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Late bilinguals see a *scan* in *scanner* AND in *scandal*: dissecting formal overlap from morphological priming in the processing of derived words

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Masked priming research with late (non-native) bilinguals has reported facilitation effects following morphologically derived prime words (scanner – scan). However, unlike for native speakers, there are suggestions that purely orthographic prime-target overlap (scandal – scan) also produces priming in non-native visual word recognition. Our study directly compares orthographically related and derived prime-target pairs. While native readers showed morphological but not formal overlap priming, the two prime types yielded the same magnitudes of facilitation for non-natives. We argue that early word recognition processes in a non-native language are more influenced by surface-form properties than in one's native language.

Keywords: Masked priming, late bilinguals, derivation, orthographic overlap

Introduction

In recent years the body of research dealing with non-native language processing has grown; however, the question of whether non-native speakers apply the same or different mechanisms as natives is still unresolved. Some researchers have claimed that non-native speakers apply the same mechanisms but processing is restrained by lower working memory, decoding difficulties or processing speed (e.g., McDonald, 2006). Others have proposed that non-native language performance relies more on lexically-based rather than grammatically-based mechanisms and information sources (e.g., Clahsen & Felser, 2006).

The majority of studies on non-native processing have concentrated on sentence-level phenomena (especially ambiguity resolution), but only a few have investigated morphological processing. The prevailing method used in the latter type of studies is masked priming, which is thought to tap into early automatic processes free of semantics (see Forster, 1998). Participants are presented with morphologically complex words as primes, which are masked (with, e.g., a row of hash marks as a forward and the target as a backward mask) and shown for short stimulus onset asynchronies (SOAs) of 60 milliseconds or less so that participants are not consciously aware of the primes. Faster response times (in comparison to an unrelated prime) to the stem as target are seen as evidence that the stem is accessed when the morphologically complex word is encountered, i.e., complex words are decomposed into stem and affix.

Previous studies with derived primes have consistently found facilitation effects in non-native speakers (Silva & Clahsen, 2008; Diependaele, Duñabeitia, Morris & Keuleers, 2011; Kırkıcı & Clahsen, 2013; but see Clahsen & Neubauer, 2010); however, opinions differ with respect to how native-like this group's processing of morphologically complex words is. For instance, Diependaele et al. (2011) report similar priming effects for non-native and native speakers, whereas Silva and Clahsen (2008), who also included an identity prime as a second baseline condition, found only partial priming in their non-native groups (i.e., derived words were less effective as primes than identity primes) but full priming in native speakers, which the authors interpret as evidence that non-native speakers rely less on decompositional processes.

However, there is reason to be sceptical about these conclusions, specifically with respect to the claim that non-native speakers are sensitive to morphological relatedness in the same way as native speakers. Instead,

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Table 1. *Length and Frequency information (from webCELEX) for related and unrelated primes as well as targets of the two item sets [WFF = word form frequency, LF = lemma frequency, Length = Length in syllables].*

	Primes			Targets		
	WFF	LF	Length	WFF	LF	Length
+O+M+S						
Related primes		e.g., *darkness*				
	5.1	5.4	2.3		e.g., *dark*	
Unrelated primes		e.g., *traffic*		83.9	97.5	1.3
	5.0	7.1	2.3			
+O-M-S						
Related primes		e.g., *example*				
	53.6	87.5	2.0		e.g., *exam*	
Unrelated primes		e.g., *history*		123.1	191.5	1.2
	47.2	69.6	2.0			

non-native processing might be influenced by the surface form of words, i.e., the observed facilitation for morphologically related word pairs might be due to the shared letters between the two words. While previous masked priming studies with native speakers did not show any facilitation for purely orthographically related prime-target pairs, some studies with non-native speakers have shown signs of orthographic priming (Diependaele et al., 2011; Feldman, Kostić, Basnight-Brown, Filipović Đurđević & Pastizzo, 2010). For instance, Diependaele et al. (2011) found, in addition to the above effects for derived items, significant facilitation effects for purely orthographically related items such as *freeze – free* in their non-native groups. As the focus of these studies was on the morphologically related items, though, the orthographic effects were only mentioned briefly. The present study, in contrast, directly compares purely orthographically related prime-target pairs to derived items with the same degree of shared letters.

Materials

The present study contained two item sets, one with orthographically, morphologically and semantically (+O+M+S) and one with purely orthographically (+O-M-S) related prime-target pairs.[1] Each target was preceded by three types of prime: related, unrelated and identity. Set 1 consisted of thirty adjectival targets (e.g., *dark*) preceded by the corresponding *–ness* nominalisation as a related prime (e.g., *darkness*), a length- and frequency-matched simple noun as an unrelated prime (e.g., *traffic*) or the adjective itself as an identity prime. In set 2, twenty-one related primes and targets were matched to the +O+M+S items with respect to the amount of orthographic overlap. The related primes (e.g., *example*) contained the target (e.g., *exam*) in the beginning and ended in a letter sequence that never functions as an affix in English (here: *–ple*). Related prime-target pairs of the two sets did not differ significantly with respect to the amount of shared letters, as measured both absolutely ($t < 1$) and with spatial coding ($t(28) = 1.02$, $p = .317$) using the Match Calculator implemented by Davis (2000). Unrelated primes (e.g., *history*) were of the same category as related primes and were matched for length and frequency using the webCELEX database (http://celex.mpi.nl/); see Appendix for a full list of experimental stimuli.

Related and unrelated primes in both item sets were matched for length in syllables ($t < 1$ for both +O+M+S and +O-M-S) and word form frequency (+O+M+S: $t < 1$; +O-M-S: $t(20) = 1.32$, $p = .20$). Additionally, the related and unrelated primes of the +O-M-S items were matched in terms of letters ($t(20) = 1.45$, $p = .16$). Across item sets, targets were matched for length in syllables ($t(48) = 1.09$, $p = .28$), word form ($t < 1$) and lemma frequency ($t(27) = 1.10$, $p = .28$). Length and frequency information for both item sets is provided in Table 1.

Experimental items were distributed across three lists so that participants saw targets only once. The 51 experimental targets were mixed with 309 fillers in a pseudo-random order. Fillers were word-word, nonword-word, word-nonword and nonword-nonword pairs, with 50 percent of targets being existing words. Nonwords were created by changing 1 to 3 letters of existing English words. Targets and primes were a mixture of simplex and morphologically derived adjectives, verbs and nouns, in

[1] We did not separately manipulate semantic relatedness (see e.g., Diependaele et al. 2011) as the focus of our study was on the role of orthographic relatedness in the processing of derived words.

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equal shares. As some of the filler prime-target pairs were orthographically related or contained identity primes, the overall relatedness ratio was 18.89%. In order to counterbalance training or fatigue effects, each of the three lists was reversed for half of the participants.

Participants

Forty-nine advanced learners of English with German as their L1 (15 male, mean age: 23.98, SD: 3.74) as well as a control group of fifty English native speakers (14 male, mean age: 40.22, SD: 13.85) took part in the study, for course credit or payment. All participants were residing in Germany at the time of testing, using both English and German in everyday life. The native speaker group had acquired English from birth while the non-native group started learning English at an average age of 9.78 (SD: 2.12), forty-two individuals as their second language (L2) and seven as their L3. They all learned English through instruction in school (N = 47) or kindergarten (N = 2). In addition, twenty-eight learners spent three months or more living in an English-speaking country (one aged 1–3). The non-native group completed either the computer-based Quick Oxford Placement Test (OPT, Oxford University Press & Cambridge ESOL, 2001) or the grammar part of the paper-based Oxford Placement Test (Allan, 2004), which tests comprehension as well as grammatical proficiency in English, reaching a mean score of 78.84% (SD: 9.33). In the Common European Framework of Reference for Languages (CEFR), this score corresponds to the C1 level ("advanced," "effective proficiency"). All participants had normal or corrected-to-normal vision.

Procedure

Participants were tested individually in a quiet room. They were asked to perform a word-nonword decision task, pressing one of two buttons on a gamepad as quickly and accurately as possible. *Yes*-responses were given with the dominant hand. Participants were not told about the presence of the primes.

Visual stimuli were presented on a 15" screen in white writing on a black background (font size: 28) with the DMDX software (Forster & Forster, 2003). Primes were presented in Bookman Old Style; targets (and the mask) were shown in Comic Sans MS.[2] Each trial consisted of four visual events: (1) a mask with as many hashes as the prime had letters displayed for 500 milliseconds, (2) the prime word displayed for either 33 (short SOA) or 67 milliseconds (long SOA) immediately following the mask, (3) the target displayed for 500 milliseconds immediately after the prime and (4) a black screen until the next trial was initiated by the participant's button press or automatically after a time-out of 5000 milliseconds. Participants were randomly assigned to one of the SOAs and lists.

In addition to the masked priming experiment, participants completed the OPT and rated their familiarity with the experimental targets on a scale from 1 ('I have never encountered this word') to 7 ('I encounter this word on a daily basis'). In the end, the experimenter checked whether participants had noticed the primes. Thirty-six participants reported seeing flickers of letters or words on the screen. Three native and seven non-native speakers reported that they could occasionally, i.e., in less than 5 percent of trials, read prime words; only one participant gave an estimate of 20–30 percent. None of the participants were excluded from the analysis. The whole session lasted approximately 45–60 minutes, of which the lexical decision task took 25–30 minutes.

Data Coding and Analysis

The dependent variables were participants' accuracy and reaction time (RT), as measured by the DMDX software from the display of the target word until the button press. Prior to analysis, one non-native participant with an exceptionally high error rate (19.44%) was excluded. Outlier removal consisted of timeouts, unknown targets (with familiarity ratings of 1) and extreme RTs (>1500ms). Due to too few data points in the non-native data for two items (*bluntness – blunt*, *witch – wit*), these items were excluded from the data set entirely. In total, 4.80 percent of the data (L2: 5.31%, L1: 4.31%) was removed. Furthermore, incorrect responses were not included in the RT analysis (overall: 2.69%, L2: 3.67%, L1:1.76%).

Data was analysed with linear mixed-effects models (generalized ones for the error data) using the software 'R', version 2.15.2 (R Development Core Team, 2012) and R's lme4 package (Bates & Sarkar, 2007). Based on the Box-Cox power transformation technique (Box & Cox, 1964), reaction times were inverse-transformed (-1000/RT). Models included the experimental factors Group (native vs. non-native), SOA (short vs. long), Relation Type (+O+M+S vs. +O-M-S) and Prime Type (related vs. unrelated and identity vs. unrelated) as well as, if significantly improving model fit, the following continuous (centred) predictors: Trial Number, Target Frequency, Target Length, Target Neighbourhood Size and, because of a wide range (21–68 years) in the native group, Age (as well as Age of Acquisition and Placement Test Score, for the non-native subset). With respect to the factor Prime Type, the first comparison investigates whether the related primes significantly accelerated target

[2] In contrast to the common procedure of presenting primes in lower and targets in upper case letters (e.g., Forster, Mohan & Hector, 2003), the current study used different fonts to reduce visual prime-target overlap; see Neubauer (2010) and Clahsen & Neubauer (2010).

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Table 2. *Non-native and native raw mean reaction times and error rates (in parentheses) following identity, related and unrelated primes for the two items sets in the short and long SOA.*

	Short SOA: Mean lexical decision times [ms]						Long SOA: Mean lexical decision times [ms]					
	Identity		Related		Unrelated		Identity		Related		Unrelated	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Non-native speakers												
+O+M+S	587	*152*	632	*155*	651	*166*	583	*159*	613	*151*	648	*159*
	(1.83%)		(0.90%)		(3.64%)		(1.67%)		(2.10%)		(4.22%)	
+O-M-S	580	*117*	649	*151*	668	*179*	598	*173*	631	*159*	653	*168*
	(6.80%)		(3.31%)		(8.55%)		(3.64%)		(6.02%)		(4.97%)	
Native speakers												
+O+M+S	572	*154*	568	*145*	617	*156*	547	*129*	574	*124*	617	*122*
	(0.41%)		(0.42%)		(2.08%)		(0.41%)		(1.25%)		(2.49%)	
+O-M-S	555	*137*	623	*166*	614	*155*	553	*134*	610	*140*	616	*137*
	(0.60%)		(4.19%)		(3.01%)		(1.20%)		(4.22%)		(2.42%)	

recognition and the second comparison reflects repetition priming, thus testing whether (non-native) participants processed the primes. Models had random intercepts by participants and items and/or random slopes for the factors Group, SOA (both by items), Relation Type (by participants), Prime Type (by participants and/or items) as well as Trial Number (by participants), if justified by the data. Following from interactions, data was split into subsets.

In line with previous studies on L2 processing of derivation (Silva & Clahsen, 2008; Diependaele et al., 2011; Kırkıcı & Clahsen, 2013), we expect facilitation effects for +O+M+S items in both participant groups. However, if non-native speakers' processing is delayed (e.g., McDonald, 2006), these effects might only surface in the long SOA for the non-native group. With respect to the +O-M-S items, significant facilitation effects are only anticipated for the non-native but not for the native group if non-native speakers are influenced by the surface form of words (i.e., their orthography) during processing, as suspected based on Diependaele et al.'s (2011) and Feldman et al.'s (2010) findings.

Results

Table 2 shows non-native and native speakers' mean error rates (in parentheses) and reaction times to targets in the two item sets for the two SOAs separately.

With respect to the accuracy data, the overall generalized linear mixed-effects model revealed main effects of Relation Type ($t = 2.02$), with lower accuracy for +O-M-S items, of Prime Type, reflecting higher accuracy rates following related ($t = -2.17$) and identity ($t = -3.33$) primes in comparison to unrelated ones, and of Age ($t = 2.11$), with lower accuracy for younger participants. As the effect of Prime Type (related vs. unrelated) was modulated by Relation Type ($t = -2.26$), the data was split into subsets based on Relation Type. A main effect of Prime Type surfaced for +O+M+S items only ($t_{related} = -3.50$ and $t_{identity} = -3.13$ vs. +O-M-S: $t_{related} = 0.07$ and $t_{identity} = -1.83$), indicating that accuracy was higher after morphologically but not after purely orthographically related primes. An effect of Group for +O-M-S items ($t = 3.24$) reflected non-native speakers' lower accuracy for these items.

For reaction times, Table 3 presents the output from the best-fit models. Below, only significant effects of the experimental factors and respective interactions will be discussed. The overall model (see Table 3a) revealed main effects of Group ($t = -2.99$), reflecting longer RTs for non-native speakers, and Prime Type ($t_{related} = 7.40$ and $t_{identity} = 17.09$), with faster RTs following both related and identity primes. More importantly, there was an interaction of Prime Type (related vs. unrelated) and Relation Type ($t = 3.75$), which was further modified by Group ($t = 2.98$), suggesting different patterns of facilitation for the two item sets in native versus non-native speakers. Therefore, data was split by Group (see Table 3b): both the non-native (left) and native (right) model revealed main effects of Prime Type, with faster reaction times following both identity and related primes, showing that both participant groups (1) processed the masked primes and (2) were sensitive to the experimental manipulation. Prime Type (related vs. unrelated) interacted with Relation Type in the native but not the non-native subset, indicating a difference in priming for +O+M+S and +O-M-S in native but not in non-native processing. To explore this interaction, both the native (Table 3c, bottom) and non-native (top) sets were further split by Relation Type: While non-

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Table 3. *Output from best-fit linear-mixed effects models run on inverse-transformed reaction time data for (a) the entire data set, (b) the Group subsets (non-native versus native) and (c) the Relation Type subsets (+O+M+S versus +O-M-S items for non-native and native speakers separately), with the factors Group (native vs. non-native), Relation Type (RelType: +O+M+S vs. +O-M-S), SOA (short vs. long) and Prime Type (PrType: related vs. unrelated; identity vs. unrelated). Only significant effects with t>|2| are reported [SE = standard error].*

	Estimate	SE	*t*-value	Estimate	SE	*t*-value
(a) OVERALL MODEL						
(Intercept)	−1.728	0.027	−64.50*			
Group (native vs. non-native)	−0.172	0.057	−2.99*			
PrType (related vs. unrelated)	0.069	0.009	7.40*			
PrType (identity vs. unrelated)	0.192	0.011	17.09*			
Trial Number	0.0003	0.00004	−6.63*			
Age	0.005	0.002	2.40*			
RelType*PrType (R vs. UR)	0.066	0.018	3.75*			
Group*RelType*PrType (R vs. UR)	0.105	0.035	2.98*			
*Formula in R: Non-natives: DV SOA*RelT*PrT + Trial + Frequency + (1+PrT+RelT+Trial/Part) + (1/Item)*						
*Natives: DV SOA*RelT*PrT + Trial + Age + (1+PrT/Part) + (1/Item)*						
(b) GROUP MODELS		Non-native speakers			Native speakers	
(Intercept)	−1.678	0.036	−46.14*	−1.779	0.035	−50.89*
PrType (related vs. unrelated)	0.065	0.013	4.85*	0.075	0.013	5.67*
PrType (identity vs. unrelated)	0.190	0.016	11.88*	0.194	0.016	12.51*
Trial Number	0.0002	0.0001	−2.98*	0.0004	0.00005	−7.84*
Target Frequency	0.0002	0.0001	−2.00*	–	–	–
Age	–	–	–	0.005	0.002	2.13*
RelType*PrType (R vs. UR)	0.014	0.026	0.54	0.118	0.024	4.85*
*Formula in R: Non-natives: DV ~ SOA*RelT*PrT + Trial + Frequency + (1+PrT+RelT+Trial/Part) + (1/Item)*						
*Natives: DV ~ SOA*RelT*PrT + Trial + Age + (1+PrT/Part) + (1/Item)*						
(c) RELATION TYPE MODELS[1]						
Non-native speakers		Set 1: +O+M+S			Set 2: +O-M-S	
(Intercept)	−1.698	0.040	−42.50*	−1.659	0.042	−39.25*
PrType (related vs. unrelated)	0.071	0.017	4.12*	0.058	0.021	2.79*
PrType (identity vs. unrelated)	0.190	0.018	10.38*	0.189	0.024	7.92*
Trial Number	0.0002	0.0001	−3.82*	0.0001	0.0001	−1.71
Target Frequency	0.00001	0.0001	−0.06	0.0003	0.0001	−2.25*
Formula in R: DV ~ SOA PrT + Trial + Frequency + (1+PrT/Part) + (1/Item)*						
Native speakers		Set 1: +O+M+S			Set 2: +O-M-S	
(Intercept)	−1.797	0.036	−49.95*	−1.761	0.039	−45.21*
PrType (related vs. unrelated)	0.133	0.018	7.55*	0.014	0.020	0.70
PrType (identity vs. unrelated)	0.193	0.020	9.81*	0.194	0.022	8.85*
Trial Number	0.0004	0.0001	−6.42*	0.0004	0.0001	−4.69*
Age	0.005	0.002	2.17*	0.005	0.002	2.18*
PrType (ID vs. UR)*SOA	−0.095	0.039	−2.43*	0.003	0.044	0.07
Formula in R: DV ~ SOA PrT + Trial + Age + (1+PrT/Part) + (1/Item)*						

[1] In order to keep the models within each of the groups (native vs. non-native) parallel, factors which significantly improved the model for one of the two sets (+O+M+S versus +O-M-S) only were added to the winner model of the other set (if they did not change the model significantly).

native speakers showed priming effects for both item sets, native speakers' RTs were not significantly facilitated by purely orthographically related primes (see right-most column). Both groups showed repetition priming throughout but, in the native +O+M+S subset, Prime Type (identity vs. unrelated) interacted with SOA, reflecting the fact that repetition priming was stronger in the long SOA.

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Apart from the above interaction with SOA, there were no further main effects or interactions with this factor in any of the models, indicating that the prime duration did not have an impact. Furthermore, including the learners' age of acquisition of English and the Oxford Placement Test scores did not significantly improve model fit, suggesting that age of acquisition and proficiency did not affect participants' reaction times.

Discussion

The present study confirmed the suspicion that non-native processing might be influenced by orthography (following Diependaele et al., 2011; Feldman et al., 2010). While priming for +O+M+S items was seen in both participant groups, facilitation after purely orthographically related primes was only found in the non-native speaker group. Crucially, this facilitation effect for +O-M-S items was not significantly different from the one observed for +O+M+S items, questioning whether the effects for derived items in non-native processing, observed both in the present and in previous studies, are morphological in nature.

Priming effects were obtained irrespective of SOA indicating effects on target recognition times for primes shown for just 33 milliseconds. This finding provides evidence against the view that non-native processing is simply delayed (e.g., McDonald, 2006). While non-native language processing is not necessarily slower or less automatic than L1 processing, our findings suggest that early word recognition processes in a non-native language are driven more by surface-form properties (viz. orthographic overlap) than by structural information (viz. morphological relatedness).

Further evidence for the influence of orthographic overlap on non-native visual word recognition comes from studies with cognates, i.e., words which share a substantial amount of letters across different languages. In a cognate priming study with Spanish-English bilinguals, Duñabeitia, Dimitropoulou, Morris and Diependaele (2013) report significantly faster reaction times to English targets when these were preceded by cognate primes (e.g., *estudiante* 'student' – *study*) but not when the primes were non-cognates (e.g., *doloroso* 'painful' – *pain*). The authors interpret these results as evidence that facilitation effects are due to orthographic activation caused by the shared letters between cognates.

Our finding that priming effects for derived word forms in non-native speakers are not morphological in nature but are caused by orthographic relatedness may also apply to inflected word forms. If *darkness* primes *dark* due to the shared letters, the same may hold for *walked* and *walk*. However, results from previous masked priming studies with inflected word forms are mixed: while some studies reported significant priming effects for inflected word forms (Feldman et al., 2010), others did not find such effects (Silva & Clahsen, 2008; Kırkıcı & Clahsen, 2013). Furthermore, the question to what extent priming effects between inflectionally related pairs are due to orthographic relatedness is still open.

In conclusion, the present study shows that non-native speakers are heavily influenced by surface form (i.e., a word's orthography) during word recognition and that what appears to be morphological priming effects in non-native speakers may be more apparent than real.

Appendix. Experimental stimuli

Item set 1: +O+M+S											
Related prime				Unrelated prime				Target			
	WFF	LF	syll		WFF	LF	syll		WFF	LF	syll
bluntness	1	1	2	*template*	1	1	2	*blunt*	6	6	1
rudeness	2	2	2	*pumpkin*	2	2	2	*rude*	42	46	1
toughness	2	2	2	*pigeon*	2	11	2	*tough*	34	41	1
smallness	2	2	2	*puddle*	2	4	2	*small*	47	59	1
tightness	2	2	2	*hassle*	2	2	2	*tight*	34	39	1
roughness	1	1	2	*duvet*	1	1	2	*rough*	101	106	1
shortness	1	1	2	*almond*	1	4	2	*short*	25	26	1
quickness	1	1	2	*hyphen*	1	1	2	*quick*	521	600	1
stiffness	3	3	2	*berry*	2	10	2	*stiff*	35	35	1
greatness	5	5	2	*napkin*	5	7	2	*great*	13	14	1
steadiness	1	1	3	*nightingale*	1	2	3	*steady*	181	201	2

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Appendix. Continued

Item set 1: +O+M+S											
Related prime				Unrelated prime				Target			
	WFF	LF	syll		WFF	LF	syll		WFF	LF	syll
darkness	54	54	2	*traffic*	54	54	2	*dark*	149	160	1
boldness	2	2	2	*riddle*	2	4	2	*bold*	11	14	1
freshness	3	3	2	*jewel*	3	9	2	*fresh*	84	89	1
sweetness	6	6	2	*guitar*	6	7	2	*sweet*	12	12	1
harshness	1	1	2	*knuckle*	1	6	2	*harsh*	41	43	1
cheapness	1	1	2	*tulip*	1	2	2	*cheap*	39	63	1
neatness	2	2	2	*wizard*	2	2	2	*neat*	23	25	1
hollowness	1	1	3	*kangaroo*	1	3	3	*hollow*	56	59	2
numbness	1	1	2	*raisin*	1	4	2	*numb*	29	30	1
weakness	21	30	2	*honey*	21	21	2	*weak*	4	4	1
nastiness	1	1	3	*tuxedo*	1	1	3	*nasty*	53	59	2
strangeness	3	3	2	*carrot*	3	8	2	*strange*	21	22	1
narrowness	1	1	3	*apricot*	1	3	3	*narrow*	59	65	2
politeness	5	5	3	*cubicle*	5	6	3	*polite*	13	13	2
awareness	24	24	3	*funeral*	22	26	3	*aware*	99	99	2
paleness	1	1	2	*turtle*	1	4	2	*pale*	71	71	1
quietness	2	2	3	*cinnamon*	3	3	3	*quiet*	18	20	2
randomness	1	1	3	*beverage*	1	2	3	*random*	652	860	2
falseness	1	1	2	*tuna*	1	2	2	*false*	44	44	1
Item set 2: +O-M-S											
Test prime				Control prime				Target			
	WFF	LF	syll		WFF	LF	syll		WFF	LF	syll
generous	25	25	3	*tremendous*	30	30	3	*gene*	6	19	1
spinach	4	4	2	*penguin*	4	5	2	*spin*	1	26	1
country	336	558	2	*office*	249	281	2	*count*	7	63	1
catch	16	193	1	*join*	16	145	1	*cat*	41	67	1
example	241	278	3	*history*	187	190	3	*exam*	8	17	2
peace	89	89	1	*skin*	90	102	1	*pea*	2	10	1
freeze	1	45	1	*dine*	1	31	1	*free*	183	185	1
dragon	8	9	2	*candle*	8	16	2	*drag*	3	48	1
factory	39	59	3	*enemy*	50	80	3	*fact*	509	571	1
jargon	7	7	2	*ferry*	7	8	2	*jar*	10	19	1
season	49	59	2	*mountain*	46	84	2	*sea*	160	173	1
witch	16	32	1	*slave*	16	33	1	*wit*	10	17	1
digit	1	4	2	*pimple*	1	3	2	*dig*	4	40	1
manage	9	128	2	*argue*	9	119	2	*man*	975	1629	1
yellow	52	52	2	*sudden*	52	52	2	*yell*	1	22	1
breast	43	74	1	*throat*	43	48	1	*bread*	74	74	1
linen	17	17	2	*apple*	18	30	2	*line*	210	287	1
parenthesis	1	1	4	*facsimile*	1	2	3	*parent*	71	317	2
prince	33	39	1	*chain*	33	48	1	*print*	2	35	1
secretary	87	98	3	*economy*	78	90	4	*secret*	33	48	2
career	52	66	2	*fashion*	53	65	2	*car*	276	354	1

(WFF = word form frequency per million, LF = lemma frequency per million, syll = number of syllables)

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