/ /t/
7	cancel	c,a,n,c,e,l	/k/ /æ/ /n/ /s/ /ə/ /l/

7	percentage	p,er,c,e,n,t,a,ge	/p/ /ə/ /s/ /ε/ /n/ /t/ /ɪ/ /dʒ/
7	cement	c,e,m,e,n,t	/s/ /ɪ/ /m/ /ε/ /n/ /t/
7	certain	c,er,t,ai,n	/s/ /ɜ:/ /t/ /ε/ /n/
7	ceiling	c,ei,l,i,ng	/s/ /i:/ /l/ /ɪ/ /ŋ/
7	cyclone	c,y,c,l,o,ne	/s/ /aɪ/ /k/ /l/ /əʊ/ /n/
7	impossible	i,m,p,o,ss,i,b,le	/ɪ/ /m/ /p/ /ɒ/ /s/ /ə/ /b/ /l/
7	impatient	i,m,p,a,t,i,e,n,t	/ɪ/ /m/ /p/ /eɪ/ /ʃ/ /ε/ /n/ /t/
7	illogical	i,ll,o,g,i,c,a,l	/ɪ/ /l/ /ɒ/ /dʒ/ /ɪ/ /k/ /ə/ /l/
7	illegal	i,ll,e,g,a,l	/ɪ/ /l/ /i:/ /g/ /ə/ /l/
7	ignorant	i,g,n,o,r,a,n,t	/ɪ/ /g/ /n/ /ə/ /r/ /ə/ /n/ /t/
7	ignoble	i,g,n,o,b,le	/ɪ/ /g/ /n/ /əʊ/ /b/ /l/
7	inappropriate	i,n,a,pp,r,o,p,r,i,a,te	/ɪ/ /n/ /ə/ /p/ /r/ /əʊ/ /p/ /r/ /ɪ/ /ə/ /t/
7	invisible	i,n,v,i,s,i,b,le	/ɪ/ /n/ /v/ /ɪ/ /z/ /ə/ /b/ /l/
7	irregular	i,rr,e,g,u,l,ar	/ɪ/ /r/ /ε/ /g/ /y/ /l/ /ə/
7	irreversible	i,rr,e,v,er,s,i,b,le	/ɪ/ /r/ /ɪ/ /v/ /ɜ:/ /s/ /ə/ /b/ /l/
7	awesome	awe,s,o,me	/ɔ:/ /s/ /ə/ /m/
7	drawer	d,r,aw,er	/d/ /r/ /ɔ:/ /ə/
7	autumn	au,t,u,mn	/ɔ:/ /t/ /ə/ /m/
7	authority	au,th,o,r,i,t,y	/ɔ:/ /θ/ /ɒ/ /r/ /ɪ/ /t/ /i:/
7	cautious	c,au,t,iou,s	/k/ /ɔ:/ /ʃ/ /ɹ/ /s/
7	altogether	a,l,t,o,g,e,th,er	/ɔ:/ /l/ /t/ /ə/ /g/ /ε/ /ð/ /ə/
7	always	a,l,w,ay,s	/ɔ:/ /l/ /w/ /eɪ/ /z/
7	almost	a,l,m,o,s,t	/ɔ:/ /l/ /m/ /əʊ/ /s/ /t/
7	palm	p,al,m	/p/ /ɑ:/ /m/
7	walk	w,al,k	/w/ /ɔ:/ /k/
7	antibiotic	a,n,t,i,b,i,o,t,i,c	/æ/ /n/ /t/ /ɪ/ /b/ /aɪ/ /ɒ/ /t/ /ɪ/ /k/
7	antibody	a,n,t,i,b,o,d,y	/æ/ /n/ /t/ /ɪ/ /b/ /ɒ/ /d/ /i:/
7	antidote	a,n,t,i,d,o,te	/æ/ /n/ /t/ /ɪ/ /d/ /əʊ/ /t/
7	antisocial	a,n,t,i,s,o,c,i,a,l	/æ/ /n/ /t/ /i:/ /s/ /əʊ/ /ʃ/ /ə/ /l/
7	antiseptic	a,n,t,i,s,e,p,t,i,c	/æ/ /n/ /t/ /ɪ/ /s/ /ε/ /p/ /t/ /ɪ/ /k/
7	antibacterial	a,n,t,i,b,a,c,t,e,r,i,a,l	/æ/ /n/ /t/ /i:/ /b/ /æ/ /k/ /t/ /ɪə/ /r/ /ɪ/ /ə/ /l/
7	anticlockwise	a,n,t,i,c,l,o,ck,w,i,se	/æ/ /n/ /t/ /i:/ /k/ /l/ /ɒ/ /k/ /w/ /aɪ/ /z/
7	anticlimax	a,n,t,i,c,l,i,m,a,x	/æ/ /n/ /t/ /i:/ /k/ /l/ /aɪ/ /m/ /æ/ /x/
7	antenatal	a,n,t,e,n,a,t,al	/æ/ /n/ /t/ /i:/ /n/ /eɪ/ /t/ /l/
7	anteroom	a,n,t,e,r,o,o,m	/æ/ /n/ /t/ /i:/ /r/ /u:/ /m/
7	grade	g,r,a,de	/g/ /r/ /eɪ/ /d/
7	gradual	g,r,a,d,u,a,l	/g/ /r/ /æ/ /d/ /y/ /ɹ/ /l/
7	graduate	g,r,a,d,u,a,te	/g/ /r/ /æ/ /d/ /y/ /eɪ/ /t/
7	downgrade	d,ow,n,g,r,a,de	/d/ /aʊ/ /n/ /g/ /r/ /eɪ/ /d/
7	centigrade	c,e,n,t,i,g,r,a,de	/s/ /ε/ /n/ /t/ /ɪ/ /g/ /r/ /eɪ/ /d/
7	Congress	c,o,n,g,r,e,ss	/k/ /ɒ/ /ŋ/ /g/ /r/ /ε/ /s/
7	progress	p,r,o,g,r,e,ss	/p/ /r/ /əʊ/ /g/ /r/ /ə/ /s/
7	aggressive	a,gg,r,e,ss,i,ve	/ə/ /g/ /r/ /ε/ /s/ /ɪ/ /v/
7	regress	r,e,g,r,e,ss	/r/ /i:/ /g/ /r/ /ε/ /s/

7	transgression	t,r,a,n,s,g,r,e,ss,i,o,n	/t/ /r/ /æ/ /n/ /s/ /g/ /r/ /ε/ /ʃ/ /ə/ /n/
7	mouthful	m,ou,th,f,u,l	/m/ /aʊ/ /θ/ /f/ /ʊ/ /l/
7	council	c,ou,n,c,i,l	/k/ /aʊ/ /n/ /s/ /ə/ /l/
7	fountain	f,ou,n,t,ai,n	/f/ /aʊ/ /n/ /t/ /ε/ /n/
7	doubtfully	d,ou,bt,f,u,ll,y	/d/ /aʊ/ /t/ /f/ /ʊ/ /l/ /i:/
7	boundaries	b,ou,n,d,a,r,i,e,s	/b/ /aʊ/ /n/ /d/ /ə/ /r/ /i:/ /z/
7	rewound	r,e,w,ou,n,d	/r/ /i:/ /w/ /u:/ /n/ /d/
7	dismount	d,i,s,m,ou,n,t	/d/ /ɪ/ /s/ /m/ /aʊ/ /n/ /t/
7	mountain	m,ou,n,t,ai,n	/m/ /aʊ/ /n/ /t/ /ε/ /n/
7	kilogram	k,i,l,o,g,r,a,m	/k/ /ɪ/ /l/ /əʊ/ /g/ /r/ /æ/ /m/
7	program	p,r,o,g,r,a,m	/p/ /r/ /əʊ/ /g/ /r/ /æ/ /m/
7	diagram	d,i,a,g,r,a,m	/d/ /aɪ/ /ə/ /g/ /r/ /æ/ /m/
7	tangram	t,a,n,g,r,a,m	/t/ /æ/ /ŋ/ /g/ /r/ /ə/ /m/
7	microscopic	m,i,c,r,o,s,c,o,p,i,c	/m/ /aɪ/ /k/ /r/ /ə/ /s/ /k/ /p/ /p/ /ɪ/ /k/
7	microphone	m,i,c,r,o,ph,o,ne	/m/ /aɪ/ /k/ /r/ /ə/ /f/ /əʊ/ /n/
7	microwave	m,i,c,r,o,w,a,ve	/m/ /aɪ/ /k/ /r/ /əʊ/ /w/ /eɪ/ /v/
7	microbiologist	m,i,c,r,o,b,i,o,l,o,g,i,s,t	/m/ /aɪ/ /k/ /r/ /əʊ/ /b/ /aɪ/ /p/ /l/ /ə/ /dʒ/ /ɪ/ /s/ /t/
7	geology	g,e,o,l,o,g,y	/dʒ/ /ɪ/ /p/ /l/ /ə/ /dʒ/ /i:/
7	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /p/ /g/ /r/ /ə/ /f/ /i:/
7	geometric	g,e,o,m,e,t,r,i,c	/dʒ/ /ɪ/ /ə/ /m/ /ε/ /t/ /r/ /ɪ/ /k/
7	geologist	g,e,o,l,o,g,i,s,t	/dʒ/ /ɪ/ /p/ /l/ /ə/ /dʒ/ /ɪ/ /s/ /t/
7	nature	n,a,t,ure	/n/ /eɪ/ /tʃ/ /ə/
7	natural	n,a,t,u,r,a,l	/n/ /æ/ /tʃ/ /ʊ/ /r/ /ə/ /l/
7	please	p,l,ea,se	/p/ /l/ /i:/ /z/
7	pleasant	p,l,ea,s,a,n,t	/p/ /l/ /ε/ /z/ /ə/ /n/ /t/
7	reduce	r,e,d,u,ce	/r/ /ɪ/ /d/ /y/ /s/
7	reduction	r,e,d,u,c,t,i,o,n	/r/ /ɪ/ /d/ /ʌ/ /k/ /ʃ/ /ə/ /n/
7	divide	d,i,v,i,de	/d/ /ɪ/ /v/ /aɪ/ /d/
7	division	d,i,v,i,s,i,o,n	/d/ /ɪ/ /v/ /ɪ/ /z/ /ə/ /n/
7	know	kn,ow	/n/ /əʊ/
7	knowledge	kn,ow,l,e,dge	/n/ /p/ /l/ /ɪ/ /dʒ/
7	receive	r,e,c,ei,ve	/r/ /ɪ/ /s/ /i:/ /v/
7	reception	r,e,c,e,p,t,i,o,n	/r/ /ɪ/ /s/ /ε/ /p/ /ʃ/ /ə/ /n/
7	athlete	a,th,l,e,te	/æ/ /θ/ /l/ /i:/ /t/
7	athletic	a,th,l,e,t,i,c	/æ/ /θ/ /l/ /ε/ /t/ /ɪ/ /k/
7	serene	s,e,r,e,ne	/s/ /ɪ/ /r/ /i:/ /n/
7	serenity	s,e,r,e,n,i,t,y	/s/ /ɪ/ /r/ /ε/ /n/ /ɪ/ /t/ /i:/
7	cave	c,a,ve	/k/ /eɪ/ /v/
7	cavity	c,a,v,i,t,y	/k/ /æ/ /v/ /ɪ/ /t/ /i:/
7	write	wr,i,te	/r/ /aɪ/ /t/
7	written	wr,i,tt,en	/r/ /ɪ/ /t/ /n/
7	vague	v,a,gue	/v/ /eɪ/ /g/
7	league	l,ea,gue	/l/ /i:/ /g/
7	plague	p,l,a,gue	/p/ /l/ /eɪ/ /g/

7	intrigue	i,n,t,r,i,gue	/ɪ/ /n/ /t/ /r/ /i:/ /g/
7	catalogue	c,a,t,a,l,o,gue	/k/ /æ/ /t/ /ə/ /l/ /ɒ/ /g/
7	epilogue	e,p,i,l,o,gue	/ɛ/ /p/ /ɪ/ /l/ /ɒ/ /g/
7	fatigue	f,a,t,i,gue	/f/ /ə/ /t/ /i:/ /g/
7	colleague	c,o,l,l,e,a,gue	/k/ /ɒ/ /l/ /i:/ /g/
7	tongue	t,o,nɡue	/t/ /ʌ/ /ŋ/
7	meringue	m,e,r,i,ngue	/m/ /ə/ /r/ /æ/ /ŋ/
7	boutique	b,ou,t,i,que	/b/ /u:/ /t/ /i:/ /k/
7	mosque	m,o,s,que	/m/ /ɒ/ /s/ /k/
7	technique	t,e,ch,n,i,que	/t/ /ɛ/ /k/ /n/ /i:/ /k/
7	oblique	o,b,l,i,que	/ə/ /b/ /l/ /i:/ /k/
7	barbeque	b,ar,b,e,q,ue	/b/ /ɑ:/ /b/ /ɪ/ /k/ /ɣ/
7	antique	a,n,t,i,que	/æ/ /n/ /t/ /i:/ /k/
7	opaque	o,p,a,que	/əʊ/ /p/ /eɪ/ /k/
7	unique	u,n,i,que	/ɣ/ /n/ /i:/ /k/
7	plaque	p,l,a,que	/p/ /l/ /ɑ:/ /k/
7	marquee	m,ar,qu,ee	/m/ /ɑ:/ /k/ /i:/
7	major	m,a,j,or	/m/ /eɪ/ /dʒ/ /ə/
7	majority	m,a,j,o,r,i,t,y	/m/ /ə/ /dʒ/ /ɒ/ /r/ /ɪ/ /t/ /i:/
7	able	a,b,le	/eɪ/ /b/ /l/
7	ability	a,b,i,l,i,t,y	/ə/ /b/ /ɪ/ /l/ /ɪ/ /t/ /i:/
7	narrate	n,a,r,r,a,te	/n/ /ə/ /r/ /eɪ/ /t/
7	narrative	n,a,r,r,a,t,i,ve	/n/ /æ/ /r/ /ə/ /t/ /ɪ/ /v/
7	stable	s,t,a,b,le	/s/ /t/ /eɪ/ /b/ /l/
7	stability	s,t,a,b,i,l,i,t,y	/s/ /t/ /ə/ /b/ /ɪ/ /l/ /ɪ/ /t/ /i:/
7	invite	i,n,v,i,te	/ɪ/ /n/ /v/ /aɪ/ /t/
7	invitation	i,n,v,i,t,a,t,i,o,n	/ɪ/ /n/ /v/ /ɪ/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	social	s,o,c,i,a,l	/s/ /əʊ/ /ʃ/ /ə/ /l/
7	society	s,o,c,i,e,t,y	/s/ /ə/ /s/ /aɪ/ /ə/ /t/ /i:/
7	prepare	p,r,e,p,are	/p/ /r/ /ɪ/ /p/ /eə/
7	preparation	p,r,e,p,a,r,a,t,i,o,n	/p/ /r/ /ɛ/ /p/ /ə/ /r/ /eɪ/ /ʃ/ /ə/ /n/
7	relate	r,e,l,a,te	/r/ /ɪ/ /l/ /eɪ/ /t/
7	relative	r,e,l,a,t,i,ve	/r/ /ɛ/ /l/ /ə/ /t/ /ɪ/ /v/
7	pose	p,o,se	/p/ /əʊ/ /z/
7	position	p,o,s,i,t,i,o,n	/p/ /ə/ /z/ /ɪ/ /ʃ/ /ə/ /n/
7	compete	c,o,m,p,e,te	/k/ /ə/ /m/ /p/ /i:/ /t/
7	competition	c,o,m,p,e,t,i,t,i,o,n	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
7	general	g,e,n,e,r,a,l	/dʒ/ /ɛ/ /n/ /ə/ /r/ /ə/ /l/
7	generality	g,e,n,e,r,a,l,i,t,y	/dʒ/ /ɛ/ /n/ /ə/ /r/ /æ/ /l/ /ɪ/ /t/ /i:/
7	normal	n,o,r,m,a,l	/n/ /ɔ:/ /m/ /ə/ /l/
7	normality	n,o,r,m,a,l,i,t,y	/n/ /ɔ:/ /m/ /æ/ /l/ /ɪ/ /t/ /i:/
7	metal	m,e,t,a,l	/m/ /ɛ/ /t/ /l/
7	metallic	m,e,t,a,l,l,i,c	/m/ /ɪ/ /t/ /æ/ /l/ /ɪ/ /k/
7	academic	a,c,a,d,e,m,i,c	/æ/ /k/ /ə/ /d/ /ɛ/ /m/ /ɪ/ /k/

7	academy	a,c,a,d,e,m,y	/ə/ /k/ /æ/ /d/ /ə/ /m/ /i:/
7	celebrate	c,e,l,e,b,r,a,t,e	/s/ /ɛ/ /l/ /ɪ/ /b/ /r/ /eɪ/ /t/
7	celebrity	c,e,l,e,b,r,i,t,y	/s/ /ɪ/ /l/ /ɛ/ /b/ /r/ /ɪ/ /t/ /i:/
7	period	p,e,r,i,o,d	/p/ /ɪə/ /r/ /ɪ/ /ə/ /d/
7	periodic	p,e,r,i,o,d,i,c	/p/ /ɪə/ /r/ /ɪ/ /ɒ/ /d/ /ɪ/ /k/
7	emphasis	e,m,ph,a,s,i,s	/ɛ/ /m/ /f/ /ə/ /s/ /ɪ/ /s/
7	emphatic	e,m,ph,a,t,i,c	/ɛ/ /m/ /f/ /æ/ /t/ /ɪ/ /k/
7	criticise	c,r,i,t,i,c,i,s,e	/k/ /r/ /ɪ/ /t/ /ɪ/ /s/ /aɪ/ /z/
7	critic	c,r,i,t,i,c	/k/ /r/ /ɪ/ /t/ /ɪ/ /k/
7	local	l,o,c,a,l	/l/ /əʊ/ /k/ /ə/ /l/
7	locality	l,o,c,a,l,i,t,y	/l/ /əʊ/ /k/ /æ/ /l/ /ɪ/ /t/ /i:/
7	vital	v,i,t,a,l	/v/ /aɪ/ /t/ /l/
7	vitality	v,i,t,a,l,i,t,y	/v/ /aɪ/ /t/ /æ/ /l/ /ɪ/ /t/ /i:/
7	silence	s,i,l,e,n,c,e	/s/ /aɪ/ /l/ /ə/ /n/ /s/
7	vital	v,i,t,a,l	/v/ /aɪ/ /t/ /l/
7	react	r,e,a,c,t	/r/ /i:/ /æ/ /k/ /t/
7	seizure	s,e,i,z,u,r,e	/s/ /i:/ /z/ /ə/
7	vocal	v,o,c,a,l	/v/ /əʊ/ /k/ /ə/ /l/
7	minor	m,i,n,o,r	/m/ /aɪ/ /n/ /ə/
7	season	s,e,a,s,o,n	/s/ /i:/ /z/ /n/
7	overt	o,v,e,r,t	/əʊ/ /v/ /z:/ /t/
7	bureau	b,u,r,e,a,u	/b/ /ʊə/ /əʊ/
7	beautiful	b,e,a,u,t,i,f,u,l	/b/ /y/ /t/ /ə/ /f/ /ʊ/ /l/
7	average	a,v,e,r,a,g,e	/æ/ /v/ /ə/ /r/ /ɪ/ /dʒ/
7	calculator	c,a,l,c,u,l,a,t,o,r	/k/ /æ/ /l/ /k/ /y/ /l/ /eɪ/ /t/ /ə/
7	camera	c,a,m,e,r,a	/k/ /æ/ /m/ /ə/ /r/ /ə/
7	somebody	s,o,m,e,b,o,d,y	/s/ /ʌ/ /m/ /b/ /ə/ /d/ /i:/
7	anything	a,n,y,t,h,i,n,g	/ɛ/ /n/ /ɪ/ /θ/ /ɪ/ /ŋ/
7	everywhere	e,v,e,r,y,w,h,e,r,e	/ɛ/ /v/ /r/ /ɪ/ /w/ /eə/
7	customer	c,u,s,t,o,m,e,r	/k/ /ʌ/ /s/ /t/ /ə/ /m/ /ə/
7	families	f,a,m,i,l,i,e,s	/f/ /æ/ /m/ /ɪ/ /l/ /i:/ /z/
7	libraries	l,i,b,r,a,r,i,e,s	/l/ /aɪ/ /b/ /r/ /ə/ /r/ /i:/ /z/
7	Wednesday	w,e,d,n,e,s,d,a,y	/w/ /ɛ/ /n/ /z/ /d/ /eɪ/
7	imply	i,m,p,l,y	/ɪ/ /m/ /p/ /l/ /aɪ/
7	oblige	o,b,l,i,g,e	/ə/ /b/ /l/ /aɪ/ /dʒ/
7	reveal	r,e,v,e,a,l	/r/ /ɪ/ /v/ /i:/ /l/
7	October	o,c,t,o,b,e,r	/ɒ/ /k/ /t/ /əʊ/ /b/ /ə/
7	aspire	a,s,p,i,r,e	/ə/ /s/ /p/ /aɪ/ /ə/
7	unusual	u,n,u,s,u,a,l	/ʌ/ /n/ /y/ /z/ /ʊ/ /ə/ /l/
7	unable	u,n,a,b,l,e	/ʌ/ /n/ /eɪ/ /b/ /l/
7	computer	c,o,m,p,u,t,e,r	/k/ /ə/ /m/ /p/ /y/ /t/ /ə/
7	providing	p,r,o,v,i,d,i,n,g	/p/ /r/ /ə/ /v/ /aɪ/ /d/ /ɪ/ /ŋ/
7	erosion	e,r,o,s,i,o,n	/ɪ/ /r/ /əʊ/ /z/ /ə/ /n/
7	uncommon	u,n,c,o,m,m,o,n	/ʌ/ /n/ /k/ /ɒ/ /m/ /ə/ /n/

7	reduction	r,e,d,u,c,t,i,o,n	/r/ /ɪ/ /d/ /ʌ/ /k/ /ʃ/ /ə/ /n/
7	election	e,l,e,c,t,i,o,n	/ɪ/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
7	deliver	d,e,l,i,v,er	/d/ /ɪ/ /l/ /ɪ/ /v/ /ə/
7	remember	r,e,m,e,m,b,er	/r/ /ɪ/ /m/ /ɛ/ /m/ /b/ /ə/
7	condition	c,o,n,d,i,t,i,o,n	/k/ /ə/ /n/ /d/ /ɪ/ /ʃ/ /ə/ /n/
7	tomorrow	t,o,m,o,rr,ow	/t/ /ə/ /m/ /ɒ/ /r/ /əʊ/
7	whoever	wh,o,e,v,er	/h/ /u:/ /ɛ/ /v/ /ə/
7	December	d,e,c,e,m,b,er	/d/ /ɪ/ /s/ /ɛ/ /m/ /b/ /ə/
7	November	n,o,v,e,m,b,er	/n/ /əʊ/ /v/ /ɛ/ /m/ /b/ /ə/
7	congratulate	c,o,n,g,r,a,t,u,l,a,te	/k/ /ə/ /n/ /g/ /r/ /æ/ /t/ /l/ /l/ /eɪ/ /t/
7	congratulation(s)	c,o,n,g,r,a,t,u,l,a,t,i,o,n,s	/k/ /ə/ /n/ /g/ /r/ /æ/ /t/ /l/ /l/ /eɪ/ /ʃ/ /ə/ /n/ /z/
7	translate	t,r,a,n,s,l,a,te	/t/ /r/ /æ/ /n/ /s/ /l/ /eɪ/ /t/
7	translation	t,r,a,n,s,l,a,t,i,o,n	/t/ /r/ /æ/ /n/ /s/ /l/ /eɪ/ /ʃ/ /ə/ /n/
7	vegetate	v,e,g,e,t,a,te	/v/ /ɛ/ /dʒ/ /ɪ/ /t/ /eɪ/ /t/
7	vegetation	v,e,g,e,t,a,t,i,o,n	/v/ /ɛ/ /dʒ/ /ɪ/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	fascinate	f,a,s,c,i,n,a,te	/f/ /æ/ /s/ /ɪ/ /n/ /eɪ/ /t/
7	fascination	f,a,s,c,i,n,a,t,i,o,n	/f/ /æ/ /s/ /ɪ/ /n/ /eɪ/ /ʃ/ /ə/ /n/
7	devastate	d,e,v,a,s,t,a,te	/d/ /ɛ/ /v/ /ə/ /s/ /t/ /eɪ/ /t/
7	devastation	d,e,v,a,s,t,a,t,i,o,n	/d/ /ɛ/ /v/ /ə/ /s/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	opposite	o,p,p,o,s,i,te	/ɒ/ /p/ /ə/ /z/ /ɪ/ /t/
7	opposition	o,p,p,o,s,i,t,i,o,n	/ɒ/ /p/ /ə/ /z/ /ɪ/ /ʃ/ /ə/ /n/
7	explode	e,x,p,l,o,de	/ɪ/ /x/ /p/ /l/ /əʊ/ /d/
7	explosion	e,x,p,l,o,s,i,o,n	/ɪ/ /x/ /p/ /l/ /əʊ/ /z/ /ə/ /n/
7	decide	d,e,c,i,de	/d/ /ɪ/ /s/ /aɪ/ /d/
7	decision	d,e,c,i,s,i,o,n	/d/ /ɪ/ /s/ /ɪ/ /z/ /ə/ /n/
7	persuade	p,e,r,s,u,a,de	/p/ /ə/ /s/ /w/ /eɪ/ /d/
7	persuasion	p,e,r,s,u,a,s,i,o,n	/p/ /ə/ /s/ /w/ /eɪ/ /z/ /ə/ /n/
7	conclude	c,o,n,c,l,u,de	/k/ /ə/ /n/ /k/ /l/ /u:/ /d/
7	conclusion	c,o,n,c,l,u,s,i,o,n	/k/ /ə/ /n/ /k/ /l/ /u:/ /z/ /ə/ /n/
7	audition	au,d,i,t,i,o,n	/ɔ:/ /d/ /ɪ/ /ʃ/ /ə/ /n/
7	audience	au,d,i,e,n,ce	/ɔ:/ /d/ /ɪ/ /ə/ /n/ /s/
7	author	au,th,or	/ɔ:/ /θ/ /ə/
7	trauma	t,r,au,m,a	/t/ /r/ /ɔ:/ /m/ /ə/
7	auction	au,c,t,i,o,n	/ɔ:/ /k/ /ʃ/ /ə/ /n/
7	daughter	d,augh,t,er	/d/ /ɔ:/ /t/ /ə/
7	nausea	n,au,s,e,a	/n/ /ɔ:/ /z/ /ɪ/ /ə/
7	laundry	l,au,n,d,r,y	/l/ /ɔ:/ /n/ /d/ /r/ /i:/
7	claw	c,l,aw	/k/ /l/ /ɔ:/
7	lawyer	l,aw,y,er	/l/ /ɔ:/ /j/ /ə/
7	awesome	awe,s,o,me	/ɔ:/ /s/ /ə/ /m/
7	yawning	y,aw,n,i,ng	/j/ /ɔ:/ /n/ /ɪ/ /ŋ/
7	awful	aw,f,u,l	/ɔ:/ /f/ /ʊ/ /l/
7	awkward	aw,k,w,ar,d	/ɔ:/ /k/ /w/ /ə/ /d/
7	falter	f,a,l,t,er	/f/ /ɔ:/ /l/ /t/ /ə/

7	walnut	w,a,l,n,u,t	/w/ /ɔ:/ /l/ /n/ /ʌ/ /t/
7	alter	a,l,t,er	/ɔ:/ /l/ /t/ /ə/
7	although	a,l,th,ough	/ɔ:/ /l/ /ð/ /əʊ/
7	hallway	h,a,ll,w,ay	/h/ /ɔ:/ /l/ /w/ /eɪ/
7	waltz	w,a,l,t,z	/w/ /ɔ:/ /l/ /t/ /z/
7	enhance	e,n,h,a,n,ce	/ɪ/ /n/ /h/ /ɑ:/ /n/ /s/
7	enforce	e,n,f,or,ce	/ɪ/ /n/ /f/ /ɔ:/ /s/
7	engross	e,n,g,r,o,ss	/ɪ/ /n/ /g/ /r/ /əʊ/ /s/
7	engage	e,n,g,a,ge	/ɪ/ /n/ /g/ /eɪ/ /dʒ/
7	entitlement	e,n,t,i,t,le,m,e,n,t	/ɪ/ /n/ /t/ /aɪ/ /t/ /l/ /m/ /ə/ /n/ /t/
7	employment	e,m,p,l,oy,m,e,n,t	/ɪ/ /m/ /p/ /l/ /ɔɪ/ /m/ /ə/ /n/ /t/
7	empathise	e,m,p,a,th,i,se	/ɛ/ /m/ /p/ /ə/ /θ/ /aɪ/ /z/
7	empower	e,m,p,ow,er	/ɪ/ /m/ /p/ /aʊ/ /ə/
7	embark	e,m,b,ar,k	/ɪ/ /m/ /b/ /ɑ:/ /k/
7	emergency	e,m,er,g,e,n,c,y	/ɪ/ /m/ /z:/ /dʒ/ /ə/ /n/ /s/ /i:/
7	dentist	d,e,n,t,i,s,t	/d/ /ɛ/ /n/ /t/ /ɪ/ /s/ /t/
7	machinist	m,a,ch,i,n,i,s,t	/m/ /ə/ /ʃ/ /i:/ /n/ /ɪ/ /s/ /t/
7	cartoonist	c,ar,t,oo,n,i,s,t	/k/ /ɑ:/ /t/ /u:/ /n/ /ɪ/ /s/ /t/
7	stylist	s,t,y,l,i,s,t	/s/ /t/ /aɪ/ /l/ /ɪ/ /s/ /t/
7	cyclist	c,y,c,l,i,s,t	/s/ /aɪ/ /k/ /l/ /ɪ/ /s/ /t/
7	optimism	o,p,t,i,m,i,s,m	/ɒ/ /p/ /t/ /ɪ/ /m/ /ɪ/ /z/ /m/
7	criticism	c,r,i,t,i,c,i,s,m	/k/ /r/ /ɪ/ /t/ /ɪ/ /s/ /ɪ/ /z/ /m/
7	absenteeism	a,b,s,e,n,t,ee,i,s,m	/æ/ /b/ /s/ /ə/ /n/ /t/ /i:/ /ɪ/ /z/ /m/
7	professionalism	p,r,o,f,e,ss,i,o,n,a,l,i,s,m	/p/ /r/ /ə/ /f/ /ɛ/ /ʃ/ /ə/ /n/ /ə/ /l/ /ɪ/ /z/ /m/
7	realism	r,e,a,l,i,s,m	/r/ /ɪ/ /ə/ /l/ /ɪ/ /z/ /m/
7	surcharge	s,ur,ch,ar,ge	/s/ /z:/ /tʃ/ /ɑ:/ /dʒ/
7	surface	s,ur,f,a,ce	/s/ /z:/ /f/ /ɪ/ /s/
7	surpass	s,ur,p,a,ss	/s/ /z:/ /p/ /ɑ:/ /s/
7	surplus	s,ur,p,l,u,s	/s/ /z:/ /p/ /l/ /ə/ /s/
7	surprise	s,ur,p,r,i,se	/s/ /ə/ /p/ /r/ /aɪ/ /z/
7	surround	s,u,rr,ou,n,d	/s/ /ə/ /r/ /aʊ/ /n/ /d/
7	exhaust	e,xh,au,s,t	/ɪ/ /z/ /ɔ:/ /s/ /t/
7	expire	e,x,p,i,re	/ɪ/ /x/ /p/ /aɪ/ /ə/
7	excellence	e,x,c,e,ll,e,n,ce	/ɛ/ /k/ /s/ /ə/ /l/ /ə/ /n/ /s/
7	explode	e,x,p,l,o,de	/ɪ/ /x/ /p/ /l/ /əʊ/ /d/
7	expensive	e,x,p,e,n,s,i,ve	/ɪ/ /x/ /p/ /ɛ/ /n/ /s/ /ɪ/ /v/
7	explore	e,x,p,l,ore	/ɪ/ /x/ /p/ /l/ /ɔ:/
7	prehistoric	p,r,e,h,i,s,t,o,r,i,c	/p/ /r/ /i:/ /h/ /ɪ/ /s/ /t/ /ɒ/ /r/ /ɪ/ /k/
7	prefix	p,r,e,f,i,x	/p/ /r/ /i:/ /f/ /ɪ/ /x/
7	precaution	p,r,e,c,au,t,i,o,n	/p/ /r/ /ɪ/ /k/ /ɔ:/ /ʃ/ /ə/ /n/
7	prepay	p,r,e,p,ay	/p/ /r/ /i:/ /p/ /eɪ/
7	postgraduate	p,o,s,t,g,r,a,d,u,a,te	/p/ /əʊ/ /s/ /t/ /g/ /r/ /æ/ /d/ /j/ /ə/ /t/
7	postpone	p,o,s,t,p,o,ne	/p/ /əʊ/ /s/ /t/ /p/ /əʊ/ /n/
7	postscript	p,o,s,t,s,c,r,i,p,t	/p/ /əʊ/ /s/ /t/ /s/ /k/ /r/ /ɪ/ /p/ /t/

7	postdate	p,o,s,t,d,a,t,e	/p/ /əʊ/ /s/ /t/ /d/ /eɪ/ /t/
7	besides	b,e,s,i,d,e,s	/b/ /ɪ/ /s/ /aɪ/ /d/ /z/
7	despite	d,e,s,p,i,t,e	/d/ /ɪ/ /s/ /p/ /aɪ/ /t/
7	except	e,x,c,e,p,t	/ɪ/ /k/ /s/ /ɛ/ /p/ /t/
7	unless	u,n,l,e,s,s	/ə/ /n/ /l/ /ɛ/ /s/
7	afterwards	a,f,t,e,r,w,a,r,d,s	/ɑ:/ /f/ /t/ /ə/ /w/ /ə/ /d/ /z/
7	finally	f,i,n,a,l,l,y	/f/ /aɪ/ /n/ /ə/ /l/ /i:/
7	lastly	l,a,s,t,l,y	/l/ /ɑ:/ /s/ /t/ /l/ /i:/
7	neither	n,e,i,t,h,e,r	/n/ /aɪ/ /ð/ /ə/
7	though	th,ough	/ð/ /əʊ/
7	meanwhile	m,e,a,n,w,h,i,l,e	/m/ /i:/ /n/ /w/ /aɪ/ /l/
7	therefore	th,ere,f,ore	/ð/ /eə/ /f/ /ɔ:/
7	initially	i,n,i,t,i,a,l,l,y	/ɪ/ /n/ /ɪ/ /j/ /ə/ /l/ /i:/
7	otherwise	o,t,h,e,r,w,i,s,e	/ʌ/ /ð/ /ə/ /w/ /aɪ/ /z/
7	previously	p,r,e,v,i,o,u,s,l,y	/p/ /r/ /i:/ /v/ /ɪ/ /ʌ/ /s/ /l/ /i:/
7	rather	r,a,t,h,e,r	/r/ /ɑ:/ /ð/ /ə/
7	consequently	c,o,n,s,e,q,u,e,n,t,l,y	/k/ /ɒ/ /n/ /s/ /ɪ/ /k/ /w/ /ə/ /n/ /t/ /l/ /i:/
7	in	i,n	/ɪ/ /n/
7	for	f,or	/f/ /ɔ:/
7	as	a,s	/æ/ /z/
7	rather	r,a,t,h,e,r	/r/ /ɑ:/ /ð/ /ə/
7	a	a	/eɪ/
7	conclusion	c,o,n,c,l,u,s,i,o,n	/k/ /ə/ /n/ /k/ /l/ /u:/ /z/ /ə/ /n/
7	example	e,x,a,m,p,l,e	/ɪ/ /x/ /ɑ:/ /m/ /p/ /l/
7	result	r,e,s,u,l,t	/r/ /ɪ/ /z/ /ʌ/ /l/ /t/
7	than	th,a,n	/ð/ /æ/ /n/
7	cereal	c,e,r,e,a,l	/s/ /ɪə/ /r/ /ɪ/ /ə/ /l/
7	serial	s,e,r,i,a,l	/s/ /ɪə/ /r/ /ɪ/ /ə/ /l/
7	board	b,o,a,r,d	/b/ /ɔ:/ /d/
7	bored	b,o,r,e,d	/b/ /ɔ:/ /d/
7	vary	v,a,r,y	/v/ /eə/ /r/ /i:/
7	very	v,e,r,y	/v/ /ɛ/ /r/ /i:/
7	queue	q,u,e,u,e	/k/ /j/ /u:/
7	cue	c,u,e	/k/ /y/
7	course	c,o,u,r,s,e	/k/ /ɔ:/ /s/
7	coarse	c,o,a,r,s,e	/k/ /ɔ:/ /s/
7	through	th,r,ough	/θ/ /r/ /u:/
7	threw	th,r,ew	/θ/ /r/ /u:/
7	symbol	s,y,m,b,o,l	/s/ /ɪ/ /m/ /b/ /ə/ /l/
7	cymbal	c,y,m,b,a,l	/s/ /ɪ/ /m/ /b/ /ə/ /l/
7	guest	g,u,e,s,t	/g/ /ɛ/ /s/ /t/
7	guessed	g,u,e,s,s,e,d	/g/ /ɛ/ /s/ /t/
7	principle	p,r,i,n,c,i,p,l,e	/p/ /r/ /ɪ/ /n/ /s/ /ə/ /p/ /l/
7	principal	p,r,i,n,c,i,p,a,l	/p/ /r/ /ɪ/ /n/ /s/ /ə/ /p/ /ə/ /l/

7	lesson	l,e,ss,on	/l/ /ɛ/ /s/ /n/
7	lessen	l,e,ss,en	/l/ /ɛ/ /s/ /n/
7	hyperlink	h,y,p,er,l,i,n,k	/h/ /aɪ/ /p/ /ə/ /l/ /ɪ/ /ŋ/ /k/
7	hyperventilate	h,y,p,er,v,e,n,t,i,l,a,te	/h/ /aɪ/ /p/ /ə/ /v/ /ɛ/ /n/ /t/ /ə/ /l/ /eɪ/ /t/
7	hyperactive	h,y,p,er,a,c,t,i,ve	/h/ /aɪ/ /p/ /ə/ /æ/ /k/ /t/ /ɪ/ /v/
7	hyperthermia	h,y,p,er,th,er,m,i,a	/h/ /aɪ/ /p/ /ə/ /θ/ /z:/ /m/ /ɪ/ /ə/
7	hypersensitive	h,y,p,er,s,e,n,s,i,t,i,ve	/h/ /aɪ/ /p/ /z:/ /s/ /ɛ/ /n/ /s/ /ɪ/ /t/ /ɪ/ /v/
7	interview	i,n,t,er,v,i,ew	/ɪ/ /n/ /t/ /ə/ /v/ /j/ /u:/
7	internet	i,n,t,er,n,e,t	/ɪ/ /n/ /t/ /ə/ /n/ /ɛ/ /t/
7	interstate	i,n,t,er,s,t,a,te	/ɪ/ /n/ /t/ /z:/ /s/ /t/ /eɪ/ /t/
7	interface	i,n,t,er,f,a,ce	/ɪ/ /n/ /t/ /ə/ /f/ /eɪ/ /s/
7	international	i,n,t,er,n,a,t,i,o,n,al	/ɪ/ /n/ /t/ /z:/ /n/ /æ/ /ʃ/ /ə/ /n/ /l/
7	submerge	s,u,b,m,er,ge	/s/ /ə/ /b/ /m/ /z:/ /dʒ/
7	submarine	s,u,b,m,a,r,i,ne	/s/ /ʌ/ /b/ /m/ /ə/ /r/ /i:/ /n/
7	subscribe	s,u,b,s,c,r,i,be	/s/ /ə/ /b/ /s/ /k/ /r/ /aɪ/ /b/
7	subconscious	s,u,b,c,o,n,sc,iou,s	/s/ /ʌ/ /b/ /k/ /ɒ/ /n/ /ʃ/ /ʌ/ /s/
7	substandard	s,u,b,s,t,a,n,d,ar,d	/s/ /ʌ/ /b/ /s/ /t/ /æ/ /n/ /d/ /ə/ /d/
7	intranet	i,n,t,r,a,n,e,t	/ɪ/ /n/ /t/ /r/ /ə/ /n/ /ɪ/ /t/
7	intraschool	i,n,t,r,a,s,ch,oo,l	/ɪ/ /n/ /t/ /r/ /ə/ /s/ /k/ /u:/ /l/
7	intravenous	i,n,t,r,a,v,e,n,ou,s	/ɪ/ /n/ /t/ /r/ /ə/ /v/ /i:/ /n/ /ə/ /s/
7	intrastate	i,n,t,r,a,s,t,a,te	/ɪ/ /n/ /t/ /r/ /ə/ /s/ /t/ /eɪ/ /t/
7	intramuscular	i,n,t,r,a,m,u,s,c,u,l,ar	/ɪ/ /n/ /t/ /r/ /ə/ /m/ /ʌ/ /s/ /k/ /ɪ/ /l/ /ə/
7	otherwise	o,th,er,w,i,se	/ʌ/ /ð/ /ə/ /w/ /aɪ/ /z/
7	likewise	l,i,ke,w,i,se	/l/ /aɪ/ /k/ /w/ /aɪ/ /z/
7	widthwise	w,i,d,th,w,i,se	/w/ /ɪ/ /d/ /θ/ /w/ /aɪ/ /z/
7	waterwise	w,a,t,er,w,i,se	/w/ /ɔ:/ /t/ /ə/ /w/ /aɪ/ /z/
7	lengthwise	l,e,n,g,th,w,i,se	/l/ /ɛ/ /ŋ/ /θ/ /w/ /aɪ/ /z/
7	clockwise	c,l,o,ck,w,i,se	/k/ /l/ /ɒ/ /k/ /w/ /aɪ/ /z/
7	anticlockwise	a,n,t,i,c,l,o,ck,w,i,se	/æ/ /n/ /t/ /ɪ/ /k/ /l/ /ɒ/ /k/ /w/ /aɪ/ /z/
7	chronic	ch,r,o,n,i,c	/k/ /r/ /ɒ/ /n/ /ɪ/ /k/
7	character	ch,a,r,a,c,t,er	/k/ /æ/ /r/ /ɪ/ /k/ /t/ /ə/
7	choir	ch,o,i,r	/k/ /w/ /aɪ/ /ə/
7	chemist	ch,e,m,i,s,t	/k/ /ɛ/ /m/ /ɪ/ /s/ /t/
7	stomach	s,t,o,m,a,ch	/s/ /t/ /ʌ/ /m/ /ə/ /k/
7	anchor	a,n,ch,or	/æ/ /ŋ/ /k/ /ə/
7	liquid	l,i,q,u,i,d	/l/ /ɪ/ /k/ /w/ /ɪ/ /d/
7	qualify	q,u,a,l,i,f,y	/k/ /w/ /ɒ/ /l/ /ɪ/ /f/ /aɪ/
7	equivalent	e,q,u,i,v,a,l,e,n,t	/ɪ/ /k/ /w/ /ɪ/ /v/ /ə/ /l/ /ə/ /n/ /t/
7	picturesque	p,i,c,t,u,r,e,s,que	/p/ /ɪ/ /k/ /tʃ/ /ə/ /r/ /ɛ/ /s/ /k/
7	inquisitive	i,n,q,u,i,s,i,t,i,ve	/ɪ/ /n/ /k/ /w/ /ɪ/ /z/ /ɪ/ /t/ /ɪ/ /v/
7	equestrian	e,q,u,e,s,t,r,i,a,n	/ɪ/ /k/ /w/ /ɛ/ /s/ /t/ /r/ /ɪ/ /ə/ /n/
7	quarantine	q,u,a,r,a,n,t,i,ne	/k/ /w/ /ɒ/ /r/ /ə/ /n/ /t/ /i:/ /n/
7	monochrome	m,o,n,o,ch,r,o,me	/m/ /ɒ/ /n/ /ə/ /k/ /r/ /əʊ/ /m/
7	monotone	m,o,n,o,t,o,ne	/m/ /ɒ/ /n/ /ə/ /t/ /əʊ/ /n/

7	monorail	m,o,n,o,r,ai,l	/m/ /ɒ/ /n/ /əʊ/ /r/ /eɪ/ /l/
7	monopoly	m,o,n,o,p,o,l,y	/m/ /ə/ /n/ /ɒ/ /p/ /ə/ /l/ /i:/
7	semiprofessional	s,e,m,i,p,r,o,f,e,ss,i,o,n,a,l	/s/ /ɛ/ /m/ /ɪ/ /p/ /r/ /ə/ /f/ /ɛ/ /ʃ/ /ə/ /n/ /ə/ /l/
7	semiprecious	s,e,m,i,p,r,e,c,iou,s	/s/ /ɛ/ /m/ /ɪ/ /p/ /r/ /ɛ/ /ʃ/ /ʌ/ /s/
7	semidetached	s,e,m,i,d,e,t,a,ch,ed	/s/ /ɛ/ /m/ /ɪ/ /d/ /ɪ/ /t/ /æ/ /tʃ/ /t/
7	semicircle	s,e,m,i,c,ir,c,le	/s/ /ɛ/ /m/ /ɪ/ /s/ /ɜ:/ /k/ /l/
7	centipede	c,e,n,t,i,p,e,de	/s/ /ɛ/ /n/ /t/ /ɪ/ /p/ /i:/ /d/
7	centimetre	c,e,n,t,i,m,e,t,re	/s/ /ɛ/ /n/ /t/ /ɪ/ /m/ /i:/ /t/ /ə/
7	million	m,i,ll,i,o,n	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/
7	millionaire	m,i,ll,i,o,n,aire	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/ /eə/
7	millimetre	m,i,ll,i,m,e,t,re	/m/ /ɪ/ /l/ /ɪ/ /m/ /i:/ /t/ /ə/
7	millipede	m,i,ll,i,p,e,de	/m/ /ɪ/ /l/ /ɪ/ /p/ /i:/ /d/
7	pentagon	p,e,n,t,a,g,o,n	/p/ /ɛ/ /n/ /t/ /ə/ /g/ /ə/ /n/
7	pentagram	p,e,n,t,a,g,r,a,m	/p/ /ɛ/ /n/ /t/ /ə/ /g/ /r/ /æ/ /m/
7	pentathlon	p,e,n,t,a,th,l,o,n	/p/ /ɛ/ /n/ /t/ /æ/ /θ/ /l/ /ə/ /n/
7	octopus	o,c,t,o,p,u,s	/ɒ/ /k/ /t/ /ə/ /p/ /ə/ /s/
7	October	o,c,t,o,b,er	/ɒ/ /k/ /t/ /əʊ/ /b/ /ə/
7	octagon	o,c,t,a,g,o,n	/ɒ/ /k/ /t/ /ə/ /g/ /ə/ /n/
7	chef	ch,e,f	/ʃ/ /ɛ/ /f/
7	encore	e,n,c,ore	/ɒ/ /ŋ/ /k/ /ɔ:/
7	restaurant	r,e,s,t,au,r,a,n,t	/r/ /ɛ/ /s/ /t/ /ɒ/ /r/ /ɒ/ /n/ /t/
7	accent	a,c,c,e,n,t	/æ/ /k/ /s/ /ə/ /n/ /t/
7	cabinet	c,a,b,i,n,e,t	/k/ /æ/ /b/ /ɪ/ /n/ /ɪ/ /t/
7	perfume	p,e,r,f,u,m,e	/p/ /ɜ:/ /f/ /y/ /m/
7	yacht	y,a,ch,t	/j/ /ɒ/ /t/
7	freight	f,r,eigh,t	/f/ /r/ /eɪ/ /t/
7	landscape	l,a,n,d,s,c,a,p,e	/l/ /æ/ /n/ /s/ /k/ /eɪ/ /p/
7	balcony	b,a,l,c,o,n,y	/b/ /æ/ /l/ /k/ /ə/ /n/ /i:/
7	cartoon	c,a,r,t,oo,n	/k/ /ɑ:/ /t/ /u:/ /n/
7	umbrella	u,m,b,r,e,ll,a	/ʌ/ /m/ /b/ /r/ /ɛ/ /l/ /ə/
7	gallery	g,a,ll,e,r,y	/g/ /æ/ /l/ /ə/ /r/ /i:/
7	coffee	c,o,ff,ee	/k/ /ɒ/ /f/ /i:/
7	orchestra	or,ch,e,s,t,r,a	/ɔ:/ /k/ /ɪ/ /s/ /t/ /r/ /ə/
7	hamburger	h,a,m,b,ur,g,er	/h/ /æ/ /m/ /b/ /ɜ:/ /g/ /ə/
7	abseil	a,b,s,e,i,l	/ /æ/ /b/ /s/ /eɪ/ /l/
7	noodle	n,oo,d,le	/n/ /u:/ /d/ /l/
7	banana	b,a,n,a,n,a	/b/ /ə/ /n/ /ɑ:/ /n/ /ə/
7	safari	s,a,f,a,r,i	/s/ /ə/ /f/ /ɑ:/ /r/ /i:/
7	resign	r,e,s,i,g,n	/r/ /ɪ/ /z/ /aɪ/ /n/
7	resignation	r,e,s,i,g,n,a,t,i,o,n	/r/ /ɛ/ /z/ /ɪ/ /g/ /n/ /eɪ/ /ʃ/ /ə/ /n/
7	column	c,o,l,u,mn	/k/ /ɒ/ /l/ /ə/ /m/
7	columnist	c,o,l,u,mn,i,s,t	/k/ /ɒ/ /l/ /ə/ /m/ /ɪ/ /s/ /t/
7	soften	s,o,ft,en	/s/ /ɒ/ /f/ /n/
7	soft	s,o,f,t	/s/ /ɒ/ /f/ /t/

7	crumb	c,r,u,mb	/k/ /r/ /ʌ/ /m/
7	crumble	c,r,u,m,b,le	/k/ /r/ /ʌ/ /m/ /b/ /l/
7	debt	d,e,bt	/d/ /ɛ/ /t/
7	debit	d,e,b,i,t	/d/ /ɛ/ /b/ /ɪ/ /t/
7	sign	s,i,gn	/s/ /aɪ/ /n/
7	signal	s,i,g,n,al	/s/ /ɪ/ /g/ /n/ /l/
7	bomb	b,o,mb	/b/ /ɒ/ /m/
7	bombard	b,o,m,b,ar,d	/b/ /ɒ/ /m/ /b/ /ɑ:/ /d/
7	sign	s,i,gn	/s/ /aɪ/ /n/
7	signature	s,i,g,n,a,t,ure	/s/ /ɪ/ /g/ /n/ /ɪ/ /tʃ/ /ə/
7	fasten	f,a,st,en	/f/ /ɑ:/ /s/ /n/
7	fast	f,a,s,t	/f/ /ɑ:/ /s/ /t/
7	muscle	m,u,sc,le	/m/ /ʌ/ /s/ /l/
7	muscular	m,u,s,c,u,l,ar	/m/ /ʌ/ /s/ /k/ /y/ /l/ /ə/
7	justify	j,u,s,t,i,f,y	/dʒ/ /ʌ/ /s/ /t/ /ɪ/ /f/ /aɪ/
7	horrify	h,o,rr,i,f,y	/h/ /ɒ/ /r/ /ɪ/ /f/ /aɪ/
7	identify	i,d,e,n,t,i,f,y	/aɪ/ /d/ /ɛ/ /n/ /t/ /ɪ/ /f/ /aɪ/
7	magnify	m,a,g,n,i,f,y	/m/ /æ/ /g/ /n/ /ɪ/ /f/ /aɪ/
7	notify	n,o,t,i,f,y	/n/ /əʊ/ /t/ /ɪ/ /f/ /aɪ/
7	qualify	q,u,a,l,i,f,y	/k/ /w/ /ɒ/ /l/ /ɪ/ /f/ /aɪ/
7	simplify	s,i,m,p,l,i,f,y	/s/ /ɪ/ /m/ /p/ /l/ /ɪ/ /f/ /aɪ/
7	mystify	m,y,s,t,i,f,y	/m/ /ɪ/ /s/ /t/ /ɪ/ /f/ /aɪ/
7	classify	c,l,a,ss,i,f,y	/k/ /l/ /æ/ /s/ /ɪ/ /f/ /aɪ/
7	verify	v,e,r,i,f,y	/v/ /ɛ/ /r/ /ɪ/ /f/ /aɪ/
7	testify	t,e,s,t,i,f,y	/t/ /ɛ/ /s/ /t/ /ɪ/ /f/ /aɪ/
7	employee	e,m,p,l,o,y,ee	/ɛ/ /m/ /p/ /l/ /ɔɪ/ /i:/
7	evacuee	e,v,a,c,u,ee	/ɪ/ /v/ /æ/ /k/ /y/ /i:/
7	refugee	r,e,f,u,g,ee	/r/ /ɛ/ /f/ /y/ /dʒ/ /i:/
7	trainee	t,r,a,i,n,ee	/t/ /r/ /eɪ/ /n/ /i:/
7	interviewee	i,n,t,e,r,v,i,e,w,ee	/ɪ/ /n/ /t/ /ə/ /v/ /j/ /u:/ /i:/
7	payee	p,a,y,ee	/p/ /eɪ/ /i:/
7	nominee	n,o,m,i,n,ee	/n/ /ɒ/ /m/ /ɪ/ /n/ /i:/
7	trustee	t,r,u,s,t,ee	/t/ /r/ /ʌ/ /s/ /t/ /i:/
7	devotee	d,e,v,o,t,ee	/d/ /ɛ/ /v/ /əʊ/ /t/ /i:/
7	evacuate	e,v,a,c,u,a,te	/ɪ/ /v/ /æ/ /k/ /y/ /eɪ/ /t/
7	investigate	i,n,v,e,s,t,i,g,a,te	/ɪ/ /n/ /v/ /ɛ/ /s/ /t/ /ɪ/ /g/ /eɪ/ /t/
7	nominate	n,o,m,i,n,a,te	/n/ /ɒ/ /m/ /ɪ/ /n/ /eɪ/ /t/
7	operate	o,p,e,r,a,te	/ɒ/ /p/ /ə/ /r/ /eɪ/ /t/
7	populate	p,o,p,u,l,a,te	/p/ /ɒ/ /p/ /y/ /l/ /eɪ/ /t/
7	regulate	r,e,g,u,l,a,te	/r/ /ɛ/ /g/ /y/ /l/ /eɪ/ /t/
7	separate	s,e,p,a,r,a,te	/s/ /ɛ/ /p/ /r/ /ɪ/ /t/
7	delegate	d,e,l,e,g,a,te	/d/ /ɛ/ /l/ /ɪ/ /g/ /ɪ/ /t/
7	abbreviate	a,b,b,r,e,v,i,a,te	/ə/ /b/ /r/ /i:/ /v/ /ɪ/ /eɪ/ /t/
7	concentrate	c,o,n,c,e,n,t,r,a,te	/k/ /ɒ/ /n/ /s/ /ə/ /n/ /t/ /r/ /eɪ/ /t/

7	advertise	a,d,v,er,t,i,se	/æ/ /d/ /v/ /ə/ /t/ /aɪ/ /z/
7	apologise	a,p,o,l,o,g,i,se	/ə/ /p/ /p/ /l/ /ə/ /dʒ/ /aɪ/ /z/
7	criticise	c,r,i,t,i,c,i,se	/k/ /r/ /ɪ/ /t/ /ɪ/ /s/ /aɪ/ /z/
7	maximise	m,a,x,i,m,i,se	/m/ /æ/ /x/ /ɪ/ /m/ /aɪ/ /z/
7	minimise	m,i,n,i,m,i,se	/m/ /ɪ/ /n/ /ɪ/ /m/ /aɪ/ /z/
7	recognise	r,e,c,o,g,n,i,se	/r/ /ɛ/ /k/ /ə/ /g/ /n/ /aɪ/ /z/
7	utilise	u,t,i,l,i,se	/y/ /t/ /ɪ/ /l/ /aɪ/ /z/
7	synthesise	s,y,n,th,e,s,i,se	/s/ /ɪ/ /n/ /θ/ /ɪ/ /s/ /aɪ/ /z/
7	formalise	f,or,m,a,l,i,se	/f/ /ɔ:/ /m/ /ə/ /l/ /aɪ/ /z/
7	rationalise	r,a,t,i,o,n,a,l,i,se	/r/ /æ/ /ʃ/ /ə/ /n/ /ə/ /l/ /aɪ/ /z/
7	migrant	m,i,g,r,a,n,t	/m/ /aɪ/ /g/ /r/ /ə/ /n/ /t/
7	assistant	a,ss,i,s,t,a,n,t	/ə/ /s/ /ɪ/ /s/ /t/ /ə/ /n/ /t/
7	attendant	a,tt,e,n,d,a,n,t	/ə/ /t/ /ɛ/ /n/ /d/ /ə/ /n/ /t/
7	consonant	c,o,n,s,o,n,a,n,t	/k/ /p/ /n/ /s/ /ə/ /n/ /ə/ /n/ /t/
7	participant	p,ar,t,i,c,i,p,a,n,t	/p/ /ɑ:/ /t/ /ɪ/ /s/ /ɪ/ /p/ /ə/ /n/ /t/
7	occupant	o,cc,u,p,a,n,t	/p/ /k/ /ʊ/ /p/ /ə/ /n/ /t/
7	servant	s,er,v,a,n,t	/s/ /ɜ:/ /v/ /ə/ /n/ /t/
7	dependant	d,e,p,e,n,d,a,n,t	/d/ /ɪ/ /p/ /ɛ/ /n/ /d/ /ə/ /n/ /t/
7	contestant	c,o,n,t,e,s,t,a,n,t	/k/ /ə/ /n/ /t/ /ɛ/ /s/ /t/ /ə/ /n/ /t/
7	confident	c,o,n,f,i,d,e,n,t	/k/ /p/ /n/ /f/ /ɪ/ /d/ /ə/ /n/ /t/
7	president	p,r,e,s,i,d,e,n,t	/p/ /r/ /ɛ/ /z/ /ɪ/ /d/ /ə/ /n/ /t/
7	dependent	d,e,p,e,n,d,e,n,t	/d/ /ɪ/ /p/ /ɛ/ /n/ /d/ /ə/ /n/ /t/
7	resident	r,e,s,i,d,e,n,t	/r/ /ɛ/ /z/ /ɪ/ /d/ /ə/ /n/ /t/
7	respondent	r,e,s,p,o,n,d,e,n,t	/r/ /ɪ/ /s/ /p/ /p/ /n/ /d/ /ə/ /n/ /t/
7	persistent	p,er,s,i,s,t,e,n,t	/p/ /ə/ /s/ /ɪ/ /s/ /t/ /ə/ /n/ /t/
7	excellent	e,x,c,e,l,l,e,n,t	/ɛ/ /k/ /s/ /ə/ /l/ /ə/ /n/ /t/
7	apparent	a,pp,a,r,e,n,t	/ə/ /p/ /æ/ /r/ /ə/ /n/ /t/
7	accident	a,c,c,i,d,e,n,t	/æ/ /k/ /s/ /ɪ/ /d/ /ə/ /n/ /t/
7	different	d,i,ff,er,e,n,t	/d/ /ɪ/ /f/ /r/ /ə/ /n/ /t/
7	independent	i,n,d,e,p,e,n,d,e,n,t	/ɪ/ /n/ /d/ /ɪ/ /p/ /ɛ/ /n/ /d/ /ə/ /n/ /t/
7	separate	s,e,p,a,r,a,t,e	/s/ /ɛ/ /p/ /r/ /ɪ/ /t/
7	leisure	l,e,i,s,u,r,e	/l/ /ɛ/ /z/ /ə/
7	awkward	aw,k,w,a,r,d	/ɔ:/ /k/ /w/ /ə/ /d/
7	appreciate	a,pp,r,e,c,i,a,t,e	/ə/ /p/ /r/ /i:/ /ʃ/ /ɪ/ /eɪ/ /t/
7	jewellery	j,ew,e,l,l,e,r,y	/dʒ/ /u:/ /ə/ /l/ /r/ /i:/
7	previously	p,r,e,v,i,ou,s,l,y	/p/ /r/ /i:/ /v/ /ɪ/ /ʌ/ /s/ /l/ /i:/
7	manageable	m,a,n,a,g,e,a,b,l,e	/m/ /æ/ /n/ /ɪ/ /dʒ/ /ə/ /b/ /l/
7	miscellaneous	m,i,s,c,e,l,l,a,n,e,o,u,s	/m/ /ɪ/ /s/ /ə/ /l/ /eɪ/ /n/ /ɪ/ /ʌ/ /s/
7	mortgage	m,ort,g,a,g,e	/m/ /ɔ:/ /g/ /ɪ/ /dʒ/
7	knowledge	kn,ow,l,e,dg,e	/n/ /p/ /l/ /ɪ/ /dʒ/
7	necessary	n,e,c,e,s,s,a,r,y	/n/ /ɛ/ /s/ /ɪ/ /s/ /r/ /i:/
7	noticeable	n,o,t,i,c,e,a,b,l,e	/n/ /əʊ/ /t/ /ɪ/ /s/ /ə/ /b/ /l/
7	occasionally	o,cc,a,s,i,o,n,a,l,l,y	/ə/ /k/ /eɪ/ /z/ /ə/ /n/ /ə/ /l/ /i:/
7	parallel	p,a,r,a,l,l,e,l	/p/ /æ/ /r/ /ə/ /l/ /ɛ/ /l/

7	particularly	p,ar,t,i,c,u,l,ar,l,y	/p/ /ə/ /t/ /ɪ/ /k/ /ʊ/ /l/ /ə/ /l/ /i:/
7	personnel	p,er,s,o,nn,e,l	/p/ /ɜ:/ /s/ /ə/ /n/ /ɛ/ /l/
7	subtle	s,u,bt,le	/s/ /ʌ/ /t/ /l/
7	yacht	y,ach,t	/j/ /ɒ/ /t/
7	technique	t,e,ch,n,i,que	/t/ /ɛ/ /k/ /n/ /i:/ /k/
7	possession	p,o,ss,e,ss,io,n	/p/ /ə/ /z/ /ɛ/ /ʃ/ /ə/ /n/
7	autograph	au,t,o,g,r,a,ph	/ɔ:/ /t/ /ə/ /g/ /r/ /ɑ:/ /f/
7	automobile	au,t,o,m,o,b,i,le	/ɔ:/ /t/ /əʊ/ /m/ /əʊ/ /b/ /i:/ /l/
7	autobiography	au,t,o,b,i,o,g,r,a,ph,y	/ɔ:/ /t/ /əʊ/ /b/ /aɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
7	autobiographic	au,t,o,b,i,o,g,r,a,ph,i,c	/ɔ:/ /t/ /əʊ/ /b/ /aɪ/ /əʊ/ /g/ /r/ /æ/ /f/ /ɪ/ /k/
7	automatic	au,t,o,m,a,t,i,c	/ɔ:/ /t/ /ə/ /m/ /æ/ /t/ /ɪ/ /k/
7	automatically	au,t,o,m,a,t,i,c,a,ll,y	/ɔ:/ /t/ /ə/ /m/ /æ/ /t/ /ɪ/ /k/ /ə/ /l/ /i:/
7	autopilot	au,t,o,p,i,l,o,t	/ɔ:/ /t/ /əʊ/ /p/ /aɪ/ /l/ /ə/ /t/
7	autonomy	au,t,o,n,o,m,y	/ɔ:/ /t/ /ɒ/ /n/ /ə/ /m/ /i:/
7	automated	au,t,o,m,a,t,e,d	/ɔ:/ /t/ /ə/ /m/ /eɪ/ /t/ /ɪ/ /d/
7	cycle	c,y,c,le	/s/ /aɪ/ /k/ /l/
7	bicycle	b,i,c,y,c,le	/b/ /aɪ/ /s/ /ɪ/ /k/ /l/
7	cyclone	c,y,c,l,o,ne	/s/ /aɪ/ /k/ /l/ /əʊ/ /n/
7	recycle	r,e,c,y,c,le	/r/ /i:/ /s/ /aɪ/ /k/ /l/
7	encyclopedia	e,n,c,y,c,l,o,p,e,d,i,a	/ɪ/ /n/ /s/ /aɪ/ /k/ /l/ /ə/ /p/ /i:/ /d/ /ɪ/ /ə/
7	polygon	p,o,l,y,g,o,n	/p/ /ɒ/ /l/ /ɪ/ /g/ /ə/ /n/
7	polyhedron	p,o,l,y,h,e,d,r,o,n	/p/ /ɒ/ /l/ /ɪ/ /h/ /ɛ/ /d/ /r/ /ə/ /n/
7	polyester	p,o,l,y,e,s,t,er	/p/ /ɒ/ /l/ /ɪ/ /ɛ/ /s/ /t/ /ə/
7	polygram	p,o,l,y,g,r,a,m	/p/ /ɒ/ /l/ /ɪ/ /g/ /r/ /æ/ /m/
7	polystyrene	p,o,l,y,s,t,y,r,e,ne	/p/ /ɒ/ /l/ /ɪ/ /s/ /t/ /aɪ/ /r/ /i:/ /n/
7	monopoly	m,o,n,o,p,o,l,y	/m/ /ə/ /n/ /ɒ/ /p/ /ə/ /l/ /i:/
7	guitar	gu,i,t,ar	/g/ /ɪ/ /t/ /ɑ:/
7	mosquito	m,o,s,qu,i,t,o	/m/ /ə/ /s/ /k/ /i:/ /t/ /əʊ/
7	macaroni	m,a,c,a,r,o,n,i	/m/ /æ/ /k/ /ə/ /r/ /əʊ/ /n/ /i:/
7	balcony	b,a,l,c,o,n,y	/b/ /æ/ /l/ /k/ /ə/ /n/ /i:/
7	delicatessen	d,e,l,i,c,a,t,e,ss,en	/d/ /ɛ/ /l/ /ɪ/ /k/ /ə/ /t/ /ɛ/ /s/ /n/
7	umbrella	u,m,b,r,e,ll,a	/ʌ/ /m/ /b/ /r/ /ɛ/ /l/ /ə/
7	ambulance	a,m,b,u,l,a,n,ce	/æ/ /m/ /b/ /ʊ/ /l/ /ə/ /n/ /s/
7	camouflage	c,a,m,o,u,f,l,a,ge	/k/ /æ/ /m/ /ʊ/ /f/ /l/ /ɑ:/ /ʒ/
7	unique	u,n,i,que	/u:/ /n/ /i:/ /k/
7	beige	b,e,i,ge	/b/ /eɪ/ /ʒ/
7	bizarre	b,i,z,arre	/b/ /ɪ/ /z/ /ɑ:/
7	yoghurt	y,o,gh,ur,t	/j/ /əʊ/ /g/ /ʌ/ /t/
7	muesli	m,ue,s,l,i	/m/ /u:/ /z/ /l/ /i:/
7	sushi	s,u,sh,i	/s/ /ʊ/ /ʃ/ /i:/
7	piano	p,i,a,n,o	/p/ /ɪ/ /æ/ /n/ /əʊ/
7	restaurant	r,e,s,t,au,r,a,n,t	/r/ /ɛ/ /s/ /t/ /ɒ/ /r/ /ɒ/ /n/ /t/
7	cappuccino	c,a,pp,u,cc,i,n,o	/k/ /æ/ /p/ /ʊ/ /tʃ/ /i:/ /n/ /əʊ/
7	spaghetti	s,p,a,gh,e,tt,i	/s/ /p/ /ə/ /g/ /ɛ/ /t/ /i:/

7	amateur	a,m,a,t,eur	/æ/ /m/ /ə/ /tʃ/ /ə/
7	bouquet	b,ou,qu,et	/b/ /u:/ /k/ /eɪ/
7	thermometer	th,er,m,o,m,e,t,er	/θ/ /ə/ /m/ /ɒ/ /m/ /ɪ/ /t/ /ə/
7	thermal	th,er,m,a,l	/θ/ /ɜ:/ /m/ /ə/ /l/
7	ectotherm	e,c,t,o,th,er,m	/ɛ/ /k/ /t/ /əʊ/ /θ/ /ɜ:/ /m/
7	endotherm	e,n,d,o,th,er,m	/ɛ/ /n/ /d/ /əʊ/ /θ/ /ɜ:/ /m/
7	thermostat	th,er,m,o,s,t,a,t	/θ/ /ɜ:/ /m/ /ə/ /s/ /t/ /æ/ /t/
7	hypothermia	h,y,p,o,th,er,m,i,a	/h/ /aɪ/ /p/ /əʊ/ /θ/ /ɜ:/ /m/ /ɪ/ /ə/
7	hyperthermia	h,y,p,er,th,er,m,i,a	/h/ /aɪ/ /p/ /ə/ /θ/ /ɜ:/ /m/ /ɪ/ /ə/
7	decade	d,e,c,a,de	/d/ /ɛ/ /k/ /eɪ/ /d/
7	December	d,e,c,e,m,b,er	/d/ /ɪ/ /s/ /ɛ/ /m/ /b/ /ə/
7	decagon	d,e,c,a,g,o,n	/d/ /ɛ/ /k/ /ə/ /g/ /ə/ /n/
7	decathlon	d,e,c,a,th,l,o,n	/d/ /ɪ/ /k/ /æ/ /θ/ /l/ /ɒ/ /n/
7	decahedron	d,e,c,a,h,e,d,r,o,n	/d/ /ɪ/ /k/ /æ/ /h/ /ɛ/ /d/ /r/ /ə/ /n/
7	decibels	d,e,c,i,b,e,l,s	/d/ /ɛ/ /s/ /ɪ/ /b/ /ɛ/ /l/ /z/
7	decimal	d,e,c,i,m,a,l	/d/ /ɛ/ /s/ /ɪ/ /m/ /ə/ /l/
7	decimate	d,e,c,i,m,a,te	/d/ /ɛ/ /s/ /ɪ/ /m/ /eɪ/ /t/
7	decimetre	d,e,c,i,m,e,t,re	/d/ /ɛ/ /s/ /ɪ/ /m/ /i:/ /t/ /ə/
7	vocal	v,o,c,a,l	/v/ /əʊ/ /k/ /ə/ /l/
7	voice	v,oi,ce	/v/ /ɔɪ/ /s/
7	vocation	v,o,c,a,t,i,o,n	/v/ /əʊ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
7	vocabulary	v,o,c,a,b,u,l,a,r,y	/v/ /əʊ/ /k/ /æ/ /b/ /ɹ/ /l/ /eə/ /r/ /i:/
7	absorption	a,b,s,or,p,t,i,o,n	/ə/ /b/ /s/ /ɔ:/ /p/ /ʃ/ /ə/ /n/
7	detention	d,e,t,e,n,t,i,o,n	/d/ /ɪ/ /t/ /ɛ/ /n/ /ʃ/ /ə/ /n/
7	resuscitation	r,e,s,u,sc,i,t,a,t,i,o,n	/r/ /ɪ/ /s/ /ʌ/ /s/ /ɪ/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	contradiction	c,o,n,t,r,a,d,i,c,t,i,o,n	/k/ /ɒ/ /n/ /t/ /r/ /ə/ /d/ /ɪ/ /k/ /ʃ/ /ə/ /n/
7	detection	d,e,t,e,c,t,i,o,n	/d/ /ɪ/ /t/ /ɛ/ /k/ /ʃ/ /ə/ /n/
7	collection	c,o,ll,e,c,t,i,o,n	/k/ /ə/ /l/ /ɛ/ /k/ /ʃ/ /ə/ /n/
7	competition	c,o,m,p,e,t,i,t,i,o,n	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ɪ/ /ʃ/ /ə/ /n/
7	education	e,d,u,c,a,t,i,o,n	/ɛ/ /d/ /ɹ/ /k/ /eɪ/ /ʃ/ /ə/ /n/
7	illustration	i,ll,u,s,t,r,a,t,i,o,n	/ɪ/ /l/ /ə/ /s/ /t/ /r/ /eɪ/ /ʃ/ /ə/ /n/
7	invitation	i,n,v,i,t,a,t,i,o,n	/ɪ/ /n/ /v/ /ɪ/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	pollution	p,o,ll,u,t,i,o,n	/p/ /ə/ /l/ /u:/ /ʃ/ /ə/ /n/
7	explanation	e,x,p,l,a,n,a,t,i,o,n	/ɛ/ /x/ /p/ /l/ /ə/ /n/ /eɪ/ /ʃ/ /ə/ /n/
7	decision	d,e,c,i,s,i,o,n	/d/ /ɪ/ /s/ /ɪ/ /z/ /ə/ /n/
7	impression	i,m,p,r,e,ss,i,o,n	/ɪ/ /m/ /p/ /r/ /ɛ/ /ʃ/ /ə/ /n/
7	conclusion	c,o,n,c,l,u,s,i,o,n	/k/ /ə/ /n/ /k/ /l/ /u:/ /z/ /ə/ /n/
7	opinion	o,p,i,n,i,o,n	/ə/ /p/ /ɪ/ /n/ /j/ /ə/ /n/
7	illusion	i,ll,u,s,i,o,n	/ɪ/ /l/ /u:/ /z/ /ə/ /n/
7	pension	p,e,n,s,i,o,n	/p/ /ɛ/ /n/ /ʃ/ /ə/ /n/
7	question	q,u,e,s,t,i,o,n	/k/ /w/ /ɛ/ /s/ /tʃ/ /ə/ /n/
7	asteroid	a,s,t,e,r,oi,d	/æ/ /s/ /t/ /ə/ /r/ /ɔɪ/ /d/
7	astrology	a,s,t,r,o,l,o,g,y	/ə/ /s/ /t/ /r/ /ɒ/ /l/ /ə/ /dʒ/ /i:/
7	astrologer	a,s,t,r,o,l,o,g,er	/ə/ /s/ /t/ /r/ /ɒ/ /l/ /ə/ /dʒ/ /ə/

7	astronomy	a,s,t,r,o,n,o,m,y	/ə/ /s/ /t/ /r/ /ɒ/ /n/ /ə/ /m/ /i:/
7	astronomer	a,s,t,r,o,n,o,m,er	/ə/ /s/ /t/ /r/ /ɒ/ /n/ /ə/ /m/ /ə/
7	astronaut	a,s,t,r,o,n,au,t	/æ/ /s/ /t/ /r/ /ə/ /n/ /ɔ:/ /t/
7	asterisk	a,s,t,e,r,i,s,k	/æ/ /s/ /t/ /ə/ /r/ /ɪ/ /s/ /k/
7	stethoscope	s,t,e,th,o,s,c,o,pe	/s/ /t/ /ɛ/ /θ/ /ə/ /s/ /k/ /əʊ/ /p/
7	telescope	t,e,l,e,s,c,o,pe	/t/ /ɛ/ /l/ /ɪ/ /s/ /k/ /əʊ/ /p/
7	gyroscope	g,y,r,o,s,c,o,pe	/dʒ/ /aɪ/ /r/ /ə/ /s/ /k/ /əʊ/ /p/
7	periscope	p,e,r,i,s,c,o,pe	/p/ /ɛ/ /r/ /ɪ/ /s/ /k/ /əʊ/ /p/
7	kaleidoscope	k,a,l,e,i,d,o,s,c,o,pe	/k/ /ə/ /l/ /aɪ/ /d/ /ə/ /s/ /k/ /əʊ/ /p/
7	horoscope	h,o,r,o,s,c,o,pe	/h/ /ɒ/ /r/ /ə/ /s/ /k/ /əʊ/ /p/
7	hydrant	h,y,d,r,a,n,t	/h/ /aɪ/ /d/ /r/ /ə/ /n/ /t/
7	hydrotherapy	h,y,d,r,o,th,e,r,a,p,y	/h/ /aɪ/ /d/ /r/ /əʊ/ /θ/ /ɛ/ /r/ /ə/ /p/ /i:/
7	dehydrate	d,e,h,y,d,r,a,te	/d/ /i:/ /h/ /aɪ/ /d/ /r/ /eɪ/ /t/
7	rehydrate	r,e,h,y,d,r,a,te	/r/ /i:/ /h/ /aɪ/ /d/ /r/ /eɪ/ /t/
7	hydration	h,y,d,r,a,t,i,o,n	/h/ /aɪ/ /d/ /r/ /eɪ/ /ʃ/ /ə/ /n/
7	hydroponics	h,y,d,r,o,p,o,n,i,c,s	/h/ /aɪ/ /d/ /r/ /əʊ/ /p/ /ɒ/ /n/ /ɪ/ /k/ /s/
7	hydrolysis	h,y,d,r,o,l,y,s,i,s	/h/ /aɪ/ /d/ /r/ /ɒ/ /l/ /ɪ/ /s/ /ɪ/ /s/
7	praiseworthy	p,r,ai,se,w,or,th,y	/p/ /r/ /eɪ/ /z/ /w/ /ɜ:/ /ð/ /i:/
7	afterthought	a,f,t,er,th,ough,t	/ɑ:/ /f/ /t/ /ə/ /θ/ /ɔ:/ /t/
7	commonplace	c,o,m,m,o,n,p,l,a,ce	/k/ /ɒ/ /m/ /ə/ /n/ /p/ /l/ /eɪ/ /s/
7	pigeonhole	p,i,g,ee,n,h,o,le	/p/ /ɪ/ /dʒ/ /ɛ/ /n/ /h/ /əʊ/ /l/
7	underground	u,n,d,er,g,r,ou,n,d	/ʌ/ /n/ /d/ /ə/ /g/ /r/ /aʊ/ /n/ /d/
7	masterpiece	m,a,s,t,er,p,ie,ce	/m/ /ɑ:/ /s/ /t/ /ə/ /p/ /i:/ /s/
7	checkerboard	ch,e,ck,er,b,oa,r,d	/tʃ/ /ɛ/ /k/ /ə/ /b/ /ɔ:/ /d/
7	troublemaker	t,r,ou,b,le,m,a,k,er	/t/ /r/ /ʌ/ /b/ /l/ /m/ /eɪ/ /k/ /ə/
7	firefighter	f,i,re,f,igh,t,er	/f/ /aɪ/ /ə/ /f/ /aɪ/ /t/ /ə/
7	paperback	p,a,p,er,b,a,ck	/p/ /eɪ/ /p/ /ə/ /b/ /æ/ /k/
7	proactive	p,r,o,a,c,t,i,ve	/p/ /r/ /əʊ/ /æ/ /k/ /t/ /ɪ/ /v/
7	pronoun	p,r,o,n,ou,n	/p/ /r/ /əʊ/ /n/ /aʊ/ /n/
7	prognosis	p,r,o,g,n,o,s,i,s	/p/ /r/ /ɒ/ /g/ /n/ /əʊ/ /s/ /ɪ/ /s/
7	promotion	p,r,o,m,o,t,i,o,n	/p/ /r/ /ə/ /m/ /əʊ/ /ʃ/ /ə/ /n/
7	projection	p,r,o,j,e,c,t,i,o,n	/p/ /r/ /ə/ /dʒ/ /ɛ/ /k/ /ʃ/ /ə/ /n/
7	foreshadow	f,ore,sh,a,d,ow	/f/ /ɔ:/ /ʃ/ /æ/ /d/ /əʊ/
7	foreground	f,ore,g,r,ou,n,d	/f/ /ɔ:/ /g/ /r/ /aʊ/ /n/ /d/
7	forethought	f,ore,th,ough,t	/f/ /ɔ:/ /θ/ /ɔ:/ /t/
7	forefinger	f,ore,f,i,n,g,er	/f/ /ɔ:/ /f/ /ɪ/ /ŋ/ /g/ /ə/
7	forecast	f,ore,c,a,s,t	/f/ /ɔ:/ /k/ /ɑ:/ /s/ /t/
7	dependable	d,e,p,e,n,d,a,b,le	/d/ /ɪ/ /p/ /ɛ/ /n/ /d/ /ə/ /b/ /l/
7	agreeable	a,g,r,ee,a,b,le	/ə/ /g/ /r/ /i:/ /ə/ /b/ /l/
7	believable	b,e,l,i,e,v,a,b,le	/b/ /ɪ/ /l/ /i:/ /v/ /ə/ /b/ /l/
7	disposable	d,i,s,p,o,s,a,b,le	/d/ /ɪ/ /s/ /p/ /əʊ/ /z/ /ə/ /b/ /l/
7	identifiable	i,d,e,n,t,i,f,i,a,b,le	/aɪ/ /d/ /ɛ/ /n/ /t/ /ɪ/ /f/ /aɪ/ /ə/ /b/ /l/
7	variable	v,a,r,i,a,b,le	/v/ /eə/ /r/ /ɪ/ /ə/ /b/ /l/
7	pliable	p,l,i,a,b,le	/p/ /l/ /aɪ/ /ə/ /b/ /l/

7	audible	au,d,i,b,le	/ɔ:/ /d/ /ə/ /b/ /l/
7	credible	c,r,e,d,i,b,le	/k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
7	responsible	r,e,s,p,o,n,s,i,b,le	/r/ /ɪ/ /s/ /p/ /ɒ/ /n/ /s/ /ə/ /b/ /l/
7	procession	p,r,o,c,e,ss,i,o,n	/p/ /r/ /ə/ /s/ /ɛ/ /ʃ/ /ə/ /n/
7	precision	p,r,e,c,i,s,i,o,n	/p/ /r/ /ɪ/ /s/ /ɪ/ /z/ /ə/ /n/
7	creation	c,r,e,a,t,i,o,n	/k/ /r/ /i:/ /eɪ/ /ʃ/ /ə/ /n/
7	graduation	g,r,a,d,u,a,t,i,o,n	/g/ /r/ /æ/ /d/ /y/ /eɪ/ /ʃ/ /ə/ /n/
7	expulsion	e,x,p,u,l,s,i,o,n	/ɪ/ /x/ /p/ /ʌ/ /l/ /ʃ/ /ə/ /n/
7	easier	ea,s,i,er	/i:/ /z/ /ɪ/ /ə/
7	noisier	n,oi,s,i,er	/n/ /ɔɪ/ /z/ /ɪ/ /ə/
7	busiest	b,u,s,i,e,s,t	/b/ /ɪ/ /z/ /ɪ/ /ɛ/ /s/ /t/
7	funniest	f,u,nn,i,e,s,t	/f/ /ʌ/ /n/ /ɪ/ /ɛ/ /s/ /t/
7	heaviest	h,ea,v,i,e,s,t	/h/ /ɛ/ /v/ /ɪ/ /ɛ/ /s/ /t/
7	microphone	m,i,c,r,o,ph,o,ne	/m/ /aɪ/ /k/ /r/ /ə/ /f/ /əʊ/ /n/
7	microscope	m,i,c,r,o,s,c,o,pe	/m/ /aɪ/ /k/ /r/ /ə/ /s/ /k/ /əʊ/ /p/
7	microwave	m,i,c,r,o,w,a,ve	/m/ /aɪ/ /k/ /r/ /əʊ/ /w/ /eɪ/ /v/
7	megapixel	m,e,g,a,p,i,x,e,l	/m/ /ɛ/ /g/ /ə/ /p/ /ɪ/ /x/ /ɪ/ /l/
7	megaphone	m,e,g,a,ph,o,ne	/m/ /ɛ/ /g/ /ə/ /f/ /əʊ/ /n/
7	megabit	m,e,g,a,b,i,t	/m/ /ɛ/ /g/ /ə/ /b/ /ɪ/ /t/
7	superficial	s,u,p,e,r,f,i,c,i,a,l	/s/ /u:/ /p/ /ə/ /f/ /ɪ/ /ʃ/ /ə/ /l/
7	supersonic	s,u,p,e,r,s,o,n,i,c	/s/ /u:/ /p/ /ə/ /s/ /ɒ/ /n/ /ɪ/ /k/
7	superlative	s,u,p,e,r,l,a,t,i,ve	/s/ /u:/ /p/ /ɜ:/ /l/ /ə/ /t/ /ɪ/ /v/
7	hyperlink	h,y,p,e,r,l,i,n,k	/h/ /aɪ/ /p/ /ə/ /l/ /ɪ/ /ŋ/ /k/
7	hyperactive	h,y,p,e,r,a,c,t,i,ve	/h/ /aɪ/ /p/ /ə/ /æ/ /k/ /t/ /ɪ/ /v/
7	hyperthermia	h,y,p,e,r,t,h,e,r,m,i,a	/h/ /aɪ/ /p/ /ə/ /θ/ /ɜ:/ /m/ /ɪ/ /ə/
7	monorail	m,o,n,o,r,a,i,l	/m/ /ɒ/ /n/ /əʊ/ /r/ /eɪ/ /l/
7	monogram	m,o,n,o,g,r,a,m	/m/ /ɒ/ /n/ /ə/ /g/ /r/ /æ/ /m/
7	unicycle	u,n,i,c,y,c,le	/u:/ /n/ /ɪ/ /s/ /aɪ/ /k/ /l/
7	uniform	u,n,i,f,o,r,m	/y/ /n/ /ɪ/ /f/ /ɔ:/ /m/
7	binoculars	b,i,n,o,c,u,l,a,r,s	/b/ /ɪ/ /n/ /ɒ/ /k/ /y/ /l/ /ə/ /z/
7	bifocals	b,i,f,o,c,a,l,s	/b/ /aɪ/ /f/ /əʊ/ /k/ /ə/ /l/ /z/
7	trilogy	t,r,i,l,o,g,y	/t/ /r/ /ɪ/ /l/ /ə/ /dʒ/ /i:/
7	triathlon	t,r,i,a,t,h,l,o,n	/t/ /r/ /aɪ/ /æ/ /θ/ /l/ /ɒ/ /n/
7	patients	p,a,t,i,e,n,t,s	/p/ /eɪ/ /ʃ/ /ɛ/ /n/ /t/ /s/
7	patience	p,a,t,i,e,n,ce	/p/ /eɪ/ /ʃ/ /ɛ/ /n/ /s/
7	stationary	s,t,a,t,i,o,n,a,r,y	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
7	stationery	s,t,a,t,i,o,n,e,r,y	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /r/ /i:/
7	council	c,o,u,n,c,i,l	/k/ /aʊ/ /n/ /s/ /ə/ /l/
7	counsel	c,o,u,n,s,e,l	/k/ /aʊ/ /n/ /s/ /ə/ /l/
7	morning	m,o,r,n,i,n,g	/m/ /ɔ:/ /n/ /ɪ/ /ŋ/
7	mourning	m,o,u,r,n,i,n,g	/m/ /ɔ:/ /n/ /ɪ/ /ŋ/
7	wait	w,a,i,t	/w/ /eɪ/ /t/
7	weight	w,eigh,t	/w/ /eɪ/ /t/
7	incite	i,n,c,i,t,e	/ɪ/ /n/ /s/ /aɪ/ /t/

7	insight	i,n,s,igh,t	/ɪ/ /n/ /s/ /aɪ/ /t/
7	lesson	l,e,ss,on	/l/ /ɛ/ /s/ /n/
7	lessen	l,e,ss,en	/l/ /ɛ/ /s/ /n/
7	naval	n,a,v,a,l	/n/ /eɪ/ /v/ /ə/ /l/
7	navel	n,a,v,e,l	/n/ /eɪ/ /v/ /ə/ /l/
7	suite	s,u,i,te	/s/ /w/ /i:/ /t/
7	sweet	s,w,ee,t	/s/ /w/ /i:/ /t/
7	paws	p,aw,s	/p/ /ɔ:/ /z/
7	pause	p,au,se	/p/ /ɔ:/ /z/
7	annoyed	a,nn,oy,ed	/ə/ /n/ /ɔɪ/ /d/
7	essence	e,ss,en,ce	/ɛ/ /s/ /n/ /s/
7	fossil	f,o,ss,il	/f/ /ɒ/ /s/ /l/
7	discussed	d,i,s,c,u,ss,ed	/d/ /ɪ/ /s/ /k/ /ʌ/ /s/ /t/
7	successful	s,u,c,c,e,ss,f,u,l	/s/ /ə/ /k/ /s/ /ɛ/ /s/ /f/ /ʊ/ /l/
7	moment	m,o,m,e,n,t	/m/ /əʊ/ /m/ /ə/ /n/ /t/
7	vacant	v,a,c,a,n,t	/v/ /eɪ/ /k/ /ə/ /n/ /t/
7	sequel	s,e,q,u,e,l	/s/ /i:/ /k/ /w/ /ə/ /l/
7	chosen	ch,o,s,en	/tʃ/ /əʊ/ /z/ /n/
7	flavour	f,l,a,v,our	/f/ /l/ /eɪ/ /v/ /ə/
7	population	p,o,p,u,l,a,t,i,o,n	/p/ /ɒ/ /p/ /y/ /l/ /eɪ/ /ʃ/ /ə/ /n/
7	regulation	r,e,g,u,l,a,t,i,o,n	/r/ /ɛ/ /g/ /y/ /l/ /eɪ/ /ʃ/ /ə/ /n/
7	international	i,n,t,er,n,a,t,i,o,n,al	/ɪ/ /n/ /t/ /z:/ /n/ /æ/ /ʃ/ /ə/ /n/ /l/
7	planetarium	p,l,a,n,e,t,a,r,i,u,m	/p/ /l/ /æ/ /n/ /ɪ/ /t/ /eə/ /r/ /ɪ/ /ə/ /m/
7	constitution	c,o,n,s,t,i,t,u,t,i,o,n	/k/ /ɒ/ /n/ /s/ /t/ /ɪ/ /t/ /y/ /ʃ/ /ə/ /n/
7	imitation	i,m,i,t,a,t,i,o,n	/ɪ/ /m/ /ɪ/ /t/ /eɪ/ /ʃ/ /ə/ /n/
7	diagnosis	d,i,a,g,n,o,s,i,s	/d/ /aɪ/ /ə/ /g/ /n/ /əʊ/ /s/ /ɪ/ /s/
7	prehistoric	p,r,e,h,i,s,t,o,r,i,c	/p/ /r/ /i:/ /h/ /ɪ/ /s/ /t/ /ɒ/ /r/ /ɪ/ /k/
7	declaration	d,e,c,l,a,r,a,t,i,o,n	/d/ /ɛ/ /k/ /l/ /ə/ /r/ /eɪ/ /ʃ/ /ə/ /n/
7	integrated	i,n,t,e,g,r,a,t,e,d	/ɪ/ /n/ /t/ /ɪ/ /g/ /r/ /eɪ/ /t/ /ɪ/ /d/
7	pamphlet	p,a,m,ph,l,e,t	/p/ /æ/ /m/ /f/ /l/ /ɪ/ /t/
7	silhouette	s,i,lh,ou,e,tte	/s/ /ɪ/ /l/ /əʊ/ /ɛ/ /t/
7	liaison	l,i,ai,s,o,n	/l/ /i:/ /eɪ/ /z/ /ɒ/ /n/
7	souvenir	s,ou,v,e,n,i,r	/s/ /u:/ /v/ /ə/ /n/ /ɪ/ /ə/
7	restaurant	r,e,s,t,au,r,a,n,t	/r/ /ɛ/ /s/ /t/ /ɒ/ /r/ /ɒ/ /n/ /t/
7	definitely	d,e,f,i,n,i,t,e,l,y	/d/ /ɛ/ /f/ /ɪ/ /n/ /ɪ/ /t/ /l/ /i:/
7	campaign	c,a,m,p,ai,gn	/k/ /æ/ /m/ /p/ /eɪ/ /n/
7	kindergarten	k,i,n,d,er,g,ar,t,en	/k/ /ɪ/ /n/ /d/ /ə/ /g/ /ɑ:/ /t/ /n/
7	bureaucracy	b,ure,au,c,r,a,c,y	/b/ /ʊə/ /ɒ/ /k/ /r/ /ə/ /s/ /i:/
7	phenomenal	ph,e,n,o,m,e,n,al	/f/ /ɪ/ /n/ /ɒ/ /m/ /ɪ/ /n/ /l/
7	camouflage	c,a,m,ou,f,l,a,ge	/k/ /æ/ /m/ /ʊ/ /f/ /l/ /ɑ:/ /z/
7	overwhelmed	o,v,er,wh,e,l,m,ed	/əʊ/ /v/ /ə/ /w/ /ɛ/ /l/ /m/ /d/
7	councillor	c,ou,n,c,i,ll,or	/k/ /aʊ/ /n/ /s/ /ə/ /l/ /ə/
7	efficient	e,ff,i,c,i,e,n,t	/ɪ/ /f/ /ɪ/ /ʃ/ /ɛ/ /n/ /t/
7	accommodate	a,cc,o,mm,o,d,a,te	/ə/ /k/ /ɒ/ /m/ /ə/ /d/ /eɪ/ /t/

7	miscellaneous	m,i,sc,e,ll,a,n,e,ou,s	/m/ /ɪ/ /s/ /ə/ /l/ /eɪ/ /n/ /ɪ/ /ʌ/ /s/
7	licence	l,i,c,e,n,ce	/l/ /aɪ/ /s/ /ə/ /n/ /s/
7	negotiate	n,e,g,o,t,i,a,te	/n/ /ɪ/ /g/ /əʊ/ /ʃ/ /i:/ /eɪ/ /t/
7	nausea	n,au,s,e,a	/n/ /ɔ:/ /z/ /ɪ/ /ə/
7	maintenance	m,ai,n,t,e,n,a,n,ce	/m/ /eɪ/ /n/ /t/ /ə/ /n/ /ə/ /n/ /s/
7	adjourn	a,dj,our,n	/ə/ /dʒ/ /ɜ:/ /n/
7	adjoining	a,dj,oi,n,i,ng	/ə/ /dʒ/ /ɔɪ/ /n/ /ɪ/ /ŋ/
7	attention	a,tt,e,n,t,i,o,n	/ə/ /t/ /ɛ/ /n/ /ʃ/ /ə/ /n/
7	attribute	a,tt,r,i,b,u,te	/æ/ /t/ /r/ /ɪ/ /b/ /u:/ /t/
7	accumulate	a,cc,u,m,u,l,a,te	/ə/ /k/ /u:/ /m/ /ʊ/ /l/ /eɪ/ /t/
7	accompany	a,cc,o,m,p,a,n,y	/ə/ /k/ /ʌ/ /m/ /p/ /ə/ /n/ /i:/
7	appropriate	a,pp,r,o,p,r,i,a,te	/ə/ /p/ /r/ /əʊ/ /p/ /r/ /ɪ/ /ə/ /t/
7	appreciate	a,pp,r,e,c,i,a,te	/ə/ /p/ /r/ /i:/ /ʃ/ /i:/ /eɪ/ /t/
7	dissatisfied	d,i,s,s,a,t,i,s,f,i,e,d	/d/ /ɪ/ /s/ /s/ /æ/ /t/ /ɪ/ /s/ /f/ /aɪ/ /d/
7	disorientated	d,i,s,o,r,i,e,n,t,a,t,e,d	/d/ /ɪ/ /s/ /ɒ/ /r/ /ɪ/ /ə/ /n/ /t/ /eɪ/ /t/ /ɪ/ /d/
7	differentiate	d,i,ff,e,r,e,n,t,i,a,te	/d/ /ɪ/ /f/ /ə/ /r/ /ɛ/ /n/ /ʃ/ /i:/ /eɪ/ /t/
7	difficulty	d,i,ff,i,c,u,l,t,y	/d/ /ɪ/ /f/ /ɪ/ /k/ /ə/ /l/ /t/ /i:/
7	inefficient	i,n,e,ff,i,c,i,e,n,t	/ɪ/ /n/ /ɪ/ /f/ /ɪ/ /ʃ/ /ɛ/ /n/ /t/
7	inaccurate	i,n,a,cc,u,r,a,te	/ɪ/ /n/ /æ/ /k/ /ɹ/ /r/ /ɪ/ /t/
7	illogical	i,ll,o,g,i,c,a,l	/ɪ/ /l/ /ɒ/ /dʒ/ /ɪ/ /k/ /ə/ /l/
7	illegible	i,ll,e,g,i,b,le	/ɪ/ /l/ /ɛ/ /dʒ/ /ə/ /b/ /l/
7	impossible	i,m,p,o,ss,i,b,le	/ɪ/ /m/ /p/ /ɒ/ /s/ /ə/ /b/ /l/
7	immaterial	i,mm,a,t,e,r,i,a,l	/ɪ/ /m/ /ə/ /t/ /ɪə/ /r/ /ɪ/ /ə/ /l/
7	irreplaceable	i,rr,e,p,l,a,ce,a,b,le	/ɪ/ /r/ /ɪ/ /p/ /l/ /eɪ/ /s/ /ə/ /b/ /l/
7	irrelevant	i,rr,e,l,e,v,a,n,t	/ɪ/ /r/ /ɛ/ /l/ /ɪ/ /v/ /ə/ /n/ /t/
7	obligation	o,b,l,i,g,a,t,i,o,n	/ɒ/ /b/ /l/ /ɪ/ /g/ /eɪ/ /ʃ/ /ə/ /n/
7	obscure	o,b,s,c,ure	/ə/ /b/ /s/ /k/ /ʊə/
7	oblivious	o,b,l,i,v,i,ou,s	/ə/ /b/ /l/ /ɪ/ /v/ /ɪ/ /ə/ /s/
7	opponent	o,pp,o,n,e,n,t	/ə/ /p/ /əʊ/ /n/ /ə/ /n/ /t/
7	opposition	o,pp,o,s,i,t,i,o,n	/ɒ/ /p/ /ə/ /z/ /ɪ/ /ʃ/ /ə/ /n/
7	opportunity	o,pp,or,t,u,n,i,t,y	/ɒ/ /p/ /ə/ /t/ /u:/ /n/ /ɪ/ /t/ /i:/
7	offensive	o,ff,e,n,s,i,ve	/ə/ /f/ /ɛ/ /n/ /s/ /ɪ/ /v/
7	officious	o,ff,i,c,iou,s	/ə/ /f/ /ɪ/ /ʃ/ /ʌ/ /s/
7	occurrence	o,cc,u,rr,e,n,ce	/ə/ /k/ /ʌ/ /r/ /ə/ /n/ /s/
7	occasion	o,cc,a,s,i,o,n	/ə/ /k/ /eɪ/ /z/ /ə/ /n/
7	occupation	o,cc,u,p,a,t,i,o,n	/ɒ/ /k/ /ɹ/ /p/ /eɪ/ /ʃ/ /ə/ /n/
7	community	c,o,mm,u,n,i,t,y	/k/ /ə/ /m/ /ɹ/ /n/ /ɪ/ /t/ /i:/
7	companion	c,o,m,p,a,n,i,o,n	/k/ /ə/ /m/ /p/ /æ/ /n/ /j/ /ə/ /n/
7	collaborate	c,o,ll,a,b,o,r,a,te	/k/ /ə/ /l/ /æ/ /b/ /ə/ /r/ /eɪ/ /t/
7	colleague	c,o,ll,ea,gue	/k/ /ɒ/ /l/ /i:/ /g/
7	colloquial	c,o,ll,o,q,u,i,a,l	/k/ /ə/ /l/ /əʊ/ /k/ /w/ /ɪ/ /ə/ /l/
7	condense	c,o,n,d,e,n,se	/k/ /ə/ /n/ /d/ /ɛ/ /n/ /s/
7	conspire	c,o,n,s,p,i,re	/k/ /ə/ /n/ /s/ /p/ /aɪ/ /ə/
7	coordinate	c,o,or,d,in,a,te	/k/ /əʊ/ /ɔ:/ /d/ /n/ /eɪ/ /t/

7	cooperate	c,o,o,p,e,r,a,te	/k/ /əʊ/ /ɒ/ /p/ /ə/ /r/ /eɪ/ /t/
7	customary	c,u,s,t,o,m,a,r,y	/k/ /ʌ/ /s/ /t/ /ə/ /m/ /eə/ /r/ /i:/
7	hereditary	h,e,r,e,d,i,t,a,r,y	/h/ /ɪ/ /r/ /ɛ/ /d/ /ɪ/ /t/ /r/ /i:/
7	necessary	n,e,c,e,ss,a,r,y	/n/ /ɛ/ /s/ /ɪ/ /s/ /r/ /i:/
7	documentary	d,o,c,u,m,e,n,t,a,r,y	/d/ /ɒ/ /k/ /ɹ/ /m/ /ɛ/ /n/ /t/ /ə/ /r/ /i:/
7	glossary	g,l,o,ss,a,r,y	/g/ /l/ /ɒ/ /s/ /ə/ /r/ /i:/
7	cemetery	c,e,m,e,t,e,r,y	/s/ /ɛ/ /m/ /ɪ/ /t/ /r/ /i:/
7	confectionery	c,o,n,f,e,c,t,i,o,n,e,r,y	/k/ /ə/ /n/ /f/ /ɛ/ /k/ /ʃ/ /ə/ /n/ /r/ /i:/
7	mandatory	m,a,n,d,a,t,o,r,y	/m/ /æ/ /n/ /d/ /ə/ /t/ /ɔ:/ /r/ /i:/
7	laboratory	l,a,b,o,r,a,t,o,r,y	/l/ /ə/ /b/ /ɒ/ /r/ /ə/ /t/ /ɔ:/ /r/ /i:/
7	territory	t,e,r,r,i,t,o,r,y	/t/ /ɛ/ /r/ /ɪ/ /t/ /ɔ:/ /r/ /i:/
7	relevant	r,e,l,e,v,a,n,t	/r/ /ɛ/ /l/ /ɪ/ /v/ /ə/ /n/ /t/
7	relevance	r,e,l,e,v,a,n,ce	/r/ /ɛ/ /l/ /ɪ/ /v/ /ə/ /n/ /s/
7	relevancy	r,e,l,e,v,a,n,c,y	/r/ /ɛ/ /l/ /ɪ/ /v/ /ə/ /n/ /s/ /i:/
7	competent	c,o,m,p,e,t,e,n,t	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ə/ /n/ /t/
7	competence	c,o,m,p,e,t,e,n,ce	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ə/ /n/ /s/
7	competency	c,o,m,p,e,t,e,n,c,y	/k/ /ɒ/ /m/ /p/ /ɪ/ /t/ /ə/ /n/ /s/ /i:/
7	dominant	d,o,m,i,n,a,n,t	/d/ /ɒ/ /m/ /ɪ/ /n/ /ə/ /n/ /t/
7	dominance	d,o,m,i,n,a,n,ce	/d/ /ɒ/ /m/ /ɪ/ /n/ /ə/ /n/ /s/
7	fluorescent	f,l,u,o,r,e,s,c,e,n,t	/f/ /l/ /ʊə/ /r/ /ɛ/ /s/ /ə/ /n/ /t/
7	fluorescence	f,l,u,o,r,e,s,c,e,n,ce	/f/ /l/ /ʊə/ /r/ /ɛ/ /s/ /ə/ /n/ /s/
9	meter	m,e,t,e,r	/m/ /i:/ /t/ /ə/
9	perimeter	p,e,r,i,m,e,t,e,r	/p/ /ə/ /r/ /ɪ/ /m/ /ɪ/ /t/ /ə/
9	diameter	d,i,a,m,e,t,e,r	/d/ /aɪ/ /æ/ /m/ /ɪ/ /t/ /ə/
9	thermometer	th,e,r,m,o,m,e,t,e,r	/θ/ /ə/ /m/ /ɒ/ /m/ /ɪ/ /t/ /ə/
9	barometer	b,a,r,o,m,e,t,e,r	/b/ /ə/ /r/ /ɒ/ /m/ /ɪ/ /t/ /ə/
9	metre	m,e,t,r,e	/m/ /i:/ /t/ /ə/
9	centimetre	c,e,n,t,i,m,e,t,r,e	/s/ /ɛ/ /n/ /t/ /ɪ/ /m/ /i:/ /t/ /ə/
9	millimetre	m,i,l,l,i,m,e,t,r,e	/m/ /ɪ/ /l/ /ɪ/ /m/ /i:/ /t/ /ə/
9	kilometre	k,i,l,o,m,e,t,r,e	/k/ /ɪ/ /l/ /əʊ/ /m/ /i:/ /t/ /ə/
9	decimetre	d,e,c,i,m,e,t,r,e	/d/ /ɛ/ /s/ /ɪ/ /m/ /i:/ /t/ /ə/
9	biography	b,i,o,g,r,a,p,h,y	/b/ /aɪ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
9	biology	b,i,o,l,o,g,y	/b/ /aɪ/ /ɒ/ /l/ /ə/ /dʒ/ /i:/
9	antibiotic	a,n,t,i,b,i,o,t,i,c	/æ/ /n/ /t/ /ɪ/ /b/ /aɪ/ /ɒ/ /t/ /ɪ/ /k/
9	biodegradable	b,i,o,d,e,g,r,a,d,a,b,le	/b/ /aɪ/ /əʊ/ /d/ /ɪ/ /g/ /r/ /eɪ/ /d/ /ə/ /b/ /l/
9	symbiotic	s,y,m,b,i,o,t,i,c	/s/ /ɪ/ /m/ /b/ /aɪ/ /ɒ/ /t/ /ɪ/ /k/
9	psychology	ps,y,ch,o,l,o,g,y	/s/ /aɪ/ /k/ /ɒ/ /l/ /ə/ /dʒ/ /i:/
9	psychiatry	ps,y,ch,i,a,t,r,y	/s/ /aɪ/ /k/ /aɪ/ /ə/ /t/ /r/ /i:/
9	physical	ph,y,s,i,c,a,l	/f/ /ɪ/ /z/ /ɪ/ /k/ /ə/ /l/
9	physician	ph,y,s,i,c,i,a,n	/f/ /ɪ/ /z/ /ɪ/ /ʃ/ /ə/ /n/
9	physiotherapy	ph,y,s,i,o,t,h,e,r,a,p,y	/f/ /ɪ/ /z/ /ɪ/ /əʊ/ /θ/ /ɛ/ /r/ /ə/ /p/ /i:/
9	phonics	ph,o,n,i,c,s	/f/ /ɒ/ /n/ /ɪ/ /k/ /s/
9	earphone	ear,ph,o,ne	/ɪə/ /f/ /əʊ/ /n/
9	homophone	h,o,m,o,ph,o,ne	/h/ /ɒ/ /m/ /əʊ/ /f/ /əʊ/ /n/

9	microphone	m,i,c,r,o,ph,o,ne	/m/ /aɪ/ /k/ /r/ /ə/ /f/ /əʊ/ /n/
9	telephone	t,e,l,e,ph,o,ne	/t/ /ɛ/ /l/ /ɪ/ /f/ /əʊ/ /n/
9	symphony	s,y,m,ph,o,n,y	/s/ /ɪ/ /m/ /f/ /ə/ /n/ /i:/
9	dialogue	d,i,a,l,o,gue	/d/ /aɪ/ /ə/ /l/ /ə/ /g/
9	prologue	p,r,o,l,o,gue	/p/ /r/ /əʊ/ /l/ /ə/ /g/
9	epilogue	e,p,i,l,o,gue	/ɛ/ /p/ /ɪ/ /l/ /ə/ /g/
9	monologue	m,o,n,o,l,o,gue	/m/ /ə/ /n/ /ə/ /l/ /ə/ /g/
9	biology	b,i,o,l,o,g,y	/b/ /aɪ/ /ə/ /l/ /ə/ /dʒ/ /i:/
9	ecology	e,c,o,l,o,g,y	/ɪ/ /k/ /ə/ /l/ /ə/ /dʒ/ /i:/
9	etymology	e,t,y,m,o,l,o,g,y	/ɛ/ /t/ /ɪ/ /m/ /ə/ /l/ /ə/ /dʒ/ /i:/
9	technology	t,e,ch,n,o,l,o,g,y	/t/ /ɛ/ /k/ /n/ /ə/ /l/ /ə/ /dʒ/ /i:/
9	democracy	d,e,m,o,c,r,a,c,y	/d/ /ɪ/ /m/ /ə/ /k/ /r/ /ə/ /s/ /i:/
9	democratic	d,e,m,o,c,r,a,t,i,c	/d/ /ɛ/ /m/ /ə/ /k/ /r/ /æ/ /t/ /ɪ/ /k/
9	epidemic	e,p,i,d,e,m,i,c	/ɛ/ /p/ /ɪ/ /d/ /ɛ/ /m/ /ɪ/ /k/
9	demographics	d,e,m,o,g,r,a,ph,i,c,s	/d/ /ɛ/ /m/ /ə/ /g/ /r/ /æ/ /f/ /ɪ/ /k/ /s/
9	geology	g,e,o,l,o,g,y	/dʒ/ /ɪ/ /ə/ /l/ /ə/ /dʒ/ /i:/
9	geography	g,e,o,g,r,a,ph,y	/dʒ/ /ɪ/ /ə/ /g/ /r/ /ə/ /f/ /i:/
9	visibility	v,i,s,i,b,i,l,i,t,y	/v/ /ɪ/ /z/ /ɪ/ /b/ /ɪ/ /l/ /ɪ/ /t/ /i:/
9	visionary	v,i,s,i,o,n,a,r,y	/v/ /ɪ/ /z/ /ə/ /n/ /ə/ /r/ /i:/
9	supervisory	s,u,p,e,r,v,i,s,o,r,y	/s/ /u:/ /p/ /ə/ /v/ /aɪ/ /z/ /ə/ /r/ /i:/
9	visualise	v,i,s,u,a,l,i,se	/v/ /ɪ/ /z/ /j/ /ə/ /l/ /aɪ/ /z/
9	improvise	i,m,p,r,o,v,i,se	/ɪ/ /m/ /p/ /r/ /ə/ /v/ /aɪ/ /z/
9	provide	p,r,o,v,i,de	/p/ /r/ /ə/ /v/ /aɪ/ /d/
9	evident	e,v,i,d,e,n,t	/ɛ/ /v/ /ɪ/ /d/ /ə/ /n/ /t/
9	evidence	e,v,i,d,e,n,ce	/ɛ/ /v/ /ɪ/ /d/ /ə/ /n/ /s/
9	literature	l,i,t,e,r,a,t,ure	/l/ /ɪ/ /t/ /ə/ /r/ /ɪ/ /tʃ/ /ə/
9	alliteration	a,ll,i,t,e,r,a,t,i,o,n	/ə/ /l/ /ɪ/ /t/ /ə/ /r/ /eɪ/ /ʃ/ /ə/ /n/
9	literal	l,i,t,e,r,a,l	/l/ /ɪ/ /t/ /ə/ /r/ /ə/ /l/
9	literacy	l,i,t,e,r,a,c,y	/l/ /ɪ/ /t/ /ə/ /r/ /ə/ /s/ /i:/
9	judge	j,u,dge	/dʒ/ /ʌ/ /dʒ/
9	adjudicate	a,dj,u,d,i,c,a,te	/ə/ /dʒ/ /u:/ /d/ /ɪ/ /k/ /eɪ/ /t/
9	prejudice	p,r,e,j,u,d,i,ce	/p/ /r/ /ɛ/ /dʒ/ /ʊ/ /d/ /ɪ/ /s/
9	script	s,c,r,i,p,t	/s/ /k/ /r/ /ɪ/ /p/ /t/
9	scribble	s,c,r,i,bb,le	/s/ /k/ /r/ /ɪ/ /b/ /l/
9	prescription	p,r,e,s,c,r,i,p,t,i,o,n	/p/ /r/ /ɪ/ /s/ /k/ /r/ /ɪ/ /p/ /ʃ/ /ə/ /n/
9	postscript	p,o,s,t,s,c,r,i,p,t	/p/ /əʊ/ /s/ /t/ /s/ /k/ /r/ /ɪ/ /p/ /t/
9	manuscript	m,a,n,u,s,c,r,i,p,t	/m/ /æ/ /n/ /y/ /s/ /k/ /r/ /ɪ/ /p/ /t/
9	design	d,e,s,i,gn	/d/ /ɪ/ /z/ /aɪ/ /n/
9	designated	d,e,s,i,g,n,a,t,e,d	/d/ /ɛ/ /z/ /ɪ/ /g/ /n/ /eɪ/ /t/ /ɪ/ /d/
9	muscle	m,u,sc,le	/m/ /ʌ/ /s/ /l/
9	muscular	m,u,s,c,u,l,ar	/m/ /ʌ/ /s/ /k/ /y/ /l/ /ə/
9	condemn	c,o,n,d,e,mn	/k/ /ə/ /n/ /d/ /ɛ/ /m/
9	condemnation	c,o,n,d,e,m,n,a,t,i,o,n	/k/ /ə/ /n/ /d/ /ɛ/ /m/ /n/ /eɪ/ /ʃ/ /ə/ /n/
9	moisten	m,oi,st,en	/m/ /ɔɪ/ /s/ /n/

9	moist	m,oi,s,t	/m/ /ɔɪ/ /s/ /t/
9	fasten	f,a,st,en	/f/ /ɑ:/ /s/ /n/
9	fast	f,a,s,t	/f/ /ɑ:/ /s/ /t/
9	hasten	h,a,st,en	/h/ /eɪ/ /s/ /n/
9	haste	h,a,s,te	/h/ /eɪ/ /s/ /t/
9	malign	m,a,l,i,gn	/m/ /ə/ /l/ /aɪ/ /n/
9	malignant	m,a,l,i,g,n,a,n,t	/m/ /ə/ /l/ /ɪ/ /g/ /n/ /ə/ /n/ /t/
9	limb	l,i,mb	/l/ /ɪ/ /m/
9	limber	l,i,m,b,er	/l/ /ɪ/ /m/ /b/ /ə/
9	sign	s,i,gn	/s/ /aɪ/ /n/
9	signature	s,i,g,n,a,t,ure	/s/ /ɪ/ /g/ /n/ /ɪ/ /tʃ/ /ə/
9	autumn	au,t,u,mn	/ɔ:/ /t/ /ə/ /m/
9	autumnal	au,t,u,m,n,a,l	/ɔ:/ /t/ /ʌ/ /m/ /n/ /ə/ /l/
9	pneumonia	pn,eu,m,o,n,i,a	/n/ /u:/ /m/ /əʊ/ /n/ /ɪ/ /ə/
9	pneumatic	pn,eu,m,a,t,i,c	/n/ /y/ /m/ /æ/ /t/ /ɪ/ /k/
9	rhapsody	rh,a,p,s,o,d,y	/r/ /æ/ /p/ /s/ /ə/ /d/ /i:/
9	rhizome	rh,i,z,o,me	/r/ /aɪ/ /z/ /əʊ/ /m/
9	rhetorical	rh,e,t,o,r,i,c,a,l	/r/ /ɪ/ /t/ /ɒ/ /r/ /ɪ/ /k/ /ə/ /l/
9	rhubarb	rh,u,b,ar,b	/r/ /u:/ /b/ /ɑ:/ /b/
9	rhombus	rh,o,m,b,u,s	/r/ /ɒ/ /m/ /b/ /ə/ /s/
9	rhyme	rh,y,me	/r/ /aɪ/ /m/
9	rhythm	rh,y,th,m	/r/ /ɪ/ /ð/ /m/
9	rheme	rh,e,me	/r/ /i:/ /m/
9	rhinoceros	rh,i,n,o,c,e,r,o,s	/r/ /aɪ/ /n/ /ɒ/ /s/ /ə/ /r/ /ə/ /s/
9	rheumatic	rh,eu,m,a,t,i,c	/r/ /u:/ /m/ /æ/ /t/ /ɪ/ /k/
9	rheumatism	rh,eu,m,a,t,i,s,m	/r/ /u:/ /m/ /ə/ /t/ /ɪ/ /z/ /m/
9	rhinestone	rh,i,ne,s,t,o,ne	/r/ /aɪ/ /n/ /s/ /t/ /əʊ/ /n/
9	pterodactyl	pt,e,r,o,d,a,c,t,y,l	/t/ /ɛ/ /r/ /ə/ /d/ /æ/ /k/ /t/ /ɪ/ /l/
9	pteranodon	pt,e,r,a,n,o,d,o,n	/t/ /ɛ/ /r/ /æ/ /n/ /ə/ /d/ /ɒ/ /n/
9	psyche	ps,y,ch,e	/s/ /aɪ/ /k/ /i:/
9	pseudonym	ps,eu,d,o,n,y,m	/s/ /u:/ /d/ /ə/ /n/ /ɪ/ /m/
9	psychologist	ps,y,ch,o,l,o,g,i,s,t	/s/ /aɪ/ /k/ /ɒ/ /l/ /ə/ /dʒ/ /ɪ/ /s/ /t/
9	psychiatrist	ps,y,ch,i,a,t,r,i,s,t	/s/ /aɪ/ /k/ /aɪ/ /ə/ /t/ /r/ /ɪ/ /s/ /t/
9	sympathy	s,y,m,p,a,th,y	/s/ /ɪ/ /m/ /p/ /ə/ /θ/ /i:/
9	empathetic	e,m,p,a,th,e,t,i,c	/ɛ/ /m/ /p/ /ə/ /θ/ /ɛ/ /t/ /ɪ/ /k/
9	pathologist	p,a,th,o,l,o,g,i,s,t	/p/ /ə/ /θ/ /ɒ/ /l/ /ə/ /dʒ/ /ɪ/ /s/ /t/
9	democrat	d,e,m,o,c,r,a,t	/d/ /ɛ/ /m/ /ə/ /k/ /r/ /æ/ /t/
9	democracy	d,e,m,o,c,r,a,c,y	/d/ /ɪ/ /m/ /ɒ/ /k/ /r/ /ə/ /s/ /i:/
9	bureaucracy	b,ure,au,c,r,a,c,y	/b/ /ʊə/ /ɒ/ /k/ /r/ /ə/ /s/ /i:/
9	grammar	g,r,a,m,m,ar	/g/ /r/ /æ/ /m/ /ə/
9	anagram	a,n,a,g,r,a,m	/æ/ /n/ /ə/ /g/ /r/ /æ/ /m/
9	paragraph	p,a,r,a,g,r,a,ph	/p/ /æ/ /r/ /ə/ /g/ /r/ /ɑ:/ /f/
9	choreograph	ch,o,r,e,o,g,r,a,ph	/k/ /ɒ/ /r/ /ɪ/ /ə/ /g/ /r/ /ɑ:/ /f/
9	venture	v,e,n,t,ure	/v/ /ɛ/ /n/ /tʃ/ /ə/

9	convention	c,o,n,v,e,n,t,i,o,n	/k/ /ə/ /n/ /v/ /ɛ/ /n/ /ʃ/ /ə/ /n/
9	souvenir	s,ou,v,e,n,i,r	/s/ /u:/ /v/ /ə/ /n/ /ɪ/ /ə/
9	convenient	c,o,n,v,e,n,i,e,n,t	/k/ /ə/ /n/ /v/ /i:/ /n/ /ɪ/ /ə/ /n/ /t/
9	venue	v,e,n,ue	/v/ /ɛ/ /n/ /y/
9	adventure	a,d,v,e,n,t,ure	/ə/ /d/ /v/ /ɛ/ /n/ /tʃ/ /ə/
9	prime	p,r,i,me	/p/ /r/ /aɪ/ /m/
9	primate	p,r,i,m,a,te	/p/ /r/ /aɪ/ /m/ /eɪ/ /t/
9	primary	p,r,i,m,a,r,y	/p/ /r/ /aɪ/ /m/ /ə/ /r/ /i:/
9	prince	p,r,i,n,ce	/p/ /r/ /ɪ/ /n/ /s/
9	principal	p,r,i,n,c,i,p,a,l	/p/ /r/ /ɪ/ /n/ /s/ /ə/ /p/ /ə/ /l/
9	principality	p,r,i,n,c,i,p,a,l,i,t,y	/p/ /r/ /ɪ/ /n/ /s/ /ɪ/ /p/ /æ/ /l/ /ɪ/ /t/ /i:/
9	terminal	t,er,m,i,n,al	/t/ /ɜ:/ /m/ /ɪ/ /n/ /l/
9	terminate	t,er,m,i,n,a,te	/t/ /ɜ:/ /m/ /ɪ/ /n/ /eɪ/ /t/
9	exterminate	e,x,t,er,m,i,n,a,te	/ɪ/ /x/ /t/ /ɜ:/ /m/ /ɪ/ /n/ /eɪ/ /t/
9	predetermine	p,r,e,d,e,t,er,m,i,ne	/p/ /r/ /i:/ /d/ /ɪ/ /t/ /ɜ:/ /m/ /ɪ/ /n/
9	proceed	p,r,o,c,ee,d	/p/ /r/ /ə/ /s/ /i:/ /d/
9	succeed	s,u,c,c,ee,d	/s/ /ə/ /k/ /s/ /i:/ /d/
9	precede	p,r,e,c,e,de	/p/ /r/ /i:/ /s/ /i:/ /d/
9	recede	r,e,c,e,de	/r/ /i:/ /s/ /i:/ /d/
9	chronic	ch,r,o,n,i,c	/k/ /r/ /ɒ/ /n/ /ɪ/ /k/
9	chronicle	ch,r,o,n,i,c,le	/k/ /r/ /ɒ/ /n/ /ɪ/ /k/ /l/
9	synchronise	s,y,n,ch,r,o,n,i,se	/s/ /ɪ/ /ŋ/ /k/ /r/ /ə/ /n/ /aɪ/ /z/
9	anachronism	a,n,a,ch,r,o,n,i,s,m	/ə/ /n/ /æ/ /k/ /r/ /ə/ /n/ /ɪ/ /z/ /m/
9	chronological	ch,r,o,n,o,l,o,g,i,c,a,l	/k/ /r/ /ɒ/ /n/ /ə/ /l/ /ɒ/ /dʒ/ /ɪ/ /k/ /ə/ /l/
9	orthopaedic	or,th,o,p,ae,d,i,c	/ɔ:/ /θ/ /əʊ/ /p/ /i:/ /d/ /ɪ/ /k/
9	orthodontist	or,th,o,d,o,n,t,i,s,t	/ɔ:/ /θ/ /ə/ /d/ /ɒ/ /n/ /t/ /ɪ/ /s/ /t/
9	orthography	or,th,o,g,r,a,ph,y	/ɔ:/ /θ/ /ɒ/ /g/ /r/ /ə/ /f/ /i:/
9	panorama	p,a,n,o,r,a,m,a	/p/ /æ/ /n/ /ə/ /r/ /ɑ:/ /m/ /ə/
9	pandemic	p,a,n,d,e,m,i,c	/p/ /æ/ /n/ /d/ /ɛ/ /m/ /ɪ/ /k/
9	pantheon	p,a,n,th,e,o,n	/p/ /æ/ /n/ /θ/ /i:/ /ə/ /n/
9	panacea	p,a,n,a,c,e,a	/p/ /æ/ /n/ /ə/ /s/ /ɪ/ /ə/
9	technician	t,e,ch,n,i,c,i,a,n	/t/ /ɛ/ /k/ /n/ /ɪ/ /ʃ/ /ə/ /n/
9	technology	t,e,ch,n,o,l,o,g,y	/t/ /ɛ/ /k/ /n/ /ɒ/ /l/ /ə/ /dʒ/ /i:/
9	technological	t,e,ch,n,o,l,o,g,i,c,a,l	/t/ /ɛ/ /k/ /n/ /ə/ /l/ /ɒ/ /dʒ/ /ɪ/ /k/ /ə/ /l/
9	technical	t,e,ch,n,i,c,a,l	/t/ /ɛ/ /k/ /n/ /ɪ/ /k/ /ə/ /l/
9	technique	t,e,ch,n,i,que	/t/ /ɛ/ /k/ /n/ /i:/ /k/
9	archaic	ar,ch,a,i,c	/ɑ:/ /k/ /eɪ/ /ɪ/ /k/
9	archaeology	ar,ch,ae,o,l,o,g,y	/ɑ:/ /k/ /i:/ /ɒ/ /l/ /ə/ /dʒ/ /i:/
9	archaeological	ar,ch,ae,o,l,o,g,i,c,a,l	/ɑ:/ /k/ /i:/ /ə/ /l/ /ɒ/ /dʒ/ /ɪ/ /k/ /ə/ /l/
9	stable	s,t,a,b,le	/s/ /t/ /eɪ/ /b/ /l/
9	station	s,t,a,t,i,o,n	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/
9	stationary	s,t,a,t,i,o,n,a,r,y	/s/ /t/ /eɪ/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
9	statue	s,t,a,t,ue	/s/ /t/ /æ/ /tʃ/ /u:/
9	consistent	c,o,n,s,i,s,t,e,n,t	/k/ /ə/ /n/ /s/ /ɪ/ /s/ /t/ /ə/ /n/ /t/

9	persistent	p,er,s,i,s,t,e,n,t	/p/ /ə/ /s/ /ɪ/ /s/ /t/ /ə/ /n/ /t/
9	science	sc,i,e,n,ce	/s/ /aɪ/ /ə/ /n/ /s/
9	conscious	c,o,n,sc,iou,s	/k/ /ɒ/ /n/ /ʃ/ /ʌ/ /s/
9	conscience	c,o,n,sc,ie,n,ce	/k/ /ɒ/ /n/ /ʃ/ /ɛ/ /n/ /s/
9	conscientious	c,o,n,sc,i,e,n,t,iou,s	/k/ /ɒ/ /n/ /ʃ/ /ɪ/ /ɛ/ /n/ /ʃ/ /ʌ/ /s/
9	credit	c,r,e,d,i,t	/k/ /r/ /ɛ/ /d/ /ɪ/ /t/
9	credible	c,r,e,d,i,b,le	/k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
9	credentials	c,r,e,d,e,n,t,i,a,l,s	/k/ /r/ /ɪ/ /d/ /ɛ/ /n/ /ʃ/ /ə/ /l/ /z/
9	incredible	i,n,c,r,e,d,i,b,le	/ɪ/ /n/ /k/ /r/ /ɛ/ /d/ /ə/ /b/ /l/
9	accredited	a,cc,r,e,d,i,t,e,d	/ə/ /k/ /r/ /ɛ/ /d/ /ɪ/ /t/ /ɪ/ /d/
9	dictate	d,i,c,t,a,te	/d/ /ɪ/ /k/ /t/ /eɪ/ /t/
9	dictation	d,i,c,t,a,t,i,o,n	/d/ /ɪ/ /k/ /t/ /eɪ/ /ʃ/ /ə/ /n/
9	dictionary	d,i,c,t,i,o,n,a,r,y	/d/ /ɪ/ /k/ /ʃ/ /ə/ /n/ /eə/ /r/ /i:/
9	verdict	v,er,d,i,c,t	/v/ /ɜ:/ /d/ /ɪ/ /k/ /t/
9	contradict	c,o,n,t,r,a,d,i,c,t	/k/ /ɒ/ /n/ /t/ /r/ /ə/ /d/ /ɪ/ /k/ /t/

Appendix 5

Testing stimuli by grade

Grade	Word	Word Final	Phoneme Final
3	like	l,i,ke	/l/ /aɪ/ /k/
3	open	o,p,e,n	/əʊ/ /p/ /ə/ /n/
3	brown	b,r,ow,n	/b/ /r/ /aʊ/ /n/
3	swimming	s,w,i,mm,i,ng	/s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/
3	around	a,r,ou,n,d	/ə/ /r/ /aʊ/ /n/ /d/
3	friends	f,r,ie,n,d,s	/f/ /r/ /ɛ/ /n/ /d/ /z/
3	cracked	c,r,a,ck,ed	/k/ /r/ /æ/ /k/ /t/
3	great	g,r,ea,t	/g/ /r/ /eɪ/ /t/
3	barked	b,a,r,k,ed	/b/ /ɑ:/ /r/ /k/ /t/
3	complained	c,o,m,p,l,ai,n,ed	/k/ /ʌ/ /m/ /p/ /l/ /eɪ/ /n/ /d/
3	wheel	wh,ee,l	/w/ /i:/ /l/
3	helmet	h,e,l,m,e,t	/h/ /ɛ/ /l/ /m/ /ə/ /t/
3	seat	s,ea,t	/s/ /i:/ /t/
3	special	s,p,e,c,ia,l	/s/ /p/ /ɛ/ /ʃ/ /ə/ /l/
3	could	c,ou,ld	/k/ /ʊ/ /d/
3	animal	a,n,i,m,a,l	/æ/ /n/ /ɪ/ /m/ /ə/ /l/
3	present	p,r,e,s,e,n,t	/p/ /r/ /ɛ/ /z/ /ɛ/ /n/ /t/
3	little	l,i,tt,le	/l/ /ɪ/ /t/ /l/
3	millions	m,i,ll,i,o,n,s	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/ /z/
3	oxygen	o,x,y,g,e,n	/ɒ/ /x/ /ɪ/ /dʒ/ /ə/ /n/
3	properly	p,r,o,p,e,r,l,y	/p/ /r/ /ɒ/ /p/ /ə/ /l/ /i:/
3	match	m,a,tch	/m/ /æ/ /tʃ/
3	loudly	l,ou,d,l,y	/l/ /aʊ/ /d/ /l/ /i:/
3	hoping	h,o,p,i,ng	/h/ /əʊ/ /p/ /ɪ/ /ŋ/
3	pour	p,our	/p/ /ɔ:/
5	swimming	s,w,i,mm,i,ng	/s/ /w/ /ɪ/ /m/ /ɪ/ /ŋ/
5	number	n,u,m,b,e,r	/n/ /ʌ/ /m/ /b/ /ə/
5	friends	f,r,ie,n,d,s	/f/ /r/ /ɛ/ /n/ /d/ /z/
5	great	g,r,ea,t	/g/ /r/ /eɪ/ /t/
5	competed	c,o,m,p,e,t,e,d	/k/ /ə/ /m/ /p/ /i:/ /t/ /ɪ/ /d/
5	popular	p,o,p,u,l,a,r	/p/ /ɒ/ /p/ /y/ /l/ /ə/
5	vanilla	v,a,n,i,l,l,a	/v/ /ə/ /n/ /ɪ/ /l/ /ə/
5	muscle	m,u,s,c,l,e	/m/ /ʌ/ /s/ /l/
5	astronauts	a,s,t,r,o,n,a,u,t,s	/æ/ /s/ /t/ /r/ /ə/ /n/ /ɔ:/ /t/ /s/
5	opposite	o,p,p,o,s,i,t,e	/ɒ/ /p/ /ə/ /z/ /ɪ/ /t/
5	shoulder	sh,ou,l,d,e,r	/ʃ/ /ɒ/ /l/ /d/ /ə/
5	button	b,u,t,t,o,n	/b/ /ʌ/ /t/ /n/
5	effects	e,f,f,e,c,t,s	/ɪ/ /f/ /ɛ/ /k/ /t/ /s/
5	volume	v,o,l,u,m,e	/v/ /ɒ/ /l/ /y/ /m/
5	millions	m,i,ll,i,o,n,s	/m/ /ɪ/ /l/ /j/ /ʌ/ /n/ /z/

5	oxygen	o,x,y,g,e,n	/ɒ/ /x/ /ɪ/ /dʒ/ /ə/ /n/
5	properly	p,r,o,p,e,r,l,y	/p/ /r/ /ɑ/ /p/ /ə/ /l/ /i:/
5	since	s,i,n,ce	/s/ /ɪ/ /n/ /s/
5	lizard	l,i,z,a,r,d	/l/ /ɪ/ /z/ /ə/ /d/
5	climb	c,l,i,m,b	/k/ /l/ /aɪ/ /m/
5	taste	t,a,s,te	/t/ /eɪ/ /s/ /t/
5	version	v,e,r,s,i,o,n	/v/ /ɜ:/ /ʃ/ /ə/ /n/
5	marathon	m,a,r,a,t,h,o,n	/m/ /ə/ /r/ /ə/ /θ/ /ə/ /n/
5	fitness	f,i,t,n,e,ss	/f/ /ɪ/ /t/ /n/ /ɪ/ /s/
5	disappointed	d,i,s,a,p,p,o,i,n,t,e,d	/d/ /ɪ/ /s/ /ə/ /p/ /ɔɪ/ /n/ /t/ /ɪ/ /d/
7	since	s,i,n,ce	/s/ /ɪ/ /n/ /s/
7	lizard	l,i,z,a,r,d	/l/ /ɪ/ /z/ /ə/ /d/
7	taste	t,a,s,te	/t/ /eɪ/ /s/ /t/
7	climb	c,l,i,m,b	/k/ /l/ /aɪ/ /m/
7	version	v,e,r,s,i,o,n	/v/ /ɜ:/ /ʃ/ /ə/ /n/
7	consumed	c,o,n,s,u,m,e,d	/k/ /ə/ /n/ /s/ /y/ /m/ /d/
7	marathon	m,a,r,a,t,h,o,n	/m/ /ə/ /r/ /ə/ /θ/ /ə/ /n/
7	fitness	f,i,t,n,e,ss	/f/ /ɪ/ /t/ /n/ /ɪ/ /s/
7	description	d,e,s,c,r,i,p,t,i,o,n	/d/ /ɪ/ /s/ /k/ /r/ /ɪ/ /p/ /ʃ/ /ə/ /n/
7	poisonous	p,o,i,s,o,n,o,u,s	/p/ /ɔɪ/ /z/ /ə/ /n/ /ə/ /s/
7	overwhelmed	o,v,e,r,w,h,e,l,m,e,d	/əʊ/ /v/ /ə/ /w/ /ɛ/ /l/ /m/ /d/
7	antique	a,n,t,i,q,u,e	/æ/ /n/ /t/ /i:/ /k/
7	disappointed	d,i,s,a,p,p,o,i,n,t,e,d	/d/ /ɪ/ /s/ /ə/ /p/ /ɔɪ/ /n/ /t/ /ɪ/ /d/
7	announcement	a,n,n,o,u,n,c,e,m,e,n,t	/ə/ /n/ /aʊ/ /n/ /s/ /m/ /ə/ /n/ /t/
7	community	c,o,m,m,u,n,i,t,y	/k/ /ə/ /m/ /y/ /n/ /ɪ/ /t/ /i:/
7	equipped	e,q,u,i,p,p,e,d	/ɪ/ /k/ /w/ /ɪ/ /p/ /t/
7	previously	p,r,e,v,i,o,u,s,l,y	/p/ /r/ /i:/ /v/ /ɪ/ /ʌ/ /s/ /l/ /i:/
7	surgery	s,u,r,g,e,r,y	/s/ /ɜ:/ /dʒ/ /ə/ /r/ /ɪ/
7	mischief	m,i,s,c,h,i,e,f	/m/ /ɪ/ /s/ /tʃ/ /ɪ/ /f/
7	recognise	r,e,c,o,g,n,i,s,e	/r/ /ɛ/ /k/ /ə/ /g/ /n/ /aɪ/ /z/
7	immediately	i,m,m,e,d,i,a,t,e,l,y	/ɪ/ /m/ /i:/ /d/ /ɪ/ /ə/ /t/ /l/ /i:/
7	secluded	s,e,c,l,u,d,e,d	/s/ /ɪ/ /k/ /l/ /u:/ /d/ /ɪ/ /d/
7	athletes	a,t,h,l,e,t,e	/æ/ /θ/ /l/ /i:/ /t/ /s/
7	substantial	s,u,b,s,t,a,n,t,i,a,l	/s/ /ə/ /b/ /s/ /t/ /æ/ /n/ /ʃ/ /ə/ /l/
7	performance	p,e,r,f,o,r,m,a,n,c,e	/p/ /ə/ /f/ /ɔ:/ /m/ /ə/ /n/ /s/
9	community	c,o,m,m,u,n,i,t,y	/k/ /ə/ /m/ /y/ /n/ /ɪ/ /t/ /i:/
9	previously	p,r,e,v,i,o,u,s,l,y	/p/ /r/ /i:/ /v/ /ɪ/ /ʌ/ /s/ /l/ /i:/
9	surgery	s,u,r,g,e,r,y	/s/ /ɜ:/ /dʒ/ /ə/ /r/ /ɪ/
9	achievement	a,c,h,i,e,v,e,m,e,n,t	/ə/ /tʃ/ /i:/ /v/ /m/ /ə/ /n/ /t/
9	sufficient	s,u,f,f,i,c,i,e,n,t	/s/ /ə/ /f/ /ɪ/ /ʃ/ /ɛ/ /n/ /t/
9	exotic	e,x,o,t,i,c	/ɪ/ /x/ /ɒ/ /t/ /ɪ/ /k/
9	imagination	i,m,a,g,i,n,a,t,i,o,n	/ɪ/ /m/ /æ/ /dʒ/ /ɪ/ /n/ /eɪ/ /ʃ/ /ə/ /n/
9	substantial	s,u,b,s,t,a,n,t,i,a,l	/s/ /ə/ /b/ /s/ /t/ /æ/ /n/ /ʃ/ /ə/ /l/
9	performance	p,e,r,f,o,r,m,a,n,c,e	/p/ /ə/ /f/ /ɔ:/ /m/ /ə/ /n/ /s/
9	system	s,y,s,t,e,m	/s/ /ɪ/ /s/ /t/ /ɪ/ /m/

9	consumed	c,o,n,s,u,m,e,d	/k/ /ə/ /n/ /s/ /y/ /m/ /d/
9	evacuate	e,v,a,c,u,a,t,e	/ɪ/ /v/ /æ/ /k/ /y/ /eɪ/ /t/
9	failure	f,a,i,l,u,r,e	/f/ /eɪ/ /l/ /j/ /ə/
9	recreational	r,e,c,r,e,a,t,i,o,n,a,l	/r/ /ɛ/ /k/ /r/ /ɪ/ /eɪ/ /ʃ/ /ə/ /n/ /l/
9	overwhelmed	o,v,e,r,w,h,e,l,m,e,d	/əʊ/ /v/ /ə/ /w/ /ɛ/ /l/ /m/ /d/
9	antique	a,n,t,i,q,u,e	/æ/ /n/ /t/ /i:/ /k/
9	applauded	a,p,p,l,a,u,d,e,d	/ə/ /p/ /l/ /ɔ:/ /d/ /ɪ/ /d/
9	recipients	r,e,c,i,p,i,e,n,t,s	/r/ /ɪ/ /s/ /ɪ/ /p/ /ɪ/ /ə/ /n/ /t/ /s/
9	vulnerable	v,u,l,n,e,r,a,b,l,e	/v/ /ʌ/ /l/ /n/ /ə/ /r/ /ə/ /b/ /l/
9	announcement	a,n,n,o,u,n,c,e,m,e,n,t	/ə/ /n/ /aʊ/ /n/ /s/ /m/ /ə/ /n/ /t/
9	negligence	n,e,g,l,i,g,e,n,c,e	/n/ /ɛ/ /g/ /l/ /ɪ/ /dʒ/ /ə/ /n/ /s/
9	satellite	s,a,t,e,l,l,i,t,e	/s/ /æ/ /t/ /ə/ /l/ /aɪ/ /t/
9	camouflage	c,a,m,o,u,f,l,a,g,e	/k/ /æ/ /m/ /ʊ/ /f/ /l/ /ɑ:/ /ʒ/
9	faint	f,a,i,n,t	/f/ /eɪ/ /n/ /t/
9	government	g,o,v,e,r,n,m,e,n,t	/g/ /ʌ/ /v/ /ə/ /n/ /m/ /ə/ /n/ /t/

Appendix 6

**Total number of data points per phoneme position for each group at each
testing grade**

Parameter & Grade	Position									
	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten
Grade 3 Students	197	197	186	149	120	76	32	8		
1 - Best Link Weight	105	96	82	40	18	2	1	7		
2 - Link Weights In		145	143	124	105	94	53	7		
3 - Link Weights Out	259	123	115	86	57	23	7			
4 - Total Weights In & Out	142	142	134	103	79	78	47	14		
5 - Number of Links In		158	150	106	78	60	30	7		
6 - Number of Links Out	289	131	130	84	57	19	7			
7 - Total Links In & Out	158	158	150	108	82	83	42	14		
8 - Overall Links In	116	116	108	149	128	41	21	3		
9 - Overall Links Out	111	111	110	80	59	42	22	3		
10 - Overall Links In & Out	118	118	110	80	59	42	22	3		
Grade 5 Students	191	191	191	191	145	107	47	24	15	8
1 - Best Link Weight	78	70	73	71	25	8	6	1	9	
2 - Link Weights In		151	148	150	100	79	23	18	7	
3 - Link Weights Out	287	144	144	144	88	53	9	7	7	
4 - Total Weights In & Out	142	142	142	142	86	76	20	13	7	
5 - Number of Links In		148	148	148	92	69	21	12	7	
6 - Number of Links Out	293	145	145	145	89	54	9	7	7	
7 - Total Links In & Out	148	148	148	148	92	82	27	13	6	
8 - Overall Links In	150	150	150	150	94	71	41	9	5	29
9 - Overall Links Out	143	143	143	143	93	70	21	8	3	4
10 - Overall Links In & Out	141	141	141	141	91	68	19	6		1
Grade 7 Students	201	201	201	201	201	180	152	114	91	50
1 - Best Link Weight	74	67	63	56	35	37	34	23	7	4
2 - Link Weights In		140	144	151	134	109	61	65	15	12
3 - Link Weights Out	256	123	123	123	97	87	54	53	14	10

4 - Total Weights In & Out	139	139	139	139	113	98	62	59	17	11
5 - Number of Links In		138	138	138	112	97	65	63	26	16
6 - Number of Links Out	273	135	135	135	109	93	63	59	17	12
7 - Total Links In & Out	138	138	138	138	112	97	65	63	26	16
8 - Overall Links In	142	142	142	142	116	104	68	63	26	15
9 - Overall Links Out	137	137	137	137	116	104	68	63	26	15
10 - Overall Links In & Out	137	137	137	137	116	104	68	63	26	15
<hr/>										
Grade 9 Students	194	194	194	194	187	173	149	120	65	65
1 - Best Link Weight	63	49	46	48	43	46	31	24	9	9
2 - Link Weights In		115	128	126	111	99	78	55	18	18
3 - Link Weights Out	223	107	112	112	102	94	76	53	22	22
4 - Total Weights In & Out	114	109	114	114	104	97	79	64	21	21
5 - Number of Links In		113	118	118	108	103	88	67	30	30
6 - Number of Links Out	240	117	122	122	112	105	91	64	33	33
7 - Total Links In & Out	125	120	125	125	115	109	94	79	32	32
8 - Overall Links In	127	162	127	127	117	109	89	72	37	37
9 - Overall Links Out	127	127	127	127	117	109	89	72	37	37
10 - Overall Links In & Out	127	127	127	127	117	109	89	72	37	37

Appendix 7

R scripts written for analyses and graphical outputs

```
##### Read all csv files in dir-----

col.DIR.files <-function(x) {
  ## Function to read a directory of CSV files and collate into data frame##
  #the directory to be read
  org <- getwd()
  setwd(x)
  # Read the directory for csv files
  myfiles <-
  dir(pattern = "\\.(csv|CSV)$",
    full.names = FALSE) # get filenames
  # read data from files
  myfiles_data <-
  lapply(myfiles, data.table::fread)
  # validate file reading
  head(myfiles_data[[2]])
  # assign names to list items
  names(myfiles_data) <- myfiles
  # Convert from List to Data Frame
  data <- do.call("rbind", lapply(myfiles_data, data.frame))
  setwd(org)
  return(data)
}

## parameters and position -----

all <- read.csv("all.csv")

child <- all %>%
  filter(m1 == 11) %>%
  select(Ã ..Spelling,
    contains("po"))
names(child) <- c("Spelling", 1:15)

child <- child %>%
  melt(id = c("Spelling")) %>%
  na.omit()

names(child) <- c("Spelling", "position", "correct")

child$parameter <- "child"

model <- all %>%
  filter(m1 != 11)%>%
  select(Ã ..Spelling,
    contains("po"))
```

```

names(model) <- c("Spelling",
  # "param 1",
  # "param 2",
  # "param 3",
  # "param 4",
  # "param 5",
  # "param 6",
  # "param 7",
  # "param 8",
  # "param 9",
  # "param 10",
  # "param 11",
  # "param 12",
  # "param 13",
  # "param 14",
  # "param 15",
  1:15)
cola <- paste("param",1:15)
colb <- paste(1:15)

model <- model %>%
  # gather(parameter,1:16, -c("Spelling", 17:31))
  melt(id = c("Spelling"))
  # variable.name = "variable",
  # value.name = "value"
# %>%
na.omit()

names(model) <- c("Spelling", "position", "correct")

para <- all %>%
  filter(m1!=11) %>%
  select(Ã..Spelling,
    contains("m"))
names(para) <- c("Spelling", 1:15)

para <- para %>%
  melt(id = c("Spelling")) %>%
  na.omit()

names(para) <- c("Spelling", "position", "parameter")

comb <- full_join(para, model)

new <- rbind(comb, child) %>%
  na.omit() %>%
  group_by(position, correct, parameter) %>%
  summarise(freq =n()) %>%
  droplevels() %>%

```

```

ungroup() %>%
# filter(parameter != 11) %>%
mutate(position = as.numeric(position),
       parameter= factor(parameter, levels = c("child",
       1:10)))

## Freq dists for acc and error by position for each parameter -----

all.freq <- new %>%

mutate(correct = as.character(correct),
       correct = recode(correct, "FALSE"= "Error"),
       correct = recode(correct, "TRUE" = "Accuracy"),
       correct = factor(correct, levels = c("Accuracy","Error")),
       parameter = recode(parameter, "child" = "Students"),
       parameter = recode(parameter, "1" = "1 - Best Link Weight"),
       parameter = recode(parameter, "2" = "2 - Link Weights In"),
       parameter = recode(parameter, "3" = "3 - Link Weights Out"),
       parameter = recode(parameter, "4" = "4 - Total Weights In-Out"),
       parameter = recode(parameter, "5" = "5 - Number of Links In"),
       parameter = recode(parameter, "6" = "6 - Number of Links Out"),
       parameter = recode(parameter, "7" = "7 - Total Links In-Out"),
       parameter = recode(parameter, "8" = "8 - Overall Links In"),
       parameter = recode(parameter, "9" = "9 - Overall Links Out"),
       parameter = recode(parameter, "10" = "10 - Overall Links In-Out"))

# Use ggplot build to extract scaled densities-----
-----
y <- ggplot_build(all.freq%>%
  ggplot()+
  geom_density(aes(position, weight = freq, group = correct, colour = correct), alpha =
  0.75, size = 2)+
  facet_wrap(~parameter, scales = "free_y"))

par.list <- unique(all.freq$parameter)

dir.create("fitted freq")

## create loop along parameter list to extract densities -----

for (i in seq_along(par.list)){

  y <- all.freq %>%
  filter(parameter == par.list[i])

  t <- ggplot_build(
  ggplot(data = y)+
  geom_density(aes(position, weight = freq, colour = correct))
  )
  tt <- as.data.frame(t$data)
}

```

```

print(tt)
write.csv(tt , file = paste('fitted freq/fitted freq',par.list[i],'Frequency_fitted.csv'))
}

## Combine all fitted frequencies in dataframe -----

raw.folder<-as.character(paste(getwd(),'/fitted freq/', sep=""))
myfiles <- list.files(path = raw.folder, pattern = "*.csv", full.names = TRUE)# get
filenames and paths

names(myfiles) <- list.files(raw.folder) %>%
  gsub(pattern = ".csv$", replacement = "")

myfiles_data <- map_df(myfiles, read_csv, col_names = TRUE,
  .id = "ID",cols(X1 = col_integer(), Area = col_double()))
# validate file reading
head(myfiles_data[[1]])

dir.create("consolidated/")

write.csv(myfiles_data, file =
paste('consolidated/', 'Densities_Consolidated_complete.csv'))

## analysis of densities-----

data <- read_csv("consolidated/ Densities_Consolidated_complete.csv")

head(data)
data%>%
  group_by(correct, parameter, x) %>%
  scale(.$density)

data %>% ggplot()+
  geom_line(aes(x= x, y = scaled, group = as.factor(group), colour = as.factor(group)),
alpha =1)+
  scale_x_continuous(breaks = seq(1,10, by =1))+
  facet_wrap(~ID, scales = "free_y")+
  theme_bw()

data.bay <- data %>%
  select(x, scaled, group, ID) %>%
  mutate(correct = as.character(group),
  correct = recode(correct, "1"= "Accuracy"),
  correct = recode(correct, "2" = "Error"),
  correct = factor(correct, levels = c("Accuracy", "Error")),
  parameter = as.character(ID),
  parameter = recode(parameter, "fitted freq Students Frequency_fitted" =
"Students"),
  parameter = recode(parameter, "fitted freq 1 - Best Link Weight
Frequency_fitted" = "1 - Best Link Weight"),

```

```

parameter = recode(parameter, "fitted freq 2 - Link Weights In Frequency_fitted"
= "2 - Link Weights In"),
parameter = recode(parameter, "fitted freq 3 - Link Weights Out
Frequency_fitted" = "3 - Link Weights Out"),
parameter = recode(parameter, "fitted freq 4 - Total Weights In-Out
Frequency_fitted" = "4 - Total Weights In-Out"),
parameter = recode(parameter, "fitted freq 5 - Number of Links In
Frequency_fitted" = "5 - Number of Links In"),
parameter = recode(parameter, "fitted freq 6 - Number of Links Out
Frequency_fitted" = "6 - Number of Links Out"),
parameter = recode(parameter, "fitted freq 7 - Total Links In-Out
Frequency_fitted" = "7 - Total Links In-Out"),
parameter = recode(parameter, "fitted freq 8 - Overall Links In Frequency_fitted"
= "8 - Overall Links In"),
parameter = recode(parameter, "fitted freq 9 - Overall Links Out
Frequency_fitted" = "9 - Overall Links Out"),
parameter = recode(parameter, "fitted freq 10 - Overall Links In-Out
Frequency_fitted" = "10 - Overall Links In-Out")) %>%
select(x, scaled, correct, parameter)

```

```
## Final plot of scaled densities accuracy -----
```

```

data.bay %>%
mutate(parameter = factor(parameter, levels = c("1 - Best Link Weight",
"2 - Link Weights In",
"3 - Link Weights Out",
"4 - Total Weights In-Out",
"5 - Number of Links In",
"6 - Number of Links Out",
"7 - Total Links In-Out",
"8 - Overall Links In",
"9 - Overall Links Out",
"10 - Overall Links In-Out",
"Students")) %>% # put orders in there
filter(correct == "Accuracy") %>%
ggplot()+
geom_line(aes(x= x, y = scaled, group = correct, colour = correct), alpha =1,
position = "dodge")+
scale_x_continuous(breaks = seq(1,10, by =1))+
facet_wrap(~parameter)+
ylab("Scaled")+
xlab(" Phoneme position")+
scale_color_manual(values = c("Accuracy" = "Black"))+
# theme_tufte(base_size = 12, base_family = "arial")+
theme_apr()+
theme(text=element_text(size=12, family="Arial"),
legend.position = c(0.9, 0.2),
axis.line.x = element_line(color="black", size = 0.5),
axis.line.y = element_line(color="black", size = 0.5))+
ggsave(file="graph_accuracy.jpg", width = 3, height = 2.5, units = "cm", scale = 8)

```

```

## Final plot of scaled densities error -----
data.bay %>%
  mutate(parameter = factor(parameter, levels = c("1 - Best Link Weight",
    "2 - Link Weights In",
    "3 - Link Weights Out",
    "4 - Total Weights In-Out",
    "5 - Number of Links In",
    "6 - Number of Links Out",
    "7 - Total Links In-Out",
    "8 - Overall Links In",
    "9 - Overall Links Out",
    "10 - Overall Links In-Out",
    "Students"))) %>% # put orders in there
  filter(correct == "Error") %>%
  ggplot()+
  geom_line(aes(x= x, y = scaled, group = correct, colour = correct), alpha =1,
position = "dodge")+
  scale_x_continuous(breaks = seq(1,10, by =1))+
  facet_wrap(~parameter)+
  ylab("Scaled")+
  xlab(" Phoneme position")+
  scale_color_manual(values = c("Error" = "Black"))+
  # theme_tufte(base_size = 12, base_family = "arial")+
  theme_apache()+
  theme(text=element_text(size=12, family="Arial"),
    legend.position = c(0.9, 0.2),
    axis.line.x = element_line(color="black", size = 0.5),
    axis.line.y = element_line(color="black", size = 0.5))+
  ggsave(file="graph_error.jpg", width = 3, height = 2.5, units = "cm", scale = 8)

```

```

## Bayesian t test for parameter and accuracy compare to child density -----

```

```

dir.create("bayes_ttest")

acc <- data.bay %>%
  filter(correct == "Accuracy")

grouplist <- as.character(unique(data.bay$parameter))

for (i in seq_along(grouplist)){

  print(grouplist[i])

  child <- filter(acc, parameter == "Students") %>%
    .$scaled

  model <- filter(acc, parameter == grouplist[i]) %>%
    .$scaled

```

```

test <- ttestBF(child, model)

print(summary(1/test))
t <- as.data.frame(1/test)
t <- rownames_to_column(t)
names(t) <- c("test", "bf", "error", "time", "code")
write.csv(t, file = paste('bayes_ttest/', grouplist[i], 'bayesout_acc.csv'))
}

## Bayesian t test for parameter and error compare to child density -----

error <- data.bay %>%
  filter(correct == "Error")

grouplist <- as.character(unique(data.bay$parameter))

for (i in seq_along(grouplist)){

  print(grouplist[i])

  child <- filter(error, parameter == "Students") %>%
    .$scaled

  model <- filter(error, parameter == grouplist[i]) %>%
    .$scaled

  test <- ttestBF(child, model)

  print(summary(1/test))
  t <- as.data.frame(1/test)
  t <- rownames_to_column(t)
  names(t) <- c("test", "bf", "error", "time", "code")
  write.csv(t, file = paste('bayes_ttest/', grouplist[i], 'bayesout_error.csv'))
}

## combine all bayes factors -----

dir.create("bayes_ttest/consolidated/")

raw.folder <- as.character(paste(getwd(), '/bayes_ttest/', sep = ""))

f <- col.DIR.files(raw.folder)

write.csv(f, file =
paste('bayes_ttest/consolidated/', 'Consolidated_Bayes_ttest_complete.csv'))

```

Appendix 8

Model and student responses to each word in the grade three testing list

Word	Students	Model
like	like lick licke look lik likee lile	like lik lic luyc
open	open opin opne opine onpe oupn opn opein	open opun opan oprn
brown	brown broun bran bron brawn broned bronw	brown broun
swimming	swimming swiming simming siming swemming swmming siwmming	swimming swiming swimin
around	around arand arond arownd aroud arund orond	around arownd
friends	friends freinds frends frinds frens	frends freands

	frendes	
cracked	cracked craked cract craced crackt crakt crat	crackt crakt cract
great (grate)	great grate grat graet gat greate grant	grayt greyt grat
barked	barked barcked baked barkt backed barct braked	barkt barct
complained	complained complaned compland complaind conpland copland compained complane	cumplaynd cumpland
wheel	wheel weel well whee wile welle wel weell	weal weel
helmet	helmet hellmet helment helmit helmat hemet helmate halmet	helmet helmat helmert helmmet healmert

seat	seat seet set sit sete site sat	seat seet set
special	special speshel specil speical speshal specail speshle	speshel speshal spesherl
could	could cood code coud cod cold cord	cood coud
animal	animal anamal anamel animale animel anamle anamil anmle	animal animel animmel animerl animmerl
present	present presint presant presnt preasent pesent prest	present preasent preesent prezzent
little	little litte littel litle littil littl littol lettlet	litl
millions	millions millons	milyuns

	millions millyens melens milens milyins millins	
oxygen	oxygen oxigen oxgen oxigin oxegon oxagen oxigon oxegin	oxigen oxidgern oxigern oxijen oxijan
properly	properly proply propely propley prople propaly propoly propily propaley	properly propely propalee propelee
match	match mach mache macth mack march macht math	match mach
loudly	loudly loudley loudly lowdly lodly ladley lady ladle londly loundly lawdle	loudly lowdly loudlee
hoping	hoping hopeing hopping howping	hoping hopeng hopin

	houping	
	hopen	
	hoppeing	
	hooping	
	hoppy	
	hoppen	
	homing	
<hr/>		
pour	pour	pour
(paw)	pore	por
(pore)	poor	pau
	por	
	paw	
	powr	
	pure	
	poar	
	powe	
	pare	
	pall	
<hr/>		

Appendix 9

Model and student responses to each word in the grade five testing list

Word	Students	Model
swimming	swimming swiming simming sweing siwmming simwwing	swimming swiming swimin
number	number nuber nummber naber nabumber nomber	number numbe numba
friends	friends freinds frends friend frens frinds friendes	frends freands
great (grate)	great grate grat graet girte gat geat	grate grat
competed	competed compeated compited compitted competied completed compieted compeeted	competid compytid campetid compeetid
popular	popular populer popula populor populur populare pouplare	popular popula

vanilla	popler vanilla vanila vinilla vinila vanilar vannila vinilar vaniler	vanila vonila vonular
muscle (mussel)	muscle musle muscel musel mucle mussle mussel musal	musl
astronauts	astronauts astronorts astronaughts astronots astronouts astranauts astronaut	astronorts astranauts astranorts astrernorts astrenorts
opposite	opposite oppisite oposite opisite opisit oppsite opersite	opesit opersit opasit
shoulder	shoulder sholder shoder shouder soulder soder solder shouldar	sholder sholde tolda
button	button butten botton buton buten botten buttin	butn

	buttern	
effects	effects efects affects effect efex effets efecs	efects effekts iffects ifects
volume	volume volum vollume vollum voulume voloum	volume volum
millions	millions millons milions millones millins milleons millyons milonses	millions miliuns milyuns
oxygen	oxygen oxegen oxigen oxegon oxogen oxagen oxeygen oxigon	oxigen oxijen oxijan oxijern oxigern oxidgern
properly	properly propely propaly propoly propley proply properley	properly propely properle propele properle propale properly
since	since science sinse sins sence sines sints scence	sins sinc
lizard	lizard	liserd

	lizerd lizzard lized lizzed lizid	lisad
climb	climb clime clim climbe clame climd clam	climb cluym
taste	taste tast tate taist teast taest testas tasted taset tast	tast
version	version vertion vershon vershion version verion vershen virshion verstion virgin	virshan virshern vurshern vurshan vershern virtan
marathon	marathon marothon marthon marithon marrathon mathon maration marethon marathone	marathan morathan morerthan
fitness	fitness fittness fitnes fittnes fitnis	fitnis fittenis

	fitness	
	fitniss	
	fitnese	
	fittnis	
disappointed	disappointed	disapointid
	dissappointed	disapoyntid
	disapointed	diserpoyntid
	disaponted	
	disopointed	
	disapionted	
	diserpointed	
	disserpointed	

Appendix 10

Model and student responses to each word in the grade seven testing list

Word	Students	Model
since	since scince sence sinse seens sinces sins sience	sinc sins
lizard	lizard lizzard lizerd lisard lizide lizzed lized	liserd lisad
taste	taste tast tate taset taiste taest taist tarest	tast
climb	climb clime climbe clim clumb climb clam clibme	climb clim cluym
version	version virshion verson vertion verion vershion verison verision virgin	vershion virshern virshan virshern vertan
consumed	consumed	consiumd

	<p>consumed consummed conshumed consume consuemed cosummed consumd</p>	<p>consiumd cansiumd cansyumd cansioomd conciwmed</p>
marathon	<p>marathon marothon marthon marrathon marithon maraton marathone marethon</p>	<p>marathan morathan morerthan marerthan</p>
fitness	<p>fitness fitness fitnes fittnes fitnise fitness</p>	<p>fitnis fittenis</p>
description	<p>description discription desciption descriptions desription describtion discreption</p>	<p>discription discriptan</p>
poisonous	<p>poisonous poisoness poiseness poisonus poisinous poisenous poisones</p>	<p>poisonas poisnas</p>
overwhelmed	<p>overwhelmed overwelmed overwellmed overwelmd overwelled overwhemed overwhelm overwhelmd</p>	<p>overwlemed ovawelmd</p>
antique	<p>antique antic anteak</p>	<p>antique antyc antec</p>

	antick anteck anteque antice antec antique	
disappointed	disappointed disapointed dissappointed dissappointed disaponted disaponited diserpointed desapointed disipointed	disappontid diserpointid
announcement	announcement announcement annoucement announcment annoucment annoucement anousment anoucement	anounsmant anownsmment anownsmiont anounsmiont anownsmont
community	community comunity commuity comunaty communitie comunite	comuniti
equipped	equipped equiped equipted equip equited equipte	ecuipt ecwipt icwipt
previously	previously previosly previsly previously preveusly preveously prevesly previesly	previously previusle preeviusly preeviusley preeviusle
surgery	surgery sergery surgury	sergari sirgari sirgeri

	surgery sergury sergary sugery surgurey	surgerri surjerri surgeouri sirgeeri
mischief	mischief mischeif mischef misscheif mischif misschief mischife mistchief	mischif mistif
recognise	recognise reconise reconised recognised reconized recignise reckonise recodnise regonise	recognise recagnis recerngis recagnis recagnuys
immediately	immediately immediatly immediety immeditly immediatley imediately emediatly emedietly immediantly	imediutle imiedioutaly imeediutley imeediutle imeediutly emeediutly emediutle
secluded	secluded sucluded sicluded surcluded succluded sercluded sacluded cecluded socluded	sicludid
athletes	athletes athlets athleats atheletes athelets athleates	athlets athliets athlyts athleyts athlyts

	athleets athlits athliets	
substantial	substantial substancial substansial substantual substancal substanchal substansal substanshal substancual substantial	sabstantial sobstantial substanshiole sobstantiole sobstantiol
performance	performance performence peformance performents proformance perfomance preformance performans performace	performance poformans paformans pafaumans

Appendix 11

Model and student responses to each word in the grade nine testing list

Word	Students	Model
community	community communittee commnity communittee commity communitie cnmutid	comunity comunite
previously	previously previosly prevesly previously previsly preversley previesly preaviously	previously previusle preeviusly preeviusley
surgery	surgery surgury sergery surgary surgey sergury sergary surgry surgeory	sergari sirgari sirgerri surgerri surjerri surgeouri
achievement	achievement achievment acheivement achivement acheivment achivment archievement achevement	achevmant acheevmant
sufficient	sufficient sufficent suficient sufficiant suficiant suffiecent suffient sufficant surfishent	saficent suffishent sofitent safitent

exotic	exotic excotic exoitic egsotic exsotic egzotic agsotic exioic	exotic ixotic
imagination	imagination immagination imagenation imaganation emagination imagernation imagnation amagination	imagination imageination imaginatan emaginatan emajinatan
substantial	substantial substancial substantual substantal substatial substaintial substancual substansual	sabstantial substnatiol
performance	performance preformance performents performance proformance preformence peformance perfomance	performance performans perfaumans
system	system sistem sistym system syste siztem system	sistim
consumed	consumed comsumed consummed consumend concuemed consumned conshumed	concuemed consumd cansumd

evacuate	evacuate evauate evaquate evacuuate evacute evacate ifacuwait	evacuat ivacuate ivacuat
failure	failure failer failier faliure failour failuar faliure	falia failya failua faleia falue
recreational	recreational recriational recreational recreational reacrecational recreational recreation recgreational	recriational recriationl recriatanl
overwhelmed	overwhelmed overwelmed overwellmed overwealmed overwhealmed overwhelemed overwelmd overwehlmed	overwelmed ovawelmd
antique	antique antic antice anteak antick anteque entic	antique antyc antec
applauded	applauded applorded aplauded appluaded aplorded appluded aplouded	aplaudid aplordid appleordid
recipients	recipients recipiants	resipiants risipiants

	recipients resipients recipeants resipients recipants receipients	risipients
vulnerable	vulnerable vunerable vonerable volnerable vonrable vunrable volnurable vaulnerable	vulnerable vulnerabl vulnariobl
announcement	announcement anouncement announcment annoucment anoucment annocement	anounsmant anownsmment anownsmiont
negligence	negligence neglegence neglegance neglagence negligance neglegents negligents neglagance	negligans negligions negligionce negligeans
satellite	satellite satelite satalite satilite sattelite satalight satillite saterlight	satalit saterlit sataluyt
camouflage	camouflage camoflage camoflaue camoflague camoflarge camaflage camoflouge	camouflage camuflage camuflas
faint	faint	fant

(feint)

feigt
fient
fant
fante
feight
fiant

governmentgovernment
goverment
goevrment
govement
govoment
govournment
governement
gurerment
conerment

government
guvernmant
guvanmant
guvernmiont
guvanmiont