

Spelling Nonwords: Effects of Sentence Context, Target Consonant Position and
Age Group

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I declare that this report is my own original work and that contributions of others
have been duly acknowledged.

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Nicole Marsh

Word Count: 9,226

Abstract

Written English is complex, as one sound can often be spelt in several ways (e.g., /f/ is most commonly spelt as *f*, and less commonly as *ph* or *gh*). This study investigated whether participants would choose the more common spelling of target consonants in nonwords presented in a sentence with a familiar rather than unfamiliar context. Further, it was predicted that this effect would be stronger for adults than children, and that adults would choose the more common spelling more often for target consonants at the end than beginning of nonwords (and vice versa for children). Forty-five adults and 56 children (Grades 4-5) completed a nonword spelling choice task in which the sentence context was either familiar or unfamiliar and the nonword's target consonant was in the word-initial or word-final position. Results revealed that more common spellings were chosen significantly more often when presented in familiar than unfamiliar sentences, and in the word-final than word-initial position. Although no interaction between sentence context and age was found, adults chose the more common spelling significantly more often than children. This research is the first to reveal a higher-level contextual influence on the use of spelling patterns. Implications for classroom teaching are discussed.

The English language utilises a complex spelling system bound by orthographical (spelling) conventions. These conventions relate to letters representing sounds, combinations of letters which do or do not go together, and positional and contextual constraints of letter use within words (Apel, 2011). However, these constraints are often ambiguous as to how words may sound the same but can be spelt differently, which means that the one-to-one correspondence between sounds and their letters in English is limited (Hayes, Treiman, & Kessler, 2006). For example, the sound /f/ may be spelt *f* as in *foam*, *ph* as in *phone*, or *gh* as in *enough*. Specifically, these context-based spelling conventions are implicitly acquired with age and are learned by extracting statistical regularities (patterns) (Pollo, Kessler, & Treiman, 2009) from the surrounding environment through listening and reading (Kessler, 2009), and are not explicitly taught.

However, as will be discussed, previous research has suggested that these orthographic patterns are affected by different contexts, such as the within-word-level context (i.e., which letters occur next to which other letters), and the word-level context (i.e., whether the word is more typical or foreign sounding) (Kemp, Treiman, Blackley, Svoboda, & Kessler, 2015). Research in this area is often conducted with nonwords rather than real words, so that word familiarity, frequency, age of acquisition and meaningfulness are not confounding variables in the results (Balota, Cortese, Sergent-Marshall, Spieler, & Yap, 2004; Kessler, 2009). However, no research to date has considered the potential effect of the sentence-level context on how people use implicit spelling patterns. Hence the aim of this study was to investigate the sentence-level contextual influence on the spelling of nonwords by assessing whether adults and children choose the spelling of a nonword in accordance with the level of familiarity suggested in the sentence context.

Within-Word Context Sensitivity

Within-word sensitivity has been widely investigated in both adults and children. Specifically, this is the idea that people are sensitive to both the sounds made by combining certain phonemes (phonotactics) and to the visual patterns made by combining specific letters (orthotactics) in a word. Furthermore, people are able to distinguish more common from less common phonotactic and orthotactic patterns in spoken and written English. Although orthotactics is the focus of the present study, the foundation of phonotactics is fundamental in understanding how people are sensitive to spelling patterns.

Phonotactic Probability

As the English spelling system has many letter combinations that sound the same but look different, it can be a difficult orthography to learn, understand, and study. However, previous research has identified implicit conventions that outline which sound combinations are used more frequently than others (Pollo et al., 2009). Specifically, phonotactic conventions refer to the fact that certain sounds are more likely to “go together” in a word than others. For example, in English, the sound combination /sl/ (as in *sleigh*) has a relatively high phonotactic probability as it seems like it could be a normal English sound combination. However, the combination /vl/ (as in *Vladimir*) has a lower phonotactic probability, and thus sounds less like a normal English sound combination (Vitevitch & Luce, 2004).

Frisch, Large, and Pisoni (2000) found that adults were more likely to recognise words containing phonotactically frequent letter combinations than words containing phonotactically infrequent letter combinations in a lexical recognition task. This is important for understanding spelling patterns because it shows that adults are sensitive to whether sound combinations seem common or not, and are

able to distinguish between them. However, although children in primary school show sensitivity to phonotactic spelling patterns, evidence about the age at which children start to use these patterns is varied and inconclusive (Kessler, 2009). Kessler (2009) found that children as young as six years old were able to apply these conditional rules, and although this ability to distinguish based on patterns is not as strong for children as it is for adults, even adults are not able to follow these patterns perfectly.

Overall, people are sensitive to sound patterns and whether combinations of certain sounds are common in English, or not. However there is also evidence to suggest that individuals are sensitive to orthotactic patterns, which govern the “look” of the word in relation to what combination of letters work together in the English language, and are thus more common.

Influence of Implicit Spelling Patterns

Positional and contextual constraints determine orthotactic patterns for the combinations of letters within a word in terms of which letters can be combined in the word, and where. The positional constraints can be at the beginning of the word (word-initial) or at the end of the word (word-final). For example, the letter *u* is rarely used following the letter *w* in English, as the vowel sound /ʌ/ (as in *fun*) is usually written with the letter *o* when following the letter *w*, as in *wonder*. Similarly, the letter combination *tch* cannot be used at the beginning of a word to represent the sound /tʃ/ (except in foreign borrowings and names, such as *Tchaikovsky*), although it is commonly used at the end, as in *catch* (Apel, 2011). As discussed below, evidence suggests that individuals who read and write in English are also able to distinguish between patterns of letters that look ‘English’ and patterns that look foreign, even though they are not explicitly taught this.

Specifically, within-word research has focused on patterns in the use of vowels and consonants that are governed by these orthotactic rules and patterns. Hayes et al. (2006) and Perry, Ziegler, and Coltheart (2002) studied the influence of vowels on the spelling of adjacent consonants. An example of this kind of influence is that in English, when a one-syllable word ends with the sound /l/, if the preceding vowel sound is a short one (written with one letter), the /l/ needs to be doubled (e.g., *fell*), whereas if the preceding vowel sound is a long one (written with more than one letter), the /l/ remains single (e.g., *feel*) (Perry et al., 2002). Adults appear to follow this pattern, as when they were asked to spell the final consonants in nonwords, participants were more likely to use doubled (extended) consonants which followed a short vowel in the middle of the word, and to use single (shortened) consonants following a long vowel (Perry et al., 2002). As the participants were not explicitly taught these patterns before completing the task, this suggests that they had implicitly acquired these spelling patterns from words they had previously been exposed to in the environment.

Treiman, Kessler, and Bick (2002) similarly found that undergraduates' spelling of vowel sounds in English words was 'conditioned' by adjacent consonants. This effect was present in the direction of the vowel-to-consonant where the length of the vowel sound influences the length of the consonant at the end of the word (as in the *feel/fell* example mentioned above; Perry et al., 2002). It was also present in the consonant-to-vowel direction where, for example, at the beginning of a word, the sound /k/ is more likely to be spelt with a *k* when preceding the letter *e*, as in *kept*, and more likely to be spelt with a *c* when preceding an *o*, as in *cost* (Hayes et al., 2006). Following this convention, when adults were tested with nonwords, they were able to implicitly follow these real-word patterns when spelling the nonwords

(Treiman et al., 2002).

Spellers are sensitive to such conventions even in childhood. For example, Kessler (2009) found that children as young as six years old were able to apply these implicit conventions, and the proportion of correct responses increased with age. The consonant-vowel and vowel-consonant relationships provide important evidence for understanding how both the beginning and the end of the word can influence individuals' spelling. Therefore, understanding patterns and conventions within the word is necessary. However, it is also important to consider patterns at the level of the whole word.

Word-Level Context Sensitivity

Compared to within-word context sensitivity, there is limited research on how the word-level context can affect the spelling of a word in both adults and children. Therefore, it is important to test both adults and children to assess potential differences across age. An example of the potential influence of the word-level context is how individuals can be influenced by the perceived language of origin of the word, and how well established the word is in the English language. For example, the sound /ʃ/ is commonly spelt with the letters *sh* (e.g., *shift*) in written English. However, in words of non-English origin, it can be spelt in less common ways, such as *ch* (e.g., *chef*, which is of French origin) or *sch* (e.g., *schnitzel*, which is of German origin) (Kessler, 2009).

Context and Type of Word

It is unclear as to how individuals are able to tell if a word comes from another language or not. However, it appears that as people get older, their sensitivity to words that sound and look 'more English' increases and they are more easily able to distinguish between words that look and sound more unusual and less part of the

English language, and those that appear more English (Kemp et al., 2015). This effect is arguably caused by increased exposure to different words and languages with age, which thus increases an individual's ability to implicitly distinguish between more or less common sounds and letter combinations in English.

One way to test how the word-level context may affect how a person chooses to spell words is to tell them explicitly that the words are somehow 'different'. Kemp et al. (2015) asked adults and children (Grades 2 to 6) to spell nonwords, which they were told were real words, nonwords, or names of monsters. Each word contained a target sound that could be spelt in a more common way (e.g., /f/ spelt as *f*) or a less common way (e.g., /f/ spelt as *ph*). It was predicted that people would use the less common spellings more often for nonwords that were presented as either nonwords or monster names, compared to nonwords that were said to be proper English words. However, there were no significant differences in participants' use of the most common spellings across word types for any age group. This suggests that children and adults were not affected by the 'type' of nonword and consequently did not vary their spelling, regardless of the description given.

As the instructions about the nature of the nonwords did not affect how participants responded, Kemp et al. (2015) decided to manipulate the nonwords themselves to see how this affected spelling choice. Specifically, they presented children and adults with nonwords that contained phonotactically frequent sound combinations (e.g., the /sp/ in *crusp*), which thus sounded more like real English words, or phonotactically infrequent combinations (e.g., the /fp/ in *cru^ufp*), which sounded more like foreign words. When participants were asked to spell these 'new words', it was found that adults, but not children, were more likely to use the more common spellings for target sounds in English-sounding nonwords (e.g., to spell

crusp with a *c*) and more likely to use the less common spelling for target sounds in foreign-sounding nonwords (e.g., to spell *crufp* with a *k* instead of the more common spelling of *c*). To expand on these findings, in a final study, the authors used a spelling choice task where participants were presented with a common and uncommon spelling of a nonword and they were asked to choose which they thought was the most appropriate spelling. The authors again found that adults chose the more common spelling of the nonword significantly more often than the uncommon spelling, but this effect was not present in children. These findings supported their hypotheses that spelling choice would be influenced by how much the nonword sounds and looks like a typical English word.

Positioning of Consonants

Another factor to consider in people's spelling of new words is the position of the target spelling in the word. Some evidence suggests that the position of the target consonant (word-initial or word-final) has no effect on how adults choose to spell words (Havy, Serres, & Nazzi, 2014). However, it has been shown that children pay more attention to the sound of specific phoneme combinations at the beginning of words because the associated conventions have been acquired before the end of the words (Zamuner, 2013).

Specifically, Zamuner (2013) found that in spoken language, infants and children aged two to three years old were not sensitive to the word-initial or word-final positioning of target consonants when the words were spoken. Furthermore, Cole (2006) found that children aged four to five years old were more sensitive to the word-initial position in terms of being able to detect the mispronunciation of words. This finding may be explained from the perspective that children of this age (four to five years) are starting to read, and thus are implicitly acquiring spelling conventions

which they use to help them make sense of the language they are learning. However, in regards to spoken language, evidence is still inconclusive, and as age and developmental levels increase, there is scope for this sensitivity pattern to change with increased exposure to written language.

When considering written language, children aged six years old still appear more sensitive to the positioning of target consonants at the beginning of the word compared to the end of the word, as research has found that children find initial consonants easier to spell in nonwords than word-final consonants (Treiman, Berch, & Weatherson, 1993). Importantly, Treiman et al. (1993) used the same target consonants at the end of the word and the beginning, and they still found that the consonants at the beginning were easier for children to spell. Therefore, this showed that the effect was a result of the positioning of the consonants, rather than the nature of the consonants.

In contrast, for adults, it has been found that more common spellings are more accurately identified for consonants in the word-final position than the word-initial position (Kemp et al., 2015). Hence as it is apparent that position effects vary across ages (Zamuner, 2013), it would be useful for research in this area to have half of the words with the target consonant at the beginning of the word and half with the target consonant at the end of the word, to assess any potential effects of word position, and whether there is a difference in sensitivity across ages.

To date, no studies have investigated whether people are equally as sensitive to orthotactic patterns (the “look” of particular letter combinations) as they are to orthographic patterns more generally (those patterns that are influenced by a wider context, e.g., the sentence). This is an important area of research to advance understanding of sensitivity to spelling patterns. Specifically, research on word-level

spelling patterns (where the words sound the same but look different) has established that children and adults are both sensitive to whole-word spelling patterns. Thus, it is important that research on the use of orthographic spelling patterns is advanced by manipulating a higher-level influence and seeing how this affects spelling patterns. In particular, the sentence-level context (i.e., the sentence surrounding the target nonword) may potentially influence spelling patterns, and so it is important to investigate this effect.

Sentence-Level Context Sensitivity

Spelling patterns beyond the word-level context have not yet been researched. As Kessler (2009) acknowledged that the use of learnt conventions could be influenced by the ‘look’ of the word, it follows that the sentence and its meaning may also potentially influence the use of spelling conventions. Specifically, manipulating the level of familiarity in a sentence context to be suggestive of either a familiar or unfamiliar context may influence how people spell a target word in the sentence. For example, a sentence with a familiar context is “I was born in a city very close to here called X”, compared to the unfamiliar equivalent of “I was born in a foreign city called X”, where ‘X’ is the target nonword. This kind of sentence-level contextual influence on the spelling of words is yet to be investigated.

The Present Study

The aim of this research was to investigate, for the first time, the sentence-level contextual influence on the spelling of nonwords by analysing whether primary school children and adults choose the spelling of a nonword based on the context of the sentence in which the nonword is presented. Specifically, we aimed to assess whether the chosen spelling of target sounds in nonwords was influenced by a sentence context, which suggests that the word was either familiar or unfamiliar. The

nonwords were developed in accordance with orthographic conventions whereby each nonword could be spelt in one of two different ways; one with a more common spelling and one with a less common spelling, but both spellings sounded the same (e.g., *gup* and *ghup*, respectively). Manipulation of the sentence context was achieved by developing sentences that made the target nonword seem either familiar (everyday and well-known) and thus might be spelt with a more common spelling, or unfamiliar (rare or unknown), which might lead to a less common spelling of the nonword.

It was hypothesised that children and adults would both choose the more common spelling of the nonword (consistent with orthographic conventions; Kemp et al., 2015) significantly more often when it was presented in a sentence which suggested that the nonword was familiar, than in a sentence which suggested that the nonword was unfamiliar. It was also hypothesised that adults would choose the most common spelling when the position of the target consonant was at the end of the nonword, compared to the beginning (consistent with Kemp et al., 2015), and that children would choose the most common spelling when the position of the target consonant was at the beginning of the nonword, compared to the end, in accordance with Zamuner (2013), Cole (2006) and Treiman et al. (1993). Consistent with Kessler's (2009) finding that spelling patterns are consolidated with age, and the finding by Kemp et al. (2015) suggesting that adults are more likely to choose the more common spelling dependent on context than children, it was hypothesised that there would be a significant interaction between familiarity and age group. Specifically, it was predicted that adults would choose the more common spelling of the nonword when presented in a familiar sentence context a higher proportion of times, compared to children.

Method

Participants

The sample consisted of 45 adults (14 males, mean age = 25.02 years, $SD = 10.55$). Thirty-eight participants were undergraduate students, and participated as either part of a class activity or via an online recruitment system, and seven were in the workforce and participated voluntarily. Fifty-six children (28 males, mean age = 9.73, $SD = 0.65$) from Grades 4 and 5 of a local private school participated. Their participation was part of a class activity completed once written consent was obtained from the Head of the Primary School and parents, and the children also gave verbal assent.

Participants' spelling ability was tested by the spelling subtest of the Wide Range Achievement Test-4 (WRAT-4; Wilkinson & Robertson, 2006), where the mean standard score is 100 ($SD = 15$). Both adults (mean score = 112.4, $SD = 9.43$) and children (mean score = 108.8, $SD = 13.60$) performed within the average range on the spelling subtest. Nine adults and 10 children reported that they frequently spoke another language at home. However an independent samples t -test revealed that the WRAT-4 spelling score for people who reported speaking another language was not significantly different from the rest of the sample, $F_s < 1$. However the mean WRAT-4 scores were slightly numerically higher, compared to participants who did not report speaking another language.

Materials

Forty experimental nonword pairs were developed by the researcher, which each contained target phonemes as identified by Kemp et al. (2015) (see Appendix A for the full word list). Expanding on phonemes identified by Kemp et al. (2015), 14 target phonemes were used in the present study (see Table 1).

Table 1

Target Phonemes, Spellings, English Examples and Nonword Examples

Target	Target	Most	Less	English	Nonword
Position	Phoneme	Common	Common	Examples	Examples
		Spelling	Spelling (s)		
Initial	/w/ (2)	<i>w</i>	<i>wh</i>	<i>wind, while</i>	<i>wint/whint</i>
	/f/ (2)	<i>f</i>	<i>ph</i>	<i>face, phase</i>	<i>fampo/phampo</i>
	/ʃ/ (3)	<i>sh</i>	<i>sch, ch</i>	<i>shine, schnitzel, chandelier</i>	<i>shink/schink, shote/chote</i>
	/z/ (2)	<i>z</i>	<i>x</i>	<i>zebra, xerox</i>	<i>zapon/xapon</i>
	/s/ (1)	<i>s</i>	<i>c</i>	<i>sign, cider</i>	<i>shupe/chupe</i>
	/k/ (5)	<i>c</i>	<i>k, ch, q</i>	<i>cat, kite, chlorine, queen</i>	<i>carzim/karzim, clartic/chlartic, cueton/queton</i>
	/n/ (1)	<i>n</i>	<i>kn</i>	<i>night, knife</i>	<i>niken/kniken</i>
	/g/ (3)	<i>g</i>	<i>gh</i>	<i>great, ghost</i>	<i>galt/ghalt</i>
	/r/ (1)	<i>r</i>	<i>wr</i>	<i>race, write</i>	<i>rilt/wrilt</i>
	/tʃ/ (5)	<i>tch</i>	<i>ch</i>	<i>hitch, much</i>	<i>datch/dach</i>
Final	/f/ (6)	<i>ff</i>	<i>f, ph</i>	<i>snuff, leaf, graph</i>	<i>sleff/slef, fuff/fuph</i>
	/l/ (5)	<i>ll</i>	<i>l</i>	<i>mill, boil</i>	<i>yoll/yol</i>
	/k/ (1) ^a	<i>k</i>	<i>q</i>	<i>milk, basque</i>	<i>tilk/tilq</i>
	/k/ (3) ^b	<i>ck</i>	<i>k, q</i>	<i>sick, trek, cheque</i>	<i>jeck/jek, leck/leq</i>

Note. Values in parentheses represent frequency of nonwords that used the target phoneme in study. Letters in bold indicate target consonants.

^a = phoneme after a consonant. ^b = phoneme after a short vowel.

Each nonword pair had one nonword with a target consonant that could be spelt in a more common way and one nonword with a target consonant that could be spelt in a less common way in English. For example in English, the sound /r/ is more commonly spelt as *r*, and less commonly spelt as *wr*. Thus each nonword in a sentence had two alternative, identical-sounding spellings, one that contained a more common target phoneme (e.g., *rilt*) and one with a less common target phoneme (e.g., *wrilt*).

Half the nonwords had the target sound at the beginning (word-initial; e.g., *rilt* / *wrilt*) and the other half had the target sound at the end (word-final; e.g., *petch* / *pech*) to allow for comparison of position effects. In total there were 30 mono-syllabic nonwords, and 10 bi-syllabic nonwords. The task was designed to be spoken so all participants heard the same pronunciation of the nonword, and could then choose the spelling from the two options.

Each nonword pair was put into one of 40 sentence contexts developed by the researcher. The sentences were created so that half made the nonword sound as though it were familiar (well-known, everyday, local), for example, ‘My Aunt brought me back a toy from the shop. It was called a *rilt* / *wrilt*’. The other half of the sentences were created to make the nonword sound as though it were an unfamiliar (unusual, faraway, foreign) concept, for example, ‘My Aunt brought me back a toy from a different country. It was called a *rilt* / *wrilt*’. The sentences were developed to be simple enough that they could be used for both children and adults.

Sentences were also developed so that there was a near-even spread of gender-specific sentences (e.g., ‘My friend and I met a man from a faraway country. His name was Sleff/Slef’ and ‘My little sister has an imaginary friend she calls Fampo/Phampo’), and gender-neutral sentences (e.g., ‘This is a painting of a local

place called Karzim/Carzim’). The topics chosen for distinguishing the familiarity of the nonwords were also broadly and diversely categorised (e.g., fruit – ‘I tried this fruit from my friend’s tree called a datch/dach’, pets – ‘I have a pet chinchilla called Quef/Queff’, and places – ‘I read a true story about the town where I live, which is called Cubot/Kubot’).

A small pilot test on five adults was undertaken to check the reliability of the test. The experimental nonword spelling task involved adults being read aloud the 40 sentences and shown the two alternative spellings of each nonword. Participants were asked to circle which nonword looked like the most appropriate spelling for each sentence. Feedback from participants about the clarity of the test was used to reduce ambiguity. For example, one participant acknowledged that the sentence ‘When I went down the road I saw a *luch/lutch*’ was ambiguous as it was not clear exactly what kind of object or event the nonword was referring to. This was important because all sentences needed to consistently refer to a specific object (e.g., fruit, animal, place) in the sentence so that sentence familiarity could be manipulated, and thus participants’ spelling choices of the nonword could be influenced by this explicit context. In accordance with feedback from participants, the sentences were also made more consistent in terms of the average number of words in each (final mean number of words per sentence = 12.25, $SD = 2.69$).

After the researcher made amendments to the task sentences, 20 sentences were selected to form the versions for the children based on the initial adult testing, which used 40 sentences. The aim of this was to provide a consolidated, clear version of the task and to reduce demand and fatigue effects on the children. The selection of these 20 sentences was done by first calculating the mean number of times the adult participants chose the more common spelling of the nonword in sentences with

familiar contexts and unfamiliar contexts, and the number of times the less common spellings were chosen in familiar and unfamiliar sentence contexts for each nonword. Then the 20 nonwords with the highest difference scores (hence suggesting more clear-cut sentences and nonword associations) were identified. Of these 20 nonwords, 10 nonwords had the target consonant in the word-initial position (mean difference = 0.22, $SD = 0.07$) and 10 nonwords had the target consonant in the word-final position (mean difference = 0.22, $SD = 0.14$).

Due to experimenter error when these nonwords were put into the sentences for the versions to be created, there was an uneven number of familiar and unfamiliar sentence contexts in the word-initial and word-final conditions: four and six instead of five and five of each combination. To address this issue, the proportion of the most common spellings chosen by participants was used, rather than the raw scores so that comparisons could be made.

Two versions of the task were created overall (A and B) to allow for alternation of the sentences (so the nonword pair had an equal chance of being presented in a familiar context sentence as an unfamiliar context sentence), and for alternation of the two nonwords in a pair (see examples below). These controls also allowed for random assignment of the task between participants to reduce order effects. Hence, each participant received the same two spelling choices for the nonword regardless of which version (dependent on sentence type) of the task they received (e.g., Version A - ‘I tried this fruit called a *datch/dach*’ or Version B - ‘I tried this strange new fruit called a *datch/dach*’).

The presentation of these nonwords was further counterbalanced within Version A and B so each overall version had two subversions (e.g., Version A1 - ‘I tried this fruit called a *datch/dach*’, Version A2 – ‘I tried this fruit called a

dach/datch', and Version B would have the unfamiliar context sentence with nonword pairs alternated between B1 and B2). Therefore there were four versions of the task with 40 questions for adults (A1, A2, B1, B2; see Appendix B) and four versions of the task with 20 questions for children (A1, A2, B1, B2; see Appendix C).

In practical terms, this meant that for example, one class of children received Version A where A1 and A2 were alternately handed out to each child, and the other class received Version B where B1 and B2 were alternated between children. Thus within one class, child X would have the sentence with '*datch/dach*' and child Y sitting next to child X would have '*dach/datch*', which also facilitated reducing the effects from copying or choosing the first nonword every time. Alternation of the test for adults was managed by keeping a tally of versions used.

Finally, the WRAT-4 spelling subtest was used to assess spelling ability, whereby 42 real words of increasing difficulty are read out (each word is given an example sentence of how the word is used) to participants for them to spell.

Procedure

Following approval from the University of Tasmania's Human Research Ethics Committee to conduct this research (see Appendix D), all participants were provided with relevant information sheets and consent forms (extra were given to the head of the primary school and parents/guardians of the children) (see Appendix E). Adult testing occurred in either a group or individual session of about 30 minutes, in which the experimental nonword spelling task was administered. In this task, the experimenter read out each sentence and participants were asked to circle the spelling of the nonword they thought was appropriate for the sentence. It was made

clear to participants that there was no right or wrong answer. This was followed by the WRAT-4 spelling subtest.

A private school was also invited to participate in the study. Once parental permission was gained, children were given the opportunity to participate after having the study explained to them (see Appendix F for verbal instructions given to the children). The testing session took approximately 40 minutes in one of two group sessions in which children were administered the WRAT-4 spelling subtest immediately followed by the experimental nonword spelling task. Upon completion of the study, all participants were debriefed about the nature of the task as to why nonwords were used and what the aim of the experimental task was.

Design

This study had a 2 (Sentence Type: Familiar, Unfamiliar) x 2 (Position of Target Consonant: Initial, Final) repeated measures design with the between-subjects variable of Age Group (Adult, Child). The dependent variable was the proportion of more common spellings of the target consonants in the nonword chosen.

Results

The mean proportion of times the most common spelling was chosen by participants was calculated, depending on the combination of the sentence context, the position of the target consonant and each factor overall. These proportions are shown in Table 2. For both adults and children, the most common spelling was chosen when the context of the sentence was familiar and when the target consonant was in the word-final position.

Table 2

Mean Proportions of Choice of Most Common Spelling for Target Consonant Across Sentence Type and Consonant Position

Sentence Type	Consonant Position	Total	Group	
			Adults ^a	Children ^b
Familiar	Initial		.53 (.22)	.52 (.27)
	Final		.83 (.14)	.70 (.21)
Unfamiliar	Initial		.49 (.21)	.43 (.26)
	Final		.72 (.19)	.64 (.21)
		Familiar	.68 (.15)	.61 (.17)
		Unfamiliar	.61 (.17)	.54 (.17)
		Initial	.51 (.19)	.48 (.19)
		Final	.78 (.14)	.67 (.16)
		Overall ^c	.65 (.14)	.57 (.13)

Note. Standard deviations are in brackets.

^aN = 45. ^bN = 56. ^c denotes most common spelling chosen overall.

These patterns were analysed using a 2x2 (within-subjects variables: Sentence Type: Familiar/Unfamiliar and Position of Target Consonant: Initial/Final) repeated measures Analysis of Variance (ANOVA) with the between-subjects variable of Age Group. With sphericity assumed, a significant main effect of familiarity was found, $F(1,99) = 15.54, p < .001, \eta_p^2 = .14$, suggesting that participants chose the most common spelling of the target consonant in the nonword significantly more often when the sentence had a familiar context compared to an unfamiliar context. A significant main effect of position was also found, $F(1,99) = 105.74, p < .001, \eta_p^2 = .52$, which suggested that participants chose the most common

spelling of the target consonant in the nonword significantly more often when the target consonant was in the word-final position compared to the word-initial position. There was also a significant effect of age group, as adults chose the most common spelling significantly more often than the children regardless of sentence type or the position of the target consonants, $F(1,99) = 7.03, p = .009, \eta_p^2 = .07$.

There was no significant interaction between sentence type and positioning of the target consonants, $F(1,99) = 0.24, p = .625, \eta_p^2 = .00$, which suggests that the proportion of most common spellings of the nonword chosen when in a familiar sentence context was not influenced by whether the target consonants were at the beginning or the end of the nonword. The interaction between sentence type and age group was also not significant, $F(1,99) = 0.01, p = .912, \eta_p^2 = .00$, suggesting that adults did not choose the more common spelling of the nonword when presented in a familiar sentence significantly more often than children. Finally, the interaction between the position of the target consonant and age group was not significant, $F(1,99) = 2.62, p = .109, \eta_p^2 = .03$, which indicates that the proportion of most common spellings chosen in each target consonant position was not significantly different for adults compared to children.

Discussion

The aim of this research was to investigate whether a sentence context can influence people's spelling of a nonword when the sentence context is manipulated to appear as either familiar or unfamiliar. Specifically, it was predicted that participants would choose the more common spellings, consistent with English spelling conventions, for nonwords presented in a sentence with a familiar context than for nonwords presented in sentences with a more unfamiliar context. It was expected that adults would also choose the more common spellings when the target

consonants were at the end of the nonword compared to beginning of the nonword. Further, that children would choose the more common spellings when the target consonants were at the beginning of the word. Lastly, it was expected that adults would choose the more common spelling of the nonword when it was presented in a familiar context than an unfamiliar context, compared to children.

The main hypothesis was supported, as it was found that both adults and children chose the more common spelling of the target nonwords (consistent with English conventions) significantly more often when they were presented in a sentence with a familiar compared to unfamiliar context. Thus, participants were able to distinguish between more and less common spellings of target consonants when nonwords were embedded in a sentence context. To our knowledge, this was the first study to manipulate the intended familiarity level of target nonwords in terms of their sentence context.

This finding supports the conceptual relationship evident between a familiar or relatable concept and the matching complexity of associated spelling patterns. This is similar to the pattern found by Kemp et al. (2015) in regards to more common English spellings being utilised when the nonword appeared to be ‘more English’ compared to ‘more foreign’. Specifically in terms of the manipulation in the present study, it makes sense that there is a conceptual and empirical link between a seemingly more common English spelling being associated with a sentence which talks about Australia (i.e., ‘There is a new Australian girl from Melbourne in my class. Her name is Cil/Cill’), compared to a more foreign and uncommon sounding spelling which matches a sentence context of another country (i.e., ‘There is a new girl from a different country in my class. Her name is Cill/Cil’). This finding is interpreted further below.

The hypothesis that there would be an interaction between age group and positioning of the target consonant was not supported. Specifically, adults did not choose the more common spelling of the target consonants when they were presented at the end of the nonword, and children did not choose the more common spelling when the target consonants were at the beginning of the nonword. This is contrary to what would have been expected based on previous literature, which found that children are sensitive towards patterns of consonants in the word-initial position (Cole, 2006; Treiman et al., 1993; Zamuner, 2013), and adults are sensitive towards consonants in the word-final position (Kemp et al., 2015). This result can best be explained by the main effect of target consonant position that was found instead. Participants showed a tendency to choose the more common spellings for target consonants in the word-final compared to the word-initial position. Hence, both adults and children chose the more common spelling of the target consonant more often when the target consonants were at the end of the word (e.g., *queff/quef*) rather than the beginning (e.g., *calp/kalp*).

Although the present study asked participants to choose the spelling of a nonword from a pair, the finding is consistent with previous research which found that adults were more accurate at spelling target consonants when they were in the word-final compared to word-initial position (Kemp et al., 2015). A possible explanation for this finding is that the spelling of word-final consonants determined by more consistent rules in the written English language than word-initial consonants (Kemp et al., 2015). Thus, the less common spelling of a nonword may appear incompatible with spelling patterns that a participant implicitly utilises. For example, the nonword pronounced /yol/ can be written with the more common spelling *yoll* which follows the vowel-consonant convention. It could also have a less common

spelling of *yol*, which does not follow the vowel-consonant convention of doubling consonants after a short vowel sound, as discussed in the Introduction section.

Therefore, the less common spelling implicitly appears to be incongruent with the vowel-consonant spelling convention.

In comparison, there is a lot more variability of consonant combinations in the word-initial position due to a greater influence from other languages. For example, the sound /ʃ/ can be commonly spelt with a *sh*, or less commonly spelt with a *ch*, or *sch*, which are both borrowed from other languages (Kessler, 2009). Similarly, the consonant combination of /sl/ appears to be more common in English compared to /vl/ (Vitevitch & Luce, 2004), but this difference is not as clear compared to the vowel-consonant convention because it does not follow a pattern. Hence, the spelling of the nonword overall may be more obvious when there is one option (from two given spellings) that does not fit the common pattern.

Notably, as Kessler (2009) found that the use of learnt conventions can be influenced by how the word ‘looks’, this provides further evidence for the possible effect found in the word-final compared to word-initial position. This is arguably because the pattern of doubling consonants after a short vowel sound has existed for longer in the written English language compared to other patterns or combinations that have a more recent foreign influence. Furthermore, Kessler (2009) also acknowledges that people can use the end of the word to aid in the spelling and pronunciation of the initial consonant(s). Thus, it could be argued that in the present study, the effects were not as strong in the word-initial position. This would reflect confusion resulting from trying to assess all parts of the word, compared to the word-final position where the patterns are more consistent.

In contrast, according to Cole (2006), children are more sensitive to word-initial patterns in their early years (i.e., ages four to five) of learning spoken language, which is increasingly aided by the development of written language. Specifically, children aged six years old who are able to write show sensitivity for word-initial consonants as well, and thus are able to spell consonants at the beginning of the word more consistently and accurately (Treiman et al., 1993). It could be argued that this sensitivity to consonants at the beginning of the word is because children's knowledge of word-initial patterns is more consolidated than word-final patterns at an early age due to hearing letter combinations at the beginning of words first, before learning to write and thus being able to learn word-final patterns. Attentional processes may also be involved, as children generally pay more attention at the beginning of the word.

Zamuner (2013) and Havy et al. (2014) both acknowledge that the general evidence for children's knowledge of patterns in the word-initial or word-final position is inconclusive, as the known effects change with age and developmental progress. However, it is possible that the findings of the present study could be explained in the same way as for the adults. This means that patterns in the word-final position may be more stable in the English language overall, compared to in the word-initial position where there is a greater influence from other languages. Furthermore, participants in the present study were older (average age of nine years) compared to previous research by Zamuner (2013), Cole (2006) and Treiman et al. (1993) (age range of two to six years old), and this may help to explain why children were showing the same sensitivity towards the word-final position as adults.

The final hypothesis, that the effects of sentence type would be stronger for adults compared to children, was not supported. It was found that adults did not

choose the more common spelling of the nonword more often when presented in a familiar sentence context than an unfamiliar sentence, when compared to children. This hypothesis was based on the study by Kemp et al. (2015), which found that the context given to a nonword significantly affected whether or not the more common spelling was chosen by adults. However, as no significant difference between children and adults was found in the proportion of most common spellings chosen when presented in a familiar context compared to an unfamiliar context in the current study. This is contrary to Kessler's (2009) findings that sensitivity to implicit spelling patterns significantly increases with age.

Furthermore, the present finding argues against the conceptual relationship evident between age and exposure in that as age increases, so does exposure to the environment in regards to other people, languages, education and written/auditory materials. Therefore it would have been expected that increased exposure for adults would lead to a consolidated knowledge of spelling patterns and the ability to discriminate between more common and less common spellings based on the context in which it is presented.

This hypothesis was based on research by Kessler (2009) and Kemp et al. (2015). However, as Kessler's (2009) study was based on younger children (around the age of six), it is possible that the children in the present study, who had a mean age of just over nine-and-a-half years, had a more consolidated knowledge of spelling patterns, and thus were able to differentiate at a higher rate based on context. Furthermore, although Kemp et al. (2015) had participants with a mean age similar to those in the present study, it could be argued that the present findings were the result of a more effective manipulation of the nonword, due to the surrounding sentence. Therefore these findings may provide evidence that children are able to

distinguish spellings based on context nearly as effectively as adults when they are older than participants in most of the previous literature, and thus this might suggest that children are actually able to distinguish patterns based on context earlier than might otherwise have been expected.

Contrary to what was hypothesised, a main effect of age group was found, which indicates that adults chose the more common spellings of the nonword more often than children, regardless of the sentence type or the positioning of the target consonant. This was an unexpected finding, as based on previous research, it would have been expected that children would use the more common spellings more often overall because they arguably know fewer less common spellings and thus predominantly default onto implicit and more common patterns (Kemp et al., 2015). Specifically, Kessler (2009) acknowledges that the main reason why children would show this trend is because the orthographic patterns that children are exposed to increase in complexity with age (e.g., textbooks use more complex words for older age groups), and it is arguable that children have not yet been exposed to these irregularities due to simplified language in the classroom context.

However, one possible way to explain this effect is that because adults have a more consolidated knowledge about patterns and more or less common spellings, they may have chosen to take what appeared to be the ‘safe’ option (i.e., more common) when choosing their answers, because they had conflicting implicit conventions and patterns to choose from based on knowledge and exposure. Specifically, their choice could have been confused by some less common patterns still appearing to be an appropriate response. For example, in the nonword pair of *braff* and *braph*, each nonword spelling could be a plausible option due to common English words using those endings (e.g., *staff* and *graph*), compared to the nonword

pair of *tilk* and *tilq*, where *tilq* looks more incongruent because there are very few words in English ending with the letter *q*. Therefore, adults may have opted to choose what they thought was the more common spelling more often (especially where it was more apparent) due to confusion resulting from competing patterns.

Comparatively, children may have chosen the more common spelling of the nonword less often than adults because they may have chosen to be more creative in their responses. For example they may have chosen *tilq* compared to *tilk* more often than adults because it was something ‘different’ and this was exciting to them. This creative component was evidenced by a few children making comments such as “this word [less common spelling of nonword] looks cool” during the task, which may have led them to make the most of a novel opportunity to utilise, and thus choose less common spellings.

When considering the results overall, it is evident that the context provided by a sentence can influence how people choose to spell words contained within it. Adults specifically use the context to reduce difficulties, such as incongruent letter combinations that do not fit with common patterns, associated with the English spelling system (Treiman et al., 2002), and to a certain extent it is apparent from the present study that children are able to utilise the context to aid their spelling as well. This finding is consistent with previous literature, which suggests that people are able to implicitly distinguish patterns at a within-word level, such as letter combinations that are more common in English than others (Vitevitch & Luce, 2004). Furthermore these effects are also evident at the word-level where the perceived origin (i.e., English or foreign) of the word can affect how it is spelt, as a word which appears more English and thus familiar is likely to be spelt with a more common spelling consistent with English spelling conventions, than a word which

seems foreign and thus utilises less common spellings (Kemp et al., 2015; Kessler, 2009).

Hence the present study provides evidence that a higher-level influence beyond the word itself (i.e., sentence context) can implicitly alter spelling. More specifically, if a person is presented with a nonword in a sentence with a familiar context, they are more likely to choose the more common spelling of that nonword. Conversely, if people are presented with a nonword in an unfamiliar context, they are more likely to utilise a less common spelling of the nonword.

Limitations and Future Directions

Interestingly, in the current study the effect of sentence type was not as strong as the effect for the position of the target consonant. An explanation for this is that participants were more focused on choosing the spelling of the nonword than considering the sentence as a whole. This is similar to the problem encountered in the first part of the study by Kemp et al. (2015), which looked at whether manipulating what the nonword was supposed to represent (i.e., real word, nonword, monster name) would affect how participants chose to spell the nonword. However as no significant differences were found in that study in regards to the number of most common spellings used by adults or children, it was opined that participants were focusing on spelling rather than the instructions given. Therefore having the sentence context read aloud to participants and giving them the chance to read the sentence to themselves helped to consolidate the manipulation of the sentence in the current study. However, future research could enhance this further by asking participants to say each sentence aloud as well, so they are also verbalising the nonword.

Although the position effect was significant, there are a few aspects that need

to be considered for future research. Treiman et al. (1993) looked at the effects of the same target consonant in both the word-initial and word-final position to ensure that their findings were a result of the position rather than the nonword itself. Therefore future research based on the present study should aim to assess the target consonants in both positions to make sure that the findings are not influenced by the nonwords created.

Furthermore, it has been found that participants are least effective at applying the most common spelling to target consonants in the middle of the word, and perform even worse if that target is a vowel (Treiman et al., 1993). Hence, it would be interesting for future research to extend the variables in the present study to manipulate the middle of the nonword as well. This could be facilitated by either a choice task (as in the present study) or by asking participants to actually spell the word. Importantly, the positioning effect can also be influenced by whether words are mono-syllabic or bi-syllabic, as bi-syllabic nonwords are harder to spell (Treiman et al., 1993). As the present study used a mix of mono- and bi-syllabic nonwords, future research could control this to assess how different syllable lengths of the nonwords may be affected by the sentence context as well.

In regards to demographic variables, participants who spoke a second language did not have significantly higher spelling scores on the WRAT-4 spelling subtest than those who did not speak a second language. However mean scores on the WRAT-4 were numerically slightly higher for participants who reported speaking another language. This slightly higher mean score could be attributed to the suggestion that people who fluently know another language (i.e., reading, writing and speaking ability) are able to acquire new spelling patterns and conventions much more easily (Cutler, 2015), and thus it could be inferred that their spelling of English

words may be more accurate as a result.

As speaking another language may influence spelling ability, an important limitation of the present study is that it was not clear whether English was a participant's first or second language, and participants were not asked what their other language was. Cutler (2015) acknowledges that learning to speak and write in another language (L2) can not only be hindered by a person's first language (L1), but it can also be influenced by whether both languages use the Latin alphabet (e.g., English and French) or one uses the Latin alphabet and the other uses a logographic system (e.g., Chinese). Therefore, as a person's L1 can affect the acquisition of all aspects of an L2, it may be beneficial for future research to analyse whether participants' ability to discriminate between the more and less common spelling of the nonword are higher if they have an L2, as they may have a better knowledge of orthographic patterns.

Similarly, as learning new words can be negatively influenced by conventions that do not match a previously learnt language, it is possible that people who spoke another language could have performed worse (although not significantly so) given that nonwords were presented with a more and less common spelling (especially when the less common spellings are often taken from another language and thus sound foreign) (Cutler, 2015). Therefore future research in this area should collect more detailed demographic information including whether or not another language is spoken fluently or less often (e.g., every day, once a week), what language it is, if it is their L1 or L2, and how long they have been speaking it for.

More generally, it would be interesting for future research to involve younger children (e.g., Grades 2-3) and older children (e.g., Grades 8-9) to see how these patterns of results, especially in regards to the influence of the sentence context, may

change across the ages, consistent with Kessler's (2009) finding that spelling patterns are consolidated with age. This is also important because children learn different spelling conventions at different grade levels and so it would be valuable to see at what age the sentence context starts to influence spelling patterns at a consistently significant level.

Furthermore, as participants were given two nonword spellings from which to choose, it could be argued that the task was easier than if they had to generate the spellings themselves, such as in the study by Kemp et al. (2015). Thus future research could expand on the present study by asking participants to spell a nonword after it is spoken out loud to them, and they have had the chance to repeat the sentence with the target word out loud. If findings were similar to the present study then this would further reinforce how context can influence spelling choice, and specifically, spelling production.

The task could further be increased in complexity by altering where the target nonword is found in the sentence (e.g., beginning, middle and end), rather than just at the end. Furthermore, each version could present the nonword at a different point in the sentences to reduce sentence-positioning effects. Lastly, an experimental consideration relates to how effective the nonwords were overall in eliciting the desired response (i.e., more common spelling chosen when presented in a sentence with a familiar context). Therefore, future research should consider creating more versions of the task where one nonword pair may be presented in two different sentence contexts to see if the same result occurs.

Implications

This research has some practical implications for both adults and children. Specifically, in a teaching setting, the findings that the context can influence spelling

is important for how teachers demonstrate spelling patterns to young children, and also for how textbooks are written. For example, if a teacher likes to employ the use of fairytales to illustrate spelling patterns for their students, this could lead children to use the more uncommon spellings for words because they are associated with a more unusual and fantasy-based context. Fairytales are thus similar to the unfamiliar context that this study was manipulating, and some sentences even used the exact phrase of fairytales (e.g., ‘In my favourite fairytale there is a monster called Braff/Brapp’). It appeared from the results that sentences such as these gave participants a ‘creative licence’ to choose a more unusual and thus less common spelling, and thus it would be important for this to be controlled in a school setting.

For adults, the present study’s findings have implications for practical everyday understanding, as the benefit of being able to implicitly distinguish between more common and less common spellings based on patterns can help people to fill in potentially missing information and may facilitate quicker processing overall. More specifically, if someone was meeting a person for the first time who said they were from another country (and they verbalised their name), how a person thinks the name is spelt may be influenced by the fact that they are from another country where a more foreign spelling may be acceptable, compared to if they said they were from Australia. For example, if a person had never heard the name ‘Burell’ before, if a man introduced himself as “Burell from Australia” a person who speaks English may implicitly follow the vowel-consonant convention and thus write the name using a double *l*. However if the man introduced himself as “Burell from Italy”, it is reasonable that the name could be written as ‘Burel’, because it is foreign sounding. Therefore, being able to implicitly use these spelling patterns in conjunction with the relevant context can facilitate the spelling of new words.

Conclusions

The aim of the current research was to investigate whether the context provided by a sentence is able to influence the spelling of words within the sentence. Specifically, it was anticipated that participants would implicitly use the context of the sentence (either familiar or unfamiliar) to guide their choice of spelling of the nonword. Results provided evidence that when a target nonword was presented in a sentence with a familiar context, participants were significantly more likely to choose the more common spelling of that nonword, and were thus more likely to choose the less common spelling of the nonword when it was presented in a sentence with an unfamiliar context.

Expanding on previous research, the present study further added to the literature regarding the effect of positioning of the target consonant in the nonword, and specifically found that the end of the word was more salient. Therefore participants chose the more common spelling of the nonword when the target consonant was in the word-final compared to word-initial position, regardless of whether the nonword matched the sentence context or not. Furthermore, adults were more likely to choose the more common spelling of the nonword compared to children, regardless of the sentence context or position of the target consonants in the nonword.

Building on from previous research, the present study indicates that the context beyond the components of the word itself can influence spelling patterns. Notably, this is the first study to provide evidence that the context surrounding a word (i.e., a sentence) can affect how a person chooses to spell that word, which has widespread and noteworthy implications for academic and everyday contexts.

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Appendix A

List of Nonword Pairs Developed for Present Study

Target Consonant of Nonword in Word-Initial Position	Target Consonant of Nonword in Word-Final Position
Fampo/Phampo	Yoll/Yol
Cubot/Kubot	Sleff/Slef
Shupe/Chupe	Blick/Bliq
Carzim/Karzim	Lutch/Luch
Zapon/Xapon	Moff/Moph
Cueton/Queton	Snill/Snil
Niken/Kniken	Petch/Pech
Shote/Chote	Braff/Braph
Rilt/Wrilt	Tilk/Tilq
Calp/Kalp	Cill/Cil
Fogan/Phogan	Datch/Dach
Gup/Ghup	Jeck/Jek
Guty/Ghuty	Fuff/Fuph
Selp/Celp	Hetch/Hech
Zego/Xego	Queff/Quef
Wint/Whint	Jitch/Jich
Shink/Schink	Kell/Kel
Galt/Ghalt	Leck/Leq
Wep/Whep	Noff/Noph
Clartic/Chlartic	Rull/Rul

Appendix B

Versions of Experimental Nonword Spelling Task (Adults)

Appendix B1

Version A1

1. My Aunt brought me back a toy from the shop. It was called a whep/wep.
2. I tried this fruit from my friend's tree called a datch/dach.
3. My friend and I met a man from a faraway country. His name was Sleff/Slef.
4. There is a new Australian girl from Melbourne in my class. Her name is Cil/Cill.
5. My little sister has an imaginary friend she calls Phampo/Fampo.
6. I have a pet chinchilla called Quef/Queff.
7. A new animal was discovered in the bush in a different country. It was called a shote/chote.
8. I learned a new English word today. It was the word zego/xego.
9. I have a teddy called Rul/Rull.
10. They named a new town in Africa this week. They called it Selp/Celp.
11. This is a painting of a local place called Karzim/Carzim.
12. My dad cooked a strange new food, which is called gup/ghup.
13. My next door neighbour moved here from Launceston. His last name is Blick/Bliq.
14. A strange new flower I saw at the Botanical Gardens is called a shupe/chupe.
15. My teacher taught our class today about the legend of the local man Snil/Snill.
16. I was born in a city very close to here called Queton/Cueton.
17. In the pet shop I saw a type of Tasmanian fish called jitch/jich.
18. A girl from another country taught me a game called jeck/jek.
19. When I went down the road I saw a big field of luch/lutch.
20. I went for a swim in the pool and saw a little beetle called a fogan/phogan.
21. At the lolly shop they have a weird new lolly, which is called a tilq/tilk.
22. In the park when we were overseas I found a schink/shink.
23. My favourite newsreader on TV is called Niken/Kniken.
24. The best name I can think of for a monster is Fuff/Fuph.
25. I read a true story about the town where I live, which is called Kubot/Cubot.
26. A weird food I once tried is called guty/ghuty.
27. Mum just came back from a foreign city called Kel/Kell.
28. At my friend's house I saw a type of bird called a wint/whint.
29. In my favourite story there is a boy called Braff/Brapp.
30. The boy in this story came from a nearby town called Yoll/Yol.
31. My little brother has a dog that sleeps under his bed. Its name is Xapon/Zapon.
32. A TV character I like comes from another planet called Clartic/Chlartic.
33. I tried a strange new vegetable called a petch/pech.
34. A special new chocolate I tried is flavoured with leq/leck.
35. Today I met a lady from down the street. She said to call her Moph/Moff.
36. A friend from another country told me a story about a galt/ghalt.
37. My grandmother brought me a present from a different country. It was called a hech/hetch.
38. There is a bug I saw in our yard which is called a noph/noff.
39. My family and I went to a weird new restaurant where we tried a dish called wrilt/rilt.
40. I went to a strange faraway town called Kalp/Calp.

Appendix B2

Version A2

1. My Aunt brought me back a toy from the shop. It was called a wep/whep.
2. I tried this fruit from my friend's tree called a dach/datch.
3. My friend and I met a man from a faraway country. His name was Slef/Sleff.
4. There is a new Australian girl from Melbourne in my class. Her name is Cill/Cil.
5. My little sister has an imaginary friend she calls Fampo/Phampo.
6. I have a pet chinchilla called Queff/Quef.
7. A new animal was discovered in the bush in a different country. It was called a chote/shote.
8. I learned a new English word today. It was the word xego/zego.
9. I have a teddy called Rull/Rul.
10. They named a new town in Africa this week. They called it Celp/Selp.
11. This is a painting of a local place called Carzim/Karzim.
12. My dad cooked a strange new food, which is called ghup/gup.
13. My next door neighbour moved here from Launceston. His last name is Bliq/Blick.
14. A strange new flower I saw at the Botanical Gardens is called a chupe/shupe.
15. My teacher taught our class today about the legend of the local man Snill/Snil.
16. I was born in a city very close to here called Cueton/Queton.
17. In the pet shop I saw a type of Tasmanian fish called jich/jitch.
18. A girl from another country taught me a game called jek/jeck.
19. When I went down the road I saw a big field of lutch/luch.
20. I went for a swim in the pool and saw a little beetle called a phogan/fogan.
21. At the lolly shop they have a weird new lolly, which is called a tilk/tilq.
22. In the park when we were overseas I found a shink/schink.
23. My favourite newsreader on TV is called Kniken/Niken.
24. The best name I can think of for a monster is Fuph/Fuff.
25. I read a true story about the town where I live, which is called Cubot/Kubot.
26. A weird food I once tried is called ghuty/guty.
27. Mum just came back from a foreign city called Kell/Kel.
28. At my friend's house I saw a type of bird called a whint/wint.
29. In my favourite story there is a boy called Braph/Braff.
30. The boy in this story came from a nearby town called Yol/Yoll.
31. My little brother has a dog that sleeps under his bed. Its name is Zapon/Xapon.
32. A TV character I like comes from another planet called Chlartic/Clartic.
33. I tried a strange new vegetable called a pech/pech.
34. A special new chocolate I tried is flavoured with leck/leq.
35. Today I met a lady from down the street. She said to call her Moff/Moph.
36. A friend from another country told me a story about a ghalt/galt.
37. My grandmother brought me a present from a different country. It was called a hetch/hech.
38. There is a bug I saw in our yard which is called a noff/noph.
39. My family and I went to a weird new restaurant where we tried a dish called rilt/wrilt.
40. I went to a strange faraway town called Calp/Kalp.

Appendix B3

Version B1

1. My next door neighbour moved here from another country. His last name is Bliq/Blick.
2. My favourite vegetable is called a pech/patch.
3. I have a pet rabbit called Queff/Quef.
4. In my favourite fairytale there is a monster called Braph/Braff.
5. The boy in this story came from a planet called Yol/Yoll.
6. My family and I went to a local restaurant where we tried a dish called rilt/wrilt.
7. They named a new town in Australia this week. They called it Celp/Selp.
8. I tried this strange new fruit called a dach/datch.
9. My dad cooked my favourite food, which is called ghup/gup.
10. I went to a nice nearby town called Calp/Kalp.
11. My teacher taught our class today about the legend of the foreign man Snill/Snil.
12. A yummy food I like is called ghuty/guty.
13. I was born in a foreign city called Cueton/Queton.
14. My Aunt brought me back a toy from a different country. It was called a wep/whep.
15. In the zoo I saw a type of tropical fish called a jich/jitch.
16. A girl from my class taught me a game called jek/jeck.
17. My little brother thinks a monster sleeps under his bed. Its name is Zapon/Xapon.
18. When I went to another country, I saw a big field of lutch/luch.
19. I went for a swim in the ocean and saw a strange creature called a phogan/fogan.
20. My friend and I met a local man from down the street. His name was Slef/Sleff.
21. There's an animal that lives in the bush near our school. It is called a chote/shote.
22. At the lolly shop they have my favourite lolly, which is called a tilk/tilq.
23. In the backyard at home I found a shink/schink.
24. The best name I can think of for a pet dog is Fuph/Fuff.
25. My favourite cartoon character on TV is called Kniken/Niken.
26. My little sister has a friend she calls Fampo/Phampo.
27. I learned a new foreign word today. It was the word xego/zego.
28. There is a rare bug I saw at the zoo which is called a noff/noph.
29. My favourite flower in our garden is called a chupe/shupe.
30. Mum just came back from a place in the north of Tasmania called Kell/Kel.
31. This is a painting of an imaginary place called Carzim/Karzim.
32. A TV actor I like comes from a town nearby called Chlartic/Clartic.
33. My favourite chocolate is flavoured with leck/leq.
34. A friend from my class told me a story about a ghalt/galt.
35. My grandmother brought me a present from the local shop. It was called a hetch/hech.
36. I have a toy monster called Rull/Rul.
37. There is a new girl from a different country in my class. Her name is Cill/Cil.
38. I read a fairytale about a kingdom called Cubot/Kubot.
39. At the museum I saw a type of bird that was called a whint/wint.
40. Today I met a lady from a faraway country. She said to call her Moff/Moph.

Appendix B4

Version B2

1. My next door neighbour moved here from another country. His last name is Blick/Bliq.
2. My favourite vegetable is called a petch/pech.
3. I have a pet rabbit called Quef/Queff.
4. In my favourite fairytale there is a monster called Braff/Braph.
5. The boy in this story came from a planet called Yoll/Yol.
6. My family and I went to a local restaurant where we tried a dish called writl/rilt.
7. They named a new town in Australia this week. They called it Selp/Celp.
8. I tried this strange new fruit called a datch/dach.
9. My dad cooked my favourite food, which is called gup/ghup.
10. I went to a nice nearby town called Kalp/Calp.
11. My teacher taught our class today about the legend of the foreign man Snil/Snill.
12. A yummy food I like is called guty/ghuty.
13. I was born in a foreign city called Queton/Cueton.
14. My Aunt brought me back a toy from a different country. It was called a whep/wep.
15. In the zoo I saw a type of tropical fish called a jitch/jich.
16. A girl from my class taught me a game called jeck/jek.
17. My little brother thinks a monster sleeps under his bed. Its name is Xapon/Zapon.
18. When I went to another country, I saw a big field of luch/lutch.
19. I went for a swim in the ocean and saw a strange creature called a fogan/phogan.
20. My friend and I met a local man from down the street. His name was Sleff/Slef.
21. There's an animal that lives in the bush near our school. It is called a shote/chote.
22. At the lolly shop they have my favourite lolly, which is called a tilq/tilk.
23. In the backyard at home I found a schink/shink.
24. The best name I can think of for a pet dog is Fuff/Fuph.
25. My favourite cartoon character on TV is called Niken/Kniken.
26. My little sister has a friend she calls Phampo/Fampo.
27. I learned a new foreign word today. It was the word zego/xego.
28. There is a rare bug I saw at the zoo which is called a noph/noff.
29. My favourite flower in our garden is called a shupe/chupe.
30. Mum just came back from a place in the north of Tasmania called Kel/Kell.
31. This is a painting of an imaginary place called Karzim/Carzim.
32. A TV actor I like comes from a town nearby called Clartic/Chlartic.
33. My favourite chocolate is flavoured with leq/leck.
34. A friend from my class told me a story about a galt/ghalt.
35. My grandmother brought me a present from the local shop. It was called a hech/hetch.
36. I have a toy monster called Rul/Rull.
37. There is a new girl from a different country in my class. Her name is Cil/Cill.
38. I read a fairytale about a kingdom called Kubot/Cubot.
39. At the museum I saw a type of bird that was called a wint/whint.
40. Today I met a lady from a faraway country. She said to call her Moph/Moff.

Appendix C

Versions of Experimental Nonword Spelling Task (Children)

Appendix C1

Version A1

1. I tried this fruit from my friend's tree called a dach/datch.
2. There is a new Australian girl from Melbourne in my class. Her name is Cill/Cil.
3. My little sister has an imaginary friend she calls Fampo/Phampo.
4. A new animal was discovered in the bush in a different country. It was called a chote/shote.
5. I learned a new English word today. It was the word xego/zego.
6. They named a new town in Africa this week. They called it Celp/Selp.
7. This is a painting of a local place called Carzim/Karzim.
8. My dad cooked a strange new food, which is called ghup/gup.
9. My next door neighbour moved here from Launceston. His last name is Bliq/Blick.
10. A strange new flower I saw at the Botanical Gardens is called a chupe/shupe.
11. I was born in a city very close to here called Cueton/Queton.
12. In the pet shop I saw a type of Tasmanian fish called jich/jitch.
13. A girl from another country taught me a game called jek/jeck.
14. When I went down the road I saw a big field of lutch/luch.
15. I went for a swim in the pool and saw a little beetle called a phogan/fogan.
16. Mum just came back from a foreign city called Kell/Kel.
17. In my favourite fairytale there is a monster called Braph/Braff.
18. My little brother thinks a monster sleeps under his bed. Its name is Zapon/Xapon.
19. Today I met a lady from down the street. She said to call her Moff/Moph.
20. My grandmother brought me a present from a different country. It was called a hetch/hech.

Appendix C2

Version A2

1. I tried this fruit from my friend's tree called a datch/dach.
2. There is a new Australian girl from Melbourne in my class. Her name is Cil/Cill.
3. My little sister has an imaginary friend she calls Phampo/Fampo.
4. A new animal was discovered in the bush in a different country. It was called a shote/chote.
5. I learned a new English word today. It was the word zego/xego.
6. They named a new town in Africa this week. They called it Selp/Celp.
7. This is a painting of a local place called Karzim/Carzim.
8. My dad cooked a strange new food, which is called gup/ghup.
9. My next door neighbour moved here from Launceston. His last name is Blick/Bliq.
10. A strange new flower I saw at the Botanical Gardens is called a shupe/chupe.
11. I was born in a city very close to here called Queton/Cueton.
12. In the pet shop I saw a type of Tasmanian fish called jitch/jich.
13. A girl from another country taught me a game called jeck/jek.
14. When I went down the road I saw a big field of luch/lutch.
15. I went for a swim in the pool and saw a little beetle called a fogan/phogan.
16. Mum just came back from a foreign city called Kel/Kell.
17. In my favourite fairytale there is a monster called Braff/Braph.
18. My little brother thinks a monster sleeps under his bed. Its name is Xapon/Zapon.
19. Today I met a lady from down the street. She said to call her Moph/Moff.
20. My grandmother brought me a present from a different country. It was called a hech/hetch.

Appendix C3

Version B1

1. My next door neighbour moved here from another country. His last name is Bliq/Blick.
2. In my favourite story there is a boy called Braph/Braff.
3. They named a new town in Australia this week. They called it Celp/Selp.
4. I tried this strange new fruit called a dach/datch.
5. My dad cooked my favourite food, which is called ghup/gup.
6. I was born in a foreign city called Cueton/Queton.
7. In the zoo I saw a type of tropical fish called a jich/jitch.
8. A girl from my class taught me a game called jek/jeck.
9. My little brother has a dog that sleeps under his bed. Its name is Zapon/Xapon.
10. When I went to another country, I saw a big field of lutch/luch.
11. I went for a swim in the ocean and saw a strange creature called a phogan/fogan.
12. There's an animal that lives in the bush near our school. It is called a chote/shote.
13. My little sister has a friend she calls Fampo/Phampo.
14. I learned a new foreign word today. It was the word xego/zego.
15. My favourite flower in our garden is called a chupe/shupe.
16. Mum just came back from a place in the north of Tasmania called Kell/Kel.
17. This is a painting of an imaginary place called Carzim/Karzim.
18. My grandmother brought me a present from the local shop. It was called a hetch/hech.
19. There is a new girl from a different country in my class. Her name is Cill/Cil.
20. Today I met a lady from a faraway country. She said to call her Moff/Moph.

Appendix C4

Version B2

1. My next door neighbour moved here from another country. His last name is Blick/Bliq.
2. In my favourite story there is a boy called Braff/Brapp.
3. They named a new town in Australia this week. They called it Selp/Celp.
4. I tried this strange new fruit called a datch/dach.
5. My dad cooked my favourite food, which is called gup/ghup.
6. I was born in a foreign city called Queton/Cueton.
7. In the zoo I saw a type of tropical fish called a jitch/jich.
8. A girl from my class taught me a game called jeck/jek.
9. My little brother has a dog that sleeps under his bed. Its name is Xapon/Zapon.
10. When I went to another country, I saw a big field of luch/lutch.
11. I went for a swim in the ocean and saw a strange creature called a fogan/phogan.
12. There's an animal that lives in the bush near our school. It is called a shote/chote.
13. My little sister has a friend she calls Phampo/Fampo.
14. I learned a new foreign word today. It was the word zego/xego.
15. My favourite flower in our garden is called a shupe/chupe.
16. Mum just came back from a place in the north of Tasmania called Kel/Kell.
17. This is a painting of an imaginary place called Karzim/Carzim.
18. My grandmother brought me a present from the local shop. It was called a hech/hetch.
19. There is a new girl from a different country in my class. Her name is Cil/Cill.
20. Today I met a lady from a faraway country. She said to call her Moph/Moff.

Appendix D

Human Research Ethics Committee Approval Letter

Social Science Ethics Officer
Private Bag 01 Hobart
Tasmania 7001 Australia
Tel: (03) 6226 2763
Fax: (03) 6226 7148
Katherine.Shaw@utas.edu.au



HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

29 April 2015

Dr Nenagh Kemp
Psychology
Private Bag 30

Dear Dr Kemp

Re: FULL ETHICS APPLICATION APPROVAL
Ethics Ref: H0014825 - How people choose the spelling of unfamiliar words

We are pleased to advise that the Tasmania Social Sciences Human Research Ethics Committee approved the above project on 29 April 2015.

This approval constitutes ethical clearance by the Tasmania Social Sciences Human Research Ethics Committee. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities is required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

Please note that this approval is for four years and is conditional upon receipt of an annual Progress Report. Ethics approval for this project will lapse if a Progress Report is not submitted.

The following conditions apply to this approval. Failure to abide by these conditions may result in suspension or discontinuation of approval.

1. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval, to ensure the project is conducted as approved by the Ethics Committee, and to notify the Committee if any investigators are added to, or cease involvement with, the project.
2. Complaints: If any complaints are received or ethical issues arise during the course of the project, investigators should advise the Executive Officer of the Ethics Committee on 03 6226 7479 or human.ethics@utas.edu.au.

A PARTNERSHIP PROGRAM IN CONJUNCTION WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES

3. Incidents or adverse effects: Investigators should notify the Ethics Committee immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
4. Amendments to Project: Modifications to the project must not proceed until approval is obtained from the Ethics Committee. Please submit an Amendment Form (available on our website) to notify the Ethics Committee of the proposed modifications.
5. Annual Report: Continued approval for this project is dependent on the submission of a Progress Report by the anniversary date of your approval. You will be sent a courtesy reminder closer to this date. **Failure to submit a Progress Report will mean that ethics approval for this project will lapse.**
6. Final Report: A Final Report and a copy of any published material arising from the project, either in full or abstract, must be provided at the end of the project.

Yours sincerely



Natasha Jones
Ethics Officer
Tasmania Social Sciences HREC

Appendix E
Information Sheets and Consent Forms

Appendix E1

Adult Information Sheet and Consent Form

**Information Sheet for Adults****How people choose the spelling of new words.****Invitation**

You are invited to participate in a research study examining how adults choose the spelling of new words. This study is being conducted by Honours student Nicole Marsh, and is being supervised by Dr. Nenagh Kemp.

What is the purpose of this study?

English spelling is complex, as many sounds have more than one possible spelling (e.g., you can spell the sound “k” with *c*, *k*, *ck*, *q*...). We are interested in examining the types of cues that adults use to choose spellings for words they have not seen before.

Why have I been invited to participate?

All adults are invited to participate in the study.

What will I be asked to do?

If you decide to participate, you will complete two spelling tasks in small groups, in about 30 minutes. In one task, you will see a set of sentences, each containing a new word written in two plausible ways (e.g., *plick* and *plik*). You will be asked to circle the spelling that you think looks best. In a second task, you will be asked to do a standardised spelling task. You will be asked to write down your age, sex, and whether you can read and write any other languages, but you won’t need to provide your name.

Are there any possible benefits from participation in this study?

Many people find it interesting to think about the complexity of the English spelling system and to consider which letters look best in certain contexts. More generally, this study will provide useful evidence about how adults choose between plausible spellings of unfamiliar words, depending on the sentence context.

Are there any possible risks from participation in this study?

There are no specific risks associated with taking part in this study.

What if I change my mind during or after the study?

You are free to discontinue participation at any time, without providing an explanation. If you decide later that you want to withdraw, your individual data won’t be identifiable, and so we won’t be able to delete it.

What will happen to the information when this study is over?

Once the data is transferred for analysis, it will be stored on a password-protected server in the Division of Psychology. Research data will be kept for at least five years after publication, but will then be deleted.

How will the results of the study be published?

We will place a summary of the results of this study on the Division of Psychology website once the work is completed, at the end of 2015. The findings will be written up in a thesis as a part of Nicole Marsh's Honours degree, and we will also aim to publish the results in an academic journal article. No participant will be identifiable from the results.

What if I have questions about this study?

Please do not hesitate to contact Dr. Nenagh Kemp on ph 6226 7534 or Nicole Marsh via email at njmarsh@utas.edu.au if you would like to discuss any aspect of this study.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number **H0014825**.

Thank you for taking the time to consider this study. If you have read and understood all of the above information, any questions have been answered to your satisfaction, and you would like to participate, please sign the consent form. Your data will not be identifiable.

Dr. Nenagh Kemp
Chief Investigator
Investigator

Miss Nicole Marsh
Student



Consent Form for Adults

How adults choose the spelling of new words.

1. I agree to be involved in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves completing a spelling task in which I will choose the spelling of novel words from two given options, and a standardised spelling task.
5. I understand that participation does not involve any foreseeable risks.
6. I understand that all research data will be securely stored on the University of Tasmania premises for five years from the publication of the study results, and will then be destroyed.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researchers will maintain confidentiality and that any information participants supply to the researchers will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that all participation is voluntary and that I may withdraw at any time without consequence.

Participant's name: _____

Participant's signature: _____

Date: _____

Statement by Investigator

☐

Via the enclosed Information Sheet and Consent Form, I have explained the project and the implications of participation in it to this principal and I believe that the consent is informed and that he/she understands the implications of participation.

Investigator's name: _____

Investigator's signature: _____

Date: _____

Appendix E2

Head of Primary School Information Sheet and Consent Form

**Information Sheet for Head of Primary School****How children choose the spelling of new words****Invitation**

We would like to invite Grade 4-6 students at your school to participate in a research study examining how children choose the spelling of new words. This study is being conducted by Nicole Marsh as part of the Honours program in Psychology at the University of Tasmania, and is being supervised by Dr. Nenagh Kemp.

What is the purpose of this study?

English spelling is difficult for children to learn, as many sounds have more than one possible spelling (e.g., you can spell the sound “k” with *c*, *k*, *ck*, *q*...), and children need to learn when to use which spelling. We know that adults can use cues about whether a new word sounds like it could be a common English word, or a more unusual word, to decide how to spell some of its sounds. This study will be the first to test at what age children start being able to use these cues.

Why has my school been invited to participate?

We would like to invite children in Grade 4-6 at your school to participate to help us learn more about how children learn to spell. This will inform researchers’ understanding of spelling development, but will also help lead to more ways that teachers can help children tackle the English spelling system.

What will children be asked to do?

If your school decides to take part, we will first obtain permission from parents and children to participate. Honours student Nicole Marsh would visit the school to work with children in small groups for about 30 minutes, to do two spelling tasks. In one task, children will see a set of sentences, each containing a new word written in two plausible ways (e.g., *plick* and *plik*). Children will be asked to circle the spelling that they think looks best. Half the sentences will make it seem like the novel word is an ordinary, everyday thing, and half will make it seem as though it’s something unusual. In a second task, children will be asked to spell a list of increasingly difficult real words. Children will be asked to write down their age, sex, and whether they can read and write any other languages, but they won’t need to provide their name.

What would the school's participation involve?

Participation would involve distributing information and consent letters to all students in Grades 4 to 6 to take home to their parents or guardians. We can also provide a very brief description of the study to place in the school newsletter/message board. We would like students to be able to take part in the study in an appropriate room in the school, at times arranged with school staff at their convenience.

Are there any possible benefits from participation in this study?

Many children find it interesting to work with a new adult to spell familiar and new words. More generally, this study will provide important evidence about when children start to use clue in the sentence context about how to spell words they've never seen before.

Are there any possible risks from participation in this study?

There are no specific risks associated with taking part in this study.

What if a child changes his or her mind during or after the study?

Children are free to discontinue participation at any time, without providing an explanation. If a child (or parent) wished to withdraw at a later date, however, individual data will no longer be identifiable, and so we won't be able to delete it.

What will happen to the information when this study is over?

Data will be stored in locked filing cabinets and on a password-protected computer in the University's Division of Psychology. Data will be kept for at least five years after publication, and then deleted.

How will the results of the study be published?

We will send the school a summary of the results of this study to let you know what we find. This can also be passed on to teachers and parents. We are also happy to come into the school to talk about the results. The findings will be written up in a thesis as a part of Nicole Marsh's Honours degree, and we will also aim to publish the results in an academic journal article. No participant, or their school, will be identifiable from the results.

What if I have questions about this study?

Please do not hesitate to contact Dr. Nenagh Kemp via email at nenagh.kemp@utas.edu.au or by phone on 6226 7534 or Nicole Marsh via email at njmarsh@utas.edu.au if you would like to discuss any aspect of this study.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number **H0014825**.

You will receive a copy of this Information sheet, and of the statement of Informed Consent. One copy of the Consent form should be signed for the investigator, and one will be given to you to keep for your own records. Thank you for considering this study.

Dr. Nenagh Kemp
Chief Investigator
Investigator

Miss Nicole Marsh
Student



Consent Form for Head of Primary School

How children choose the spelling of new words.

1. I agree for my school to be involved in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves Grade 4-6 students doing a spelling task where they choose the spelling of a new word from two given options, and a standard spelling task of real words.
5. I understand that participation does not involve any foreseeable risks.
6. I understand that all research data will be securely stored on the University of Tasmania premises for five years from the publication of the study results, and will then be destroyed.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researchers will maintain confidentiality and that any information participants supply to the researchers will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that participants cannot be identified as a participant.
10. I understand that all participation is voluntary and that participants may withdraw at any time without any consequence.

School name: _____

Head of Primary School's name: _____

Head of Primary School's signature: _____

Date: _____

Statement by Investigator

☐

Via the enclosed Information Sheet and Consent Form, I have explained the project and the implications of participation in it to this principal and I believe that the consent is informed and that he/she understands the implications of participation.

Investigator's name: _____

Investigator's signature: _____

Date: _____

Appendix E3

Parent/Guardian Information Sheet and Consent Form

**Information Sheet for Parents of School Student Participants****How children choose the spelling of new words****Invitation**

Your child is invited to participate in a research study examining how children choose the spelling of new words. This study is being conducted by Nicole Marsh as part of the Honours program in Psychology at the University of Tasmania, and is being supervised by Dr. Nenagh Kemp.

What is the purpose of this study?

English spelling is difficult for children to learn, as many sounds have more than one possible spelling (e.g., you can spell the sound “k” with *c*, *k*, *ck*, *q*...), and children need to learn when to use which spelling. We know that adults can use cues about whether a new word sounds like it could be a common English word, or a more unusual word, to decide how to spell some of its sounds. This study is to test at what age children start being able to use these cues.

Why has my child been invited to participate?

The school is sending this invitation, on the researchers’ behalf, to parents of all children in Grades 4 to 6. Any child can take part.

What will my child be asked to do?

If you and your child agree that your child can participate, Honours student Nicole Marsh will work with your child in a small group for about 30 minutes, to do two spelling tasks. In one task, children will see a set of sentences, each containing a new word written in two plausible ways (e.g., *plick* and *plik*). Children will be asked to circle the spelling that they think looks best. Half the sentences will make it seem like the novel word is an ordinary, everyday thing, and half will make it seem as though it’s something unusual. In a second task, children will be asked to spell a list of increasingly difficult real words. Children will be asked to write down their age, sex, and whether they can read and write any other languages, but they won’t need to provide their name.

Are there any possible benefits from participation in this study?

Many children find it interesting to work with a new adult to spell familiar and new words. More generally, this study will provide important evidence about when children start to use clue in the sentence context about how to spell words they’ve never seen before.

Are there any possible risks from participation in this study?

There are no specific risks associated with taking part in this study.

What if my child changes his or her mind during or after the study?

If your child decides not to continue with the study once it has started, he or she can stop at any time, without needing to provide an explanation. If you or your child wished to withdraw at a later date, however, the individual data will no longer be identifiable, and so we won't be able to delete it.

What will happen to the information when this study is over?

Data will be stored in locked filing cabinets and on a password-protected computer in the University's Division of Psychology. Data will be kept for at least five years after publication, and then deleted.

How will the results of the study be published?

We will send a summary of the results of this study to the Principal to let parents know what we found. The findings of this study will also be written up in a thesis as a part of Nicole Marsh's Honours degree, and eventually in a scientific journal article. Your child and school will not be identifiable in the publication of the results.

What if I have questions about this study?

Please do not hesitate to contact Dr. Nenagh Kemp via email at nenagh.kemp@utas.edu.au or by phone on 6226 7534 or Nicole Marsh via email at njmarsh@utas.edu.au if you would like to discuss any aspect of this study.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number **H0014825**.

You can keep this Information sheet. If you consent for your child to participate, please sign and return the attached statement of Informed Consent to the school.

Dr. Nenagh Kemp
Chief Investigator
Investigator

Miss Nicole Marsh
Student



Consent Form for Parents of School Student Participants

How children choose the spelling of new words

1. I agree for my child to take part in the research survey named above, if he/she agrees.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves my child doing a spelling task where they choose the spelling of a new word from two given options, and a standard spelling task of real words.
5. I understand that participation does not involve any foreseeable risks.
6. I understand that all research data will be securely stored on the University of Tasmania premises for five years from the publication of the study results, and will then be deleted.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researchers will maintain confidentiality and that any information my child supplies to the researchers will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that my child cannot be identified as a participant.
10. I understand that my child's participation is voluntary and that I may withdraw him or her at any time without any consequence.

Child's name: _____

Parent's name: _____

Parent's signature: _____

Date: _____

Statement by Investigator

☐

Via the enclosed Information Sheet and Consent Form, I have explained the project and the implications of participation in it to this parent and I believe that the consent is informed and that he/she understands the implications of participation.

Investigator's name: _____

Investigator's signature: _____

Date: _____

Appendix F

Verbal Information Sheet/Instructions for Children

Introduction:

Hi everyone! My name is Nicole and I've come from the University!

I was hoping that you might all be able to help me with some writing tasks I have. I will tell you all about the task and then you can ask me any questions you have about it!

You are all invited to help with the research I am doing on how children, such as yourselves, choose to spell different made-up words. If you decide to help with this research, you will be deciding on the best spellings for some made-up words. I will read you some sentences with a new word in them, that you haven't seen before, and you can choose which of the two spellings you think looks the best for that new word that I have made up. I'll also ask you to spell some real words for me.

I will ask how old you are, and what language or languages you speak at home, but you won't have to write down your name, so no one will know which answers are yours.

I would be pleased if you would like to be in my study. But if you don't want to do it, or if you start and then want to stop, you can just say so. You don't need to tell me why.

Any questions?

For WRAT test:

So... now on the side of your paper with all the numbers in boxes I would like you to answer a few questions about yourself but you don't have to put your name on the sheet! If you could just tell me how old you are and what month your birthday is in, whether you are a boy or girl, and whether you speak any other language at home with your family that would be wonderful.

I'm now going to read some words to you, and I would like you to write down each one. Listen carefully so that you hear each word I say. Then try to spell the word. I will say the word, then read a sentence with the word in it, and then say the word again. Try to do your best. If you are not sure how to spell a word, you should make a guess.

Great, thank you for helping me to spell those words! Now if you could all turn over to the other side of the sheet?

For experimental task:

This activity is a bit different. I'm going to say some words that you've never heard before, and I'll ask you to try to choose the best spelling for each one. So I'm going to read out the sentences that you can see, one by one, and there will be two spellings of the new made-up words at the end of each sentence.

At the end of each sentence I will stop so you can circle the spelling of the new word you think is the best spelling. Remember, they're new words that we've made up for this activity, so you can just choose which you think the best spelling is.

Thank you so much for your help everyone!!

Appendix G

SPSS Output

Participant Descriptive Statistics

Descriptive Statistics

AgeGroup		N	Minimum	Maximum	Mean	Std. Deviation
Adult	Age	45	19	74	25.02	10.545
	WRATstandardscore	45	99	145	112.40	9.428
	Valid N (listwise)	45				
Child	Age	56	9	11	9.73	.646
	WRATstandardscore	56	75	142	108.80	13.595
	Valid N (listwise)	56				

Sex

AgeGroup			Frequency	Percent	Valid Percent	Cumulative Percent
Adult	Valid	Male	14	31.1	31.1	31.1
		Female	31	68.9	68.9	100.0
		Total	45	100.0	100.0	
	Total					
Child	Valid	Male	28	50.0	50.0	50.0
		Female	28	50.0	50.0	100.0
		Total	56	100.0	100.0	
	Total					

OtherLang

AgeGroup			Frequency	Percent	Valid Percent	Cumulative Percent
Adult	Valid	Yes	9	20.0	20.0	20.0
		No	36	80.0	80.0	100.0
		Total	45	100.0	100.0	
	Total					
Child	Valid	Yes	10	17.9	18.2	18.2
		No	45	80.4	81.8	100.0
		Total	55	98.2	100.0	
	Missing	System	1	1.8		
	Total		56	100.0		

Statistics

Education

Uni	N	Valid	38
		Missing	0
NotAtUni	N	Valid	7
		Missing	0
School	N	Valid	56
		Missing	0

Analysis of Sentence Length in Experimental Task

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
LengthOfSentence	40	6	17	12.25	2.687
Valid N (listwise)	40				

WRAT Score Dependent on Whether Participants Spoke Another Language

Descriptives

WRATstandardscore

AgeGroup	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Adult Yes	9	114.78	13.498	4.499	104.40	125.15	99	145
	No	36	111.81	1.377	109.01	114.60	99	131
	Total	45	112.40	1.405	109.57	115.23	99	145
Child Yes	10	109.90	15.096	4.774	99.10	120.70	90	132
	No	45	108.80	2.008	104.75	112.85	75	142
	Total	55	109.00	1.839	105.31	112.69	75	142

ANOVA

WRATstandardscore

AgeGroup		Sum of Squares	df	Mean Square	F	Sig.
Adult	Between Groups	63.606	1	63.606	.711	.404
	Within Groups	3847.194	43	89.470		
	Total	3910.800	44			
Child	Between Groups	9.900	1	9.900	.052	.820
	Within Groups	10036.100	53	189.360		
	Total	10046.000	54			

Descriptive Statistics for Table 2 – Mean Proportions of Most Common Spellings Chosen for Target Consonant for Sentence Type and Consonant Position and Overall Results for Each Variable

Descriptive Statistics

AgeGroup		Mean	Std. Deviation	N
PropFI	Adult	.5331	.22294	45
	Child	.5208	.27120	56
	Total	.5263	.24972	101
PropFF	Adult	.8335	.14435	45
	Child	.7009	.20888	56
	Total	.7600	.19379	101
PropUI	Adult	.4905	.20700	45
	Child	.4345	.26339	56
	Total	.4594	.24039	101
PropUF	Adult	.7235	.19093	45
	Child	.6429	.21362	56
	Total	.6788	.20678	101

AgeGroup		OverallFamiliar	OverallUnfamiliar	OverallInitial	OverallFinal
Adult	Mean	.6833	.6070	.5118	.7785
	N	45	45	45	45
	Std. Deviation	.14503	.16493	.19187	.14054
Child	Mean	.6109	.5387	.4777	.6719
	N	56	56	56	56
	Std. Deviation	.16823	.16796	.19085	.16323
Total	Mean	.6431	.5691	.4929	.7194
	N	101	101	101	101
	Std. Deviation	.16165	.16925	.19111	.16181

OverallCommon

AgeGroup	Mean	N	Std. Deviation
Adult	.6451	45	.13724
Child	.5748	56	.12860
Total	.6061	101	.13645

ANOVA Analysis for Main Effects and Interactions

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Familiarity	1.000	.000	0	.	1.000	1.000	1.000
Position	1.000	.000	0	.	1.000	1.000	1.000
Familiarity * Position	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + AgeGroup

Within Subjects Design: Familiarity + Position + Familiarity * Position

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Familiarity	Sphericity Assumed	.550	1	.550	15.535	.000	.136
	Greenhouse-Geisser	.550	1.000	.550	15.535	.000	.136
	Huynh-Feldt	.550	1.000	.550	15.535	.000	.136
	Lower-bound	.550	1.000	.550	15.535	.000	.136
Familiarity * AgeGroup	Sphericity Assumed	.000	1	.000	.012	.912	.000
	Greenhouse-Geisser	.000	1.000	.000	.012	.912	.000
	Huynh-Feldt	.000	1.000	.000	.012	.912	.000
	Lower-bound	.000	1.000	.000	.012	.912	.000
Error(Familiarity)	Sphericity Assumed	3.508	99	.035			
	Greenhouse-Geisser	3.508	99.000	.035			
	Huynh-Feldt	3.508	99.000	.035			
	Lower-bound	3.508	99.000	.035			
Position	Sphericity Assumed	5.300	1	5.300	105.740	.000	.516
	Greenhouse-Geisser	5.300	1.000	5.300	105.740	.000	.516
	Huynh-Feldt	5.300	1.000	5.300	105.740	.000	.516
	Lower-bound	5.300	1.000	5.300	105.740	.000	.516
Position * AgeGroup	Sphericity Assumed	.131	1	.131	2.617	.109	.026
	Greenhouse-Geisser	.131	1.000	.131	2.617	.109	.026
	Huynh-Feldt	.131	1.000	.131	2.617	.109	.026
	Lower-bound	.131	1.000	.131	2.617	.109	.026
Error(Position)	Sphericity Assumed	4.962	99	.050			
	Greenhouse-Geisser	4.962	99.000	.050			
	Huynh-Feldt	4.962	99.000	.050			
	Lower-bound	4.962	99.000	.050			
Familiarity * Position	Sphericity Assumed	.010	1	.010	.240	.625	.002
	Greenhouse-Geisser	.010	1.000	.010	.240	.625	.002
	Huynh-Feldt	.010	1.000	.010	.240	.625	.002
	Lower-bound	.010	1.000	.010	.240	.625	.002
Familiarity * Position * AgeGroup	Sphericity Assumed	.057	1	.057	1.435	.234	.014
	Greenhouse-Geisser	.057	1.000	.057	1.435	.234	.014
	Huynh-Feldt	.057	1.000	.057	1.435	.234	.014
	Lower-bound	.057	1.000	.057	1.435	.234	.014
Error (Familiarity*Position)	Sphericity Assumed	3.940	99	.040			
	Greenhouse-Geisser	3.940	99.000	.040			
	Huynh-Feldt	3.940	99.000	.040			
	Lower-bound	3.940	99.000	.040			

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	148.524	1	148.524	2114.674	.000	.955
AgeGroup	.494	1	.494	7.034	.009	.066
Error	6.953	99	.070			