PHONOLOGICAL GREY AREAS:
THE CASE OF POLISH VOWEL-ZERO ALTERNATIONS

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1.0 INTRODUCTION

1.1 Theoretical problem

Language in the real world is not always black and white, and productive processes can often be obscured if several lexical exceptions exist. These "phonological grey areas" can be illustrated by the process of trisyllabic laxing in English. Usually, the quality of the vowel in the stem will change when the *–ity* suffix is present. This is seen in the following pairs: *div*[aj]*n/div*[ɪ]*nity*, *op*[ej]*que/op*[æ]*city*, *ser*[i]*ne/ser*[ɛ]*nity*. However, there are word pairs such as *ob*[i]*se/ob*[i]*sity* where, for most speakers, the vowel quality remains the same.

In such cases, it can sometimes be difficult to define the target environment of a phonological rule, or indeed to determine whether the phonological rule even exists. For instance, in the English example above, *obesity* may simply be an exception to a regular phonological rule of vowel shift, or there may not be a phonological rule at all and the pronunciation of words like *divinity* must be memorized. Furthermore, if *obesity* is the exception, then it may simply be memorized, or there may be something about its form (such as the consonant [s]) that disprefers vowel shift. Nonce forms are useful in these situations since they can be used to test speakers' phonological intuitions without interference from purely memorized lexical exceptions.

The present paper reports on an experimental study that used nonce forms to clarify a problematic aspect of Polish grammar: the *vowel-zero* alternation. Just as in the example of English *–ity* above, the *vowel-zero* alternation is a process which applies to some words but not others. The present paper begins by describing the *vowel-zero* phenomenon and the issues surrounding it (§1.2), and by outlining the goals of the study in more detail (§1.3). It then goes on to explain the methodology, including the experimental design and data collection (§2). After

an analysis of the results (§3), the paper discusses how the results help us better understand Polish phonology (§4) before concluding (§5).

1.2 Vowel-zero alternations in Polish

1.2.1 Description of the phenomenon

In nominal inflectional paradigms[1], the *vowel-zero* alternation can be described thus: when a noun ends in a consonant cluster, the vowel /ɛ/ appears between the final two consonants (#1.1a); when the noun has a vocalic inflectional suffix, the consonants remain a cluster (#1.1b).

(#1.1) a. $CVC_1\varepsilon C_2\#$ b. CVC_1C_2-a

A noun most often ends in a consonant if it is masculine and inflected for the nominative singular case (#1.2a), or if it is either feminine or neuter and inflected for the genitive plural case (#1.2b). This is because in each case the inflectional suffix is null.

(#1.2) a. Masc: dʲabɛw+Ø (nom.sg.) ~ dʲabw+i̇ (nom.pl.) 'devil'
b. Neut: ɕfʲatw+o (nom.sg.) ~ ɕfʲatɛw+Ø (gen.pl.) 'light'

However, there are many nouns that end in two or more consonants where the *vowel-zero* alternation does not occur. Compare the words with /tw/ and /dw/ clusters in (#1.2) above to the words in (#1.3) below, where the consonants in the clusters /wt/ and /wd/ are in the opposite order.

(#1.3) a. fawd+a (nom.sg.) ~ fawd+Ø (gen.pl.) 'fold/pleat'
b. kʂtawt+Ø (nom.sg.) ~ kʂtawt+i̇ (nom.pl.) 'shape'

[1] For the purposes of this study, I limit my investigation of *vowel-zero* in Polish to the context of nominal inflectional paradigms. However, it is important to note that similar phenomena can occur in Polish verbs and adjectives as well.

Furthermore, it is not just different types of consonant clusters that behave differently with respect to *vowel-zero*. Lexemes with the same consonant cluster can also behave differently. Note for example the vowel between /t/ and /f/ in (#1.4a) but the lack of vowel between the same two consonants in (#1.4b).

(#1.4) a. kotf+a (nom.sg.) ~ kotɛf+Ø (gen.pl.) 'anchor'
b. pwɛtf+a (nom.g.) ~ pwɛtf+Ø (gen.pl.) 'fin'

The data like the ones presented in (#1.4) form the crux of the problem in analyzing vowel-zero as a productive phonological rule: why are there vowel-zero alternations in some cases, while in other cases only the zero form is possible?

1.2.2 Traditional analyses

The existence of lexical exceptions has led many researchers to believe that all *vowel-zero* alternations are lexically encoded. Notably, Rubach (1984) argued that all instances of *vowel-zero* are due to underlying abstract vowels, transcribed as /ĭ/ and /ŭ/, which are present in the Polish phonemic inventory. According to Rubach, these vowels are able to surface only under specific conditions and are deleted if these conditions are not met. Specifically, an abstract vowel is able to surface if another abstract vowel follows it. This is found in masculine nominative singular words, and feminine and neuter genitive plural words because, according to Rubach, the inflectional suffix in these cases is an abstract vowel. In (#1.5a) below, the abstract vowel in the stem surfaces as /ɛ/ because another abstract vowel follows it in the suffix. The abstract vowel in the suffix does not surface because no other abstract vowel follows. In (#1.5b), on the other hand, the abstract vowel in the stem does not surface because the following vowel is a regular (non-abstract) vowel.

(#1.5) a. *pies* ‘dog, nom.sg.’ /pĭs+ĭ/ → [pʲɛs]
b. *psy* ‘dog, nom.pl.’ /pĭs+ɨ/ → [psɨ]

More recently, working within the theory of Government Phonology, Gussman (2007) reanalysed these abstract vowels as floating vowels. For Gussman, *vowel-zero* alternations are a result of floating vowels being linked to the skeletal tier, and consequently being allowed to surface. If particular conditions are not met, the vowel remains a floating vowel and does not surface.

Under both analyses, *vowel-zero* is a lexical phenomenon. The special (abstract or floating) vowel must exist in the underlying representation of the lexeme for the phenomenon to occur; lexemes which do not have the special vowel in their underlying representation cannot exhibit *vowel-zero*.

1.2.3 Challenges to the traditional analyses

According to Mellander (2000), the traditional approach to *vowel-zero* alternations in Polish (and other Slavic languages) outlined in §1.2.2 above results in an abundance of lexical specification. Furthermore, it does not take into account a number of important patterns in the data, which in turn make the traditional approach empirically inadequate.

One important observation is that most consonant clusters do not exhibit any variability. I base my observations on a collected corpus of approximately one thousand Polish noun stems ending in consonant clusters.[2] Within this corpus, all noun stems ending in a /tw/ or /dw/ consonant cluster (and there are over a dozen such examples) always have a vowel between the two consonants when the consonants are word-final (#1.2). Conversely, none of the noun stems

[2] I used three main resources in compiling my corpus: an orthographic dictionary (Saloni et al. 1994); a dictionary of nominal inflections (Mędak 2003); and the online dictionary at ‘pl.wiktionary.org’.

ending in a /wt/ or /wd/ consonant cluster exhibit *vowel-zero* (#1.3). Therefore, there are trends regarding consonant clusters in which *vowel-zero* alternations consistently do or do not occur.

The sonority hierarchy combined with the Sonority Sequencing Principle is one factor that appears to have an effect. Versions of the Sonority Sequencing Principle generally state that "Between any member of a syllable and the syllable peak, a sonority rise or plateau must occur" (Blevins 1995:210). Segments in a language are ranked with respect to each other on a sonority scale based on phonetic and phonological features. For the purposes of this paper, I assume there are five levels of sonority for non-vocalic segments (#1.6), based on limited distinctive features. However, there are other, sometimes more nuanced, ways to define the sonority scale (see Blevins 1995:210-212).

(#1.6)	glides /w, j/	[-consonantal]
	liquids /l, r/	[+consonantal, +sonorant, -nasal]
	nasals /ɲ, n, m/	[+consonantal, +sonorant, +nasal]
	fricatives	[+consonantal, -sonorant, +continuant]
	stops & affricates	[+consonantal, -sonorant, -continuant]

In Polish, coda clusters of falling sonority tend not to exhibit *vowel-zero*, coda clusters of rising sonority tend to exhibit *vowel-zero*, while coda clusters with level sonority tend to exhibit the most variation with respect to *vowel-zero*. These tendencies are expressed visually in the chart in Appendix A, which places coda clusters of rising sonority in the top left and coda clusters of falling sonority in the bottom right. In this respect, vowel-zero resembles processes of epenthesis found in other languages. In languages that strictly follow the Sonority Sequencing Principle, the second consonant in a coda cluster C_1C_2, where C_2 is more sonorous than C_1, cannot be syllabified. In these situations, "epenthesis is a strategy for saving otherwise unsyllabifiable strings" (Blevins 1995:224).

A second observation regarding Polish *vowel-zero* was made by Bethin (1992:147-150), who points out that when it comes to words borrowed from other languages, some words exhibit *vowel-zero* alternations and others do not. Some borrowings that ended in a consonant cluster in the source language remain faithful to the source and maintain the cluster throughout their inflectional paradigm in Polish (e.g. [alarm]~[alarmɨ] 'alarm, nom.sg.~nom.pl.'), while others develop a *vowel-zero* alternation (e.g. [pɛrwa]~[pɛrɛw] 'pearl, nom.sg.~gen.pl.'). Conversely, some borrowings that ended in a CɛC sequence in the source language remain faithful to the source and maintain the vowel throughout the inflectional paradigm in Polish (e.g. [sfɛtɛr]~[sfɛtruf] 'sweater, nom.sg.~gen.pl.'), while others develop a *vowel-zero* alternation (e.g. [lidɛr]~[lidɛruf] 'leader, nom.sg.~gen.pl.'). If *vowel-zero* was always lexically encoded, then there should be no reason why any borrowing would exhibit the alternation.

Finally, a third important observation is that certain lexemes have the option of exhibiting *vowel-zero* or not. For instance, the genitive plural of [sarna] 'deer' can be either [sarɛn] or [sarn], and many speakers use both possible forms interchangeably. Based on prescriptive grammars and dictionaries (e.g. Mędak 2003), this optionality can only occur in feminine nouns with /rn/ clusters. However, Cyran (2005), among others, has also observed variable pronunciations of words like [sfɛtɛr] 'sweater' as [sfɛtr], and [vʲatr] 'wind' as [vʲatɛr]. If *vowel-zero* alternations resulted from a special vowel in the underlying representation, then we cannot explain the optional nature of its surfacing.

All three observations outlined above suggest that vowel-zero alternations are in fact governed by general phonotactic constraints. This paper therefore concerns itself with finding further evidence to support the existence of a phonotactically-governed process, and with teasing apart the exact nature of these phonotactic constraints.

1.3 Goals of the study

The goals of this study are two-fold. The first task is to empirically determine whether *vowel-zero* is in fact a lexically-driven process, or if it can be accounted for phonotactically. If the latter holds true, it is predicted that, when faced with nonsense forms, speakers will apply vowel-zero only to break up coda consonant clusters that are defined in their phonology as unacceptable. If this is not true, it is predicted that speakers will either not employ *vowel-zero* at all or will apply it randomly. As the results section will show (§3), after consulting with five speakers, it was found that their use of vowel-zero was not random, but rather followed specific patterns.

Once it has been established whether *vowel-zero* alternations are phonotactically constrained, the second task is to specifically define their target environment. For consonant clusters such as /tf/ in (#1.4a-b) where Polish data is greatly variable and exhibits many lexical exceptions, nonce forms allow us to determine the "default" for that cluster. For example, if all nonce forms with /tf/ clusters exhibit *vowel-zero*, then it is safe to assume that /tf/ is a target environment for this process and all words with a /tf/ cluster that do not exhibit vowel-zero are the exception. Furthermore, factors in addition to the quality of the consonants in the coda cluster may also affect *vowel-zero*. It is the goal of this study to isolate and test a number of important factors to determine their individual effect. In particular, these factors are: the grammatical gender of the stem (§3.2.2), the quality of the vowel immediately preceding the consonant cluster (§3.2.3), the length of the stem (§3.2.4), and the number of possible morphemes in the stem (§3.2.5). Results show that each of these have an effect on vowel-zero for at least one speaker.

2.0 METHODS AND PREDICTIONS

To meet the goals of the study, an experiment was designed to test whether speakers would employ *vowel-zero* when asked to produce inflected forms of nonce words with various consonant clusters. The design of this experiment was inspired by Berko's (1958) study which tested children's acquisition of English morphemes and allomorphs. In her study, Berko created a number of nonsense words that were designed to reflect the vocabulary of English-speaking children. These nonsense words were embedded in meaningful phrases that were then followed by a phrase with a missing word. Children were presented with these phrases, and then asked to supply the missing word. The missing word was intended to be an inflected form of the nonsense word. The children's responses were recorded to see which allomorph was used with which type of word.

The methods of the present study closely follow those of Berko (1958). The following sections outline first which consonant clusters and linguistic variables were tested (§2.1), how these consonant clusters were used to create nonce words (§2.2), how these nonce words were embedded into meaningful phrases (§2.3), and how these phrases were presented to the speakers (§2.4). This section ends with a description of the speakers who participated in this experiment (§2.5), and with an explanation of how their responses were interpreted and coded (§2.6). A complete list of the experiment materials presented to the speakers can be found in Appendix C.

2.1 Clusters and variables tested

The present experiment tested 186 types of consonant cluster. A consonant cluster "type" is defined as a particular segment preceded by another segment. For instance, /zk/ and /zg/ belong to two different cluster types because the second consonant in each case is different.

Similarly, /sk/ and /zk/ belong to different cluster types because the first consonant in each case is different.

One of the major predictions of this experiment is that sonority plays a substantial role in vowel-zero. Therefore, forms with final consonant clusters of various sonority contours had to be tested. This experiment tests consonant clusters ending in /w, l, r, ɲ, n, m, ʂ, ʐ, f, v, tɕ, ts, k, g, t, p, b/ (see Appendix B for a detailed description of each of these clusters). In order to prevent the speakers from becoming too fatigued during the experiment, the number of nonce words that was tested had to be kept to a reasonable amount. As a result, not all possible Polish consonant clusters were used in the creation of the nonce words in this study. Consonant clusters ending in /j, ɕ, x, s, z, tʂ, dʐ/ were not tested since they do not exhibit any variability and are relatively rare in the Polish language (as seen in Appendix A). Sequences of the same consonant (e.g. /nn/, /tt/, etc.) are rarely found word-finally and were also not tested. Furthermore, in *obstruent+consonant* clusters, either the voiced or the voiceless obstruent was used, not both.

A table highlighting the consonant clusters that were tested can be found in (#2.1) below. Cells that are blacked out indicate clusters that were not tested. The remaining cells indicate the predicted responses to nonce forms with that cluster. Certain predictions are dependent on gender, so where relevant the gender of the nonce form is indicated at the top ("m"=masculine, "f"=feminine, "n"=neuter). Predictions are based on how the cluster behaves in standard Polish. If all standard Polish lexemes with the cluster exhibit vowel-zero, then we predict that cluster to exhibit vowel-zero in nonce forms. On the other hand, if all standard Polish lexemes with the cluster fail to exhibit vowel-zero, then we predict that the cluster will also fail to exhibit vowel-zero in nonce forms. If a particular cluster exhibits vowel-zero with some lexemes but not with others, then we cannot make a prediction as to how it will behave in nonce forms. Similarly, we

cannot make any predictions regarding nonce forms if no lexemes that end in the particular cluster exist in standard Polish. In both cases, any response is possible. Finally, the table also indicates the consonant clusters that were tested using multiple nonce forms, the response to which may depend on variables other than the type of cluster.

(#2.1) Predicted responses to nonce forms

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (m)	n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		+	*	+/-			+				+	-	+	+		-		
t d	+	+	*	+			*	-		*			+	+			?	?
k g		*	*	+			+	-		*	+	?				-	?	?
ts		+		?			?							+/-		+	-	?
tʂ		?		+			?	-					?	+		+/-	?	-
tɕ								+/-					+	+			?	?
f v		+/-	*	?			+/-				?	-	?	+		-	?	?
s z	*	+					*	*		-			?	*	-	-	*	-
ʂ ʐ		+		+			+	+/-		+			+	?		-	?	-
x		+		?			+	-		+/-	+	?	?	?		-	?	
ɕ ʑ		-		+	-			-			-	-	+	+			?	-
m		-	*	-	?	-	+		*	-	?	-	?	+		?	-	-
n										-			-	-	-	-		
ɲ											?	-	+	+			?	-
r		-		+	-	-	+/-	-		-	-	-	-	+/-	-	-	-	+/-
l		-		?	-	?	?	-		-	?	?	+/-	+/-	-	-	-	-
j		-		?	-	-	+	+/-			?	?	+	+/-	-	-	-	-
w				?	-	+/-	+/-	-		-	+	-	?	+/-	-	-	-	-

+	response expected to exhibit vowel-zero
-	response expected to not exhibit vowel-zero
+/-	standard Polish exhibits variability; responses to nonce forms may or may not exhibit vowel-zero
?	cluster not found in standard Polish; responses to nonce forms may or may not exhibit vowel-zero
*	standard Polish exhibits variability; multiple nonce forms tested correspond to different predictions[3]

Highly variable consonant clusters were included in multiple nonce words. Therefore, the nonce words they appear in were designed with specific linguistic variables in mind in order

[3] See the sections in Appendix E for details regarding these clusters.

to test the reasons for the cluster's variable behaviour. The four linguistic variables that are predicted to have an effect on vowel-zero are: morphology, length of the stem, quality of the stem vowel, and grammatical gender. Next, I discuss the evidence for each predicted variable.

Morphology

Morphology is expected to have an effect because nominal stems that are made up of multiple morphemes tend to behave differently than words that have the same final cluster but are monomorphemic. This phenomenon can be seen in numerous morphemes (such as /-mɨsw/ 'thought', /-mʲɔsw/ 'thought', /-izn/ 'deadjectival suffix', and /-ɨzm/ '-ism') which end in a cluster of rising sonority but do not exhibit vowel-zero. This is in contrast to similar words which do exhibit vowel-zero. For instance, the bimorphemic word *pomysł* [pɔmɨsw] 'idea, nom.sg.' (made up of the preposition *po* and the root *mysł* 'thought') does not exhibit vowel-zero, while the monomorphemic word *krzesło* [kʂɛswɔ] 'chair, nom.sg.' does (cf. [kʂɛsɛw] 'chair, gen.pl.'). Similarly, the bimorphemic word *bielizna* [bʲɛlizna] 'undergarment, nom.sg.' (made up of the root *biel* 'white' and the suffix -*izna*) does not exhibit vowel zero (cf. [bʲɛlizn] 'undergarment, gen.pl.'), while the monomorphemic word *błazen* [bwazɛn] 'fool, nom.sg.' does (cf. [bwaznɨ] 'fool, nom.pl.').

Polish also has a few morphemes which behave in the opposite way. The derivational morphemes /-ts/ and/-k/, when added to a stem, do not cause a rise in sonority since they are both some of the least sonorous segments in the inventory. However, they consistently exhibit vowel-zero. For instance, the bimorphemic word *goniec* [gɔɲɛts] 'currier, nom.sg.' (made up of the verb root *goń* 'chase' and the suffix /-ts/) exhibits vowel-zero (cf. [gɔɲtsɨ] 'currier, nom.pl.'), while the monomorphemic word *słońce* [swɔɲtsɛ] 'sun, nom.sg.' fails to (cf. [swɔɲts] 'sun, gen.pl.'). Similarly, the bimorphemic word *pasek* [pasɛk] 'belt, nom.sg.' (made up of the root

pas ‘waist’ and the suffix /-k/) exhibits vowel-zero (cf. [paski] ‘belt, nom.pl.’), while the monomorphemic word *blask* [blask] ‘shine, nom.sg.’ fails to.

Finally, certain segments can be indicative of multiple morphemes. For instance, the segment /ɲ/ at the end of a word could indicate a masculine suffix that derives nouns from adjectives (seen in the noun [durɛɲ] ‘dummy’ derived from the adjective [durnɨ] ‘stupid’), or it could indicate a feminine suffix that denotes place names (seen in the noun [vartɔvɲa] ‘guard post’ derived from the noun [varta] ‘guard’). Similarly, the segment /tɕ/ at the end of a word could indicate a masculine nominalising suffix (seen in the noun [pɔwɛtɕ] ‘piece’ derived from [puw] ‘half’), or it could indicate a feminine diminutive suffix (seen in [babtɕa] ‘grandmother’ derived from [baba] ‘woman’). Words with the masculine /ɲ/ and /tɕ/ suffixes exhibit vowel-zero, while words with the feminine /ɲ/ and /tɕ/ suffixes fail to exhibit vowel-zero. While this difference may be an inherent property of the morphemes, it is also possible that this difference is actually due to the grammatical gender alone (see discussion of grammatical gender below).

Length

The length of the stem is expected to have an effect because of shifting stress patterns. Word stress in Polish regularly appears on the penultimate syllable. Therefore, if a bisyllabic stem was to lose its vocalic suffix, the stress would shift from the second syllable to the first (#2.2a). Bisyllabic stems that exhibit vowel-zero would not be affected by this stress shift (#2.2b), nor would monosyllabic stems (#2.2c-d).

(#2.2) a. CVCV́CC+a → CV́CVCC
b. CVCV́CC+a → CVCV́CɛC
c. CV́CC+a → CV́CC
d. CV́CC+a → CV́CɛC

This hypothesis is partially supported by observations of word pairs such as *półwysep* 'peninsula' and *wyspa* 'island'. As a word with a bisyllabic stem, *półwysep* exhibits vowel-zero [puwvɨspɨ]~[puwvɨsɛp] 'nom.pl.~nom.sg.'; as a word with a monosyllabic stem, *wyspa* fails to exhibit vowel-zero [vɨspa]~[vɨsp] 'nom.sg.~nom.pl.'

Vowel Quality

There are a number of situations where consonant clusters in lexemes with particular stem vowels behave differently from lexemes with other stem vowels. For instance, although words with /kl/ clusters tend to exhibit vowel-zero, words where the vowel /ɨ/ precedes the cluster form the exception (e.g. *cykl* [tsɨkl] 'cycle'). Similarly, words with *obstruent+n* clusters tend to exhibit vowel-zero; yet, words with /tn/ clusters which are preceded by the vowel /ɛ̃/ fail to do so (e.g. *tętno* [tɛ̃tnɔ]~[tɛ̃tn] 'pulse, nom.sg.~gen.pl.').

In highly variable consonant clusters, where the effect of one particular vowel over others may not be as obvious, the vowel [ɛ] in particular is expected to have an effect. As an epenthetic vowel in this language, [ɛ] is considered to be especially light or unmarked. Its status as a light vowel may perhaps attract vowel-zero in order to give certain "weight" to the word it appears in. Alternatively, /ɛ/ in the stem might resist vowel-zero because the grammar wants to avoid having two light vowels or two vowels of the same quality in a row.

Grammatical Gender

Previous research on Polish suggests grammatical gender may have an effect on vowel-zero. In his study of vowel-zero in lexemes with Cr coda clusters, Laskowski (1975) observed that masculine nouns tend to exhibit vowel-zero (with a vowel-zero rate of 75%), feminine nouns tend not to exhibit vowel-zero (with a vowel-zero rate of 20%), while neuter nouns always exhibit vowel-zero (with a vowel-zero rate of nearly 100%).

The tendency for masculine nouns to favour vowel-zero and feminine nouns to disfavour vowel-zero can also be found in lexemes with coda clusters other than Cr. For instance, the masculine noun *półwysep* 'peninsula' exhibits vowel-zero [puwvɨspɨ]~[puwvɨsɛp] 'nom.pl.~nom.sg.', while the feminine noun *wyspa* 'island' fails to exhibit vowel-zero [vɨspa]~[vɨsp] 'nom.sg.~nom.pl.' Similarly, it can be argued that nouns ending in Cɲ and Ctɕ exhibit vowel-zero when they are masculine but fail to exhibit vowel-zero when they are feminine because of their grammatical gender, rather than as a result of their morphological makeup (see discussion on morphology above).

Nonetheless, not all coda clusters behave the same way. Notably, in Cn clusters, masculine nouns tend to not exhibit vowel-zero (e.g. [kɔmbajn] 'combine harvester, nom.sg.'), while feminine and neuter nouns tend to at least optionally exhibit *vowel-zero* (e.g. [vɔjna]~[vɔjɛn] 'war, nom.sg.~gen.pl'). This tendency in Cn clusters is therefore in conflict with Laskowski's (1975) observation for Cr clusters.

Not all of the linguistic variables discussed above are expected to be important for all consonant clusters. In general, most nonce words used in this experiment are based on monosyllabic stems and have random stem vowels; the stems of the words are assumed to be monomorphemic and are inflected for whichever gender is most common for real Polish lexemes with the same consonant cluster.

Table #2.3 below summarizes the consonant clusters that were tested along with the linguistic variables that were deemed relevant for each cluster. The table first answers whether the effect of a particular linguistic variable was tested in the experiment. If the answer is yes, the table briefly elaborates on the kind of effect the variable is expected to have. Blank cells indicate the variable was not tested as it was deemed not relevant for the particular cluster.

(#2.3) Consonant cluster-specific hypotheses regarding linguistic variables

	morphology	**length**	**vowel**	**gender**
Cw	*yes* -words with /-mʲɔsw/ and /-misw/ will not have V-Ø	--	--	--
Cl	--	--	*yes* -words with /ɨ/ will not have V-Ø	--
Cr	--	*yes* -bisyllabic and monosyllabic words will behave differently	*yes* -words with /ɛ/ will behave differently from words with /a/	*yes* -neuter words will always have V-Ø; feminine words will rarely have V-Ø; masculine words will often have V-Ø
Cɲ	*yes* -words with feminine /-ɲ/ will not have V-Ø; words with masculine /-ɲ/ will have V-Ø	--	--	*yes* -words with feminine /-ɲ/ will not have V-Ø; words with masculine /-ɲ/ will have V-Ø
Cn	*yes* -words with /-izna/ will not have V-Ø	--	*yes* -words with /ɛ̃/ will not have V-Ø	*yes* -masculine words will not have V-Ø; feminine words will have V-Ø
Cm	*yes* -words with /-izm/ will not have V-Ø	--	--	--
Cʂ	--	--	--	*yes* -feminine words will have V-Ø
Cʐ	--	--	--	*yes* -masculine words will not have V-Ø
Cv	--	*yes* -bisyllabic and monosyllabic words will behave differently	*yes* -words with /ɛ/ will behave differently from words with /a/	--
Ctɕ	*yes* -words with feminine /-tɕ/ will not have V-Ø; words with masculine /-tɕ/ will have V-Ø	--	--	*yes* -words with feminine /-tɕ/ will not have V-Ø; words with masculine /-tɕ/ will have V-Ø
Cts	*yes* -words with morpheme /-ɛts/ will have V-Ø	--	--	--
Ck	*yes* -words with morpheme /-ɛk/ will have V-Ø; words with morpheme /-iskɔ/ will not have V-Ø	--	--	--
Cg	--	--	--	--
Ct	--	--	--	--
Cp	--	*yes* -bisyllabic words will have V-Ø; monosyllabic words will not have V-Ø	--	*yes* -masculine words will have V-Ø; feminine words will not have V-Ø
Cb	--	--	--	--

2.2 Nonsense form design

The experiment consisted of 320 forms with the various consonant clusters and test variables specified in the previous section. All test forms had the following basic shape: (CV)CVCC+V. Most forms had monosyllabic stems and so had a CVCC+V skeleton. However, some clusters were tested with bisyllabic stems and so had a CVCVCC+V skeleton. The final vowel in the skeleton above indicates a case suffix that is dependent on the gender of the noun. (More on how these suffixes were chosen can be found in §2.3.) At this point in the experimental design process, these vowels were simply noted as being masculine, feminine, or neuter.

First, the final two consonants of the skeleton stem were filled with the consonant cluster being tested. For example, if we wanted to test a monosyllabic stem with a /tr/ cluster, we would start building the form CVtr+V. Next, if vowel quality was relevant, the stem vowel immediately preceding the cluster was filled in. For instance, all Cr clusters were tested with /a/ and /ɛ/ stem vowels. Therefore, we had to create two forms: Catr+V and Cɛtr+V. However, in the case of /rn/ clusters, for example, because vowel quality was not relevant, the vowel was not filled in at this time: CVrn+V. Finally, all remaining consonants and vowels in the skeletons were filled in at random. Note that if a cluster was to be tested with different grammatical gender suffixes, the remaining consonants and vowels in the two forms were different. For instance, if there was to be a CVrn+V_{MASC} and a CVrn+V_{FEM} form, these became zɛrn+V_{MASC} and tɕurn+V_{FEM} so that there was never any repetition of stems.

All forms were ultimately transcribed into standard Polish orthography. Polish orthography is based on the Latin alphabet. Words are spelled phonemically, and most letters

are pronounced the same way as the corresponding IPA symbol. Letters and digraphs which do not correspond to IPA symbols are summarized in (#2.4) below.

(#2.4)

Letter	IPA symbol
y	[ɨ]
ą	[ɔ̃]
ę	[ɛ̃]
sz	[ʂ]
ż/rz	[ʐ]
cz	[tʂ]
dż	[dʐ]
ś/si	[ɕ]
ź/zi	[ʑ]
ć/ci	[tɕ]
dź/dzi	[dʑ]
ch	[x]

2.3 Numeric phrase design

Each nonce form was first embedded in a numeric phrase ("initial phrase"), and was then followed by a number that prompted speakers to produce the nonsense word and inflect it with the appropriate suffix ("prompt"). For example, speakers would be presented an initial phrase and prompt as in (#2.5a). As the translation in (#2.5b) indicates, speakers would know that the form is feminine because the numeral in the initial phrase has a feminine form and the nonce word ends in a feminine suffix. They would also know that they are expected to inflect the form in the genitive plural, because only genitive plural forms follow numerals five and above. For a full list of initial phrases and prompts see Appendix C.

(#2.5)

a.

jedna mecatwa
pięć _____

b.

one$_{fem}$ *mecatw+a*$_{fem}$
five _____

Numeric phrases were chosen because they require nouns to be inflected in specific ways. The number "one" requires the following noun to be nominative singular. Numbers "two", "three", and "four" require the following noun to be nominative plural. Finally, numbers "five" and higher require the following noun to be genitive plural. Recall that, in general, masculine nouns have a zero suffix in the nominative singular while feminine and neuter nouns have a zero suffix in the genitive plural. Therefore, a prompt of "one" can be used to elicit word-final clusters in masculine nouns, and a prompt of "five" and higher can be used to elicit word-final clusters in feminine and neuter nouns.

The purpose of the numeric phrases was also to clearly identify these nonsense forms as nouns, as well as to give additional information about the grammatical gender of these nonsense nouns. In some cases, the inflectional suffix alone does not give enough information to be able to conclusively identify the gender of the noun. However, the number of the initial phrase, the inflectional suffix in the initial phrase, and the number of the prompt *combined* give unambiguous information about the grammatical gender. The following outlines how each of these components was chosen for each grammatical gender.

Masculine

In initial phrases, masculine nonce forms can be preceded by any numeral because the form of the following prompt number *jeden* 'one' is always unambiguously masculine. Therefore, the speakers would be sure that they are expected to produce a masculine form.

(#2.6)

initial number	**initial suffix**	**prompt number**
dwa, trzy, cztery	+y	jeden
two$_{MASC/NEUT}$, three, four	*nom.pl.$_{MASC/FEM}$*	*one$_{MASC}$*
pięć, etc.	+ów	jeden
five, etc.	*gen.pl.$_{MASC}$*	*one$_{MASC}$*

Feminine

Prompts for feminine nouns had to be more carefully composed. In Table (#2.7), only the initial number is unambiguously feminine. If the initial number was "three" or "four", the gender of the noun would be ambiguous since the plural suffix *+y* is ambiguously masculine and feminine, and the numerals "three" and "four" do not carry gender information at all.

(#2.7)

initial number	**initial suffix**	**prompt number**
jedna	+a	pięć, etc.
one$_{FEM}$	nom.sg.$_{FEM}$	*five, etc.*
dwie	+y	pięć, etc.
two$_{FEM}$	*nom.pl.$_{MASC/FEM}$*	*five, etc.*

In some cases (see §2.1.4 *Cɲ* and §2.1.9 *Cтɛ)*, feminine nouns end in consonants in the nominative singular. In these cases the form was embedded in the phrase in Table (#2.8). In these cases, both the initial suffix and the prompt number is unambiguously feminine.

(#2.8)

initial number	**initial suffix**	**prompt number**
pięć, etc.	+i	jedna
five, etc.	*gen.pl.*$_{FEM}$	one$_{FEM}$

Neuter

Neuter forms were embedded in the phrases in Table (#2.9). These phrases suggest the form is unambiguously neuter because of the nominative inflectional suffixes.

(#2.9)

initial number	**initial suffix**	**prompt number**
jedno	+o	pięć, etc.
one$_{NEUT}$	nom.sg.$_{NEUT}$	*five, etc.*
dwa, trzy, cztery	+a	pięć, etc.
two$_{MASC/NEUT}$, three, four	*nom.pl.$_{NEUT}$*	*five, etc.*

2.4 Experiment procedure

The experiment was conducted entirely in Polish. One initial phrase and its corresponding prompt were presented on two lines at the centre of a computer screen. They were presented in a different random order for each speaker in order to eliminate priming effects. Speakers were seated in front of a computer screen and were asked to read the initial phrase aloud first and then complete the prompt. This was to ensure that they had read the letters of the form correctly. If not, they were asked to reread the initial phrase and complete the prompt again. Once they had completed the prompt, they were presented with the next phrase and prompt.

Before starting the experiment proper, speakers completed a trial section made up of six real Polish words to make sure they understood the instructions. The trial did not include any forms with final consonant clusters, again in order to eliminate priming effects. Following the trial, the phrases with the nonce forms were presented in random order for each speaker. The

experiment lasted between 1 hour and 1.5 hours, and speakers were given the option to take a break at any point during the experiment.

The speakers' responses and commentary during the experiment were recorded using a digital recorder. If it was not immediately clear whether a speaker's response to the prompt had a vowel between the final two consonants, they were asked to repeat it. If a speaker produced a number of different responses to the same prompt, they were asked to clarify which response is "better" or whether all responses are equally "correct".

2.5 Speakers

Five native speakers of Polish, two male and three female, participated in the experiment in May and June 2011. Their ages, at the time of the experiment, ranged from 26 to 61 years old. Although they are predominantly from one area of Poland, they are all speakers of standard Polish and as such their responses can be said to be representative of a wider Polish population.

The following table summarizes their social characteristics, including sex, age, and place of origin. These may turn out to be relevant if certain groups of speakers are found to behave differently from others with respect to vowel-zero (see §4.2).

(#2.10)

Speaker	Sex	Decade of birth	Grew up near
TC	Male	1950s	Białystok (northeast)
LC	Female	1950s	Białystok (northeast)
AC	Male	1970s	Białystok (northeast)
EW	Female	1970s	Białystok (northeast)
KP	Female	1980s	Lublin (southeast)

Furthermore, all speakers have lived in Canada for at least 15 years, therefore their use of Polish may exhibit some influence from English. The following table summarizes their contact

with English, including age of arrival, English proficiency, and languages spoken at home (in the evenings and on weekends) and work (during weekdays).

(#2.11)

Speaker	Age of Arrival	English proficiency	Language at home	Language at work
TC	39	advanced	Polish	English
LC	40	intermediate	Polish	English & Polish
AC	18	intermediate	Polish	English & Polish
EW	15	fluent	Polish & English	N/A (Polish)
KP	12	fluent	Polish & English	English

2.6 Coding the results

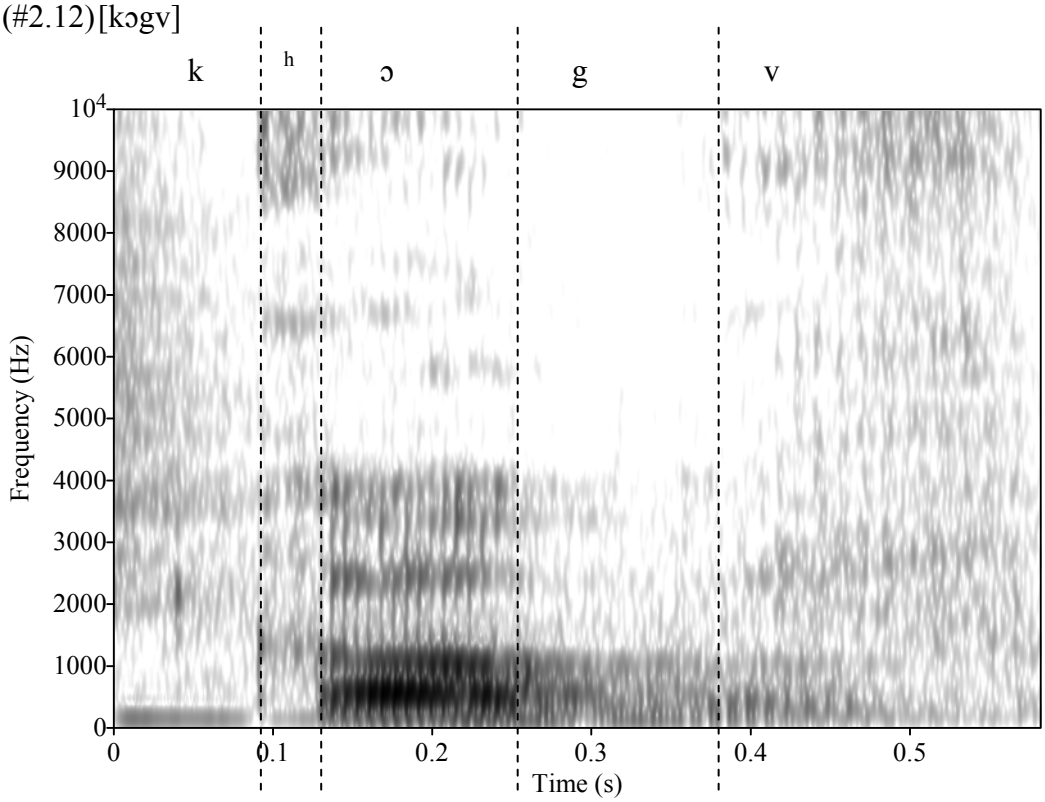
For each nonce form in the experiment, a speaker's response to the phrase and prompt was categorized in one of four ways: (1) the speaker produced a vowel /ɛ/ between the final two consonants of the word; (2) the speaker did not produce a vowel between the final two consonants of the word; (3) the speaker produced two forms in response to the prompt—one response had a vowel between the final two consonants of the word and the second response did not; and finally (4) the speaker's response ended in a vowel or included a consonant that was not found in the prompt. Answers marked as belonging to category (4) were discarded from analyses. For four of the speakers consulted, the number of discarded answers totalled between 8 and 12 out of 320. However, for one speaker (LC), the total number of discarded answers was much higher: 92 out of 320. These answers were later brought back into an analysis focusing on this speaker (see §3.3).

As mentioned in §2.4, when a speaker produced a number of different responses to the same prompt, they were asked to clarify which response is "better". If they explicitly said both are equally acceptable, their answer was marked as category (3). If at any point they indicated a

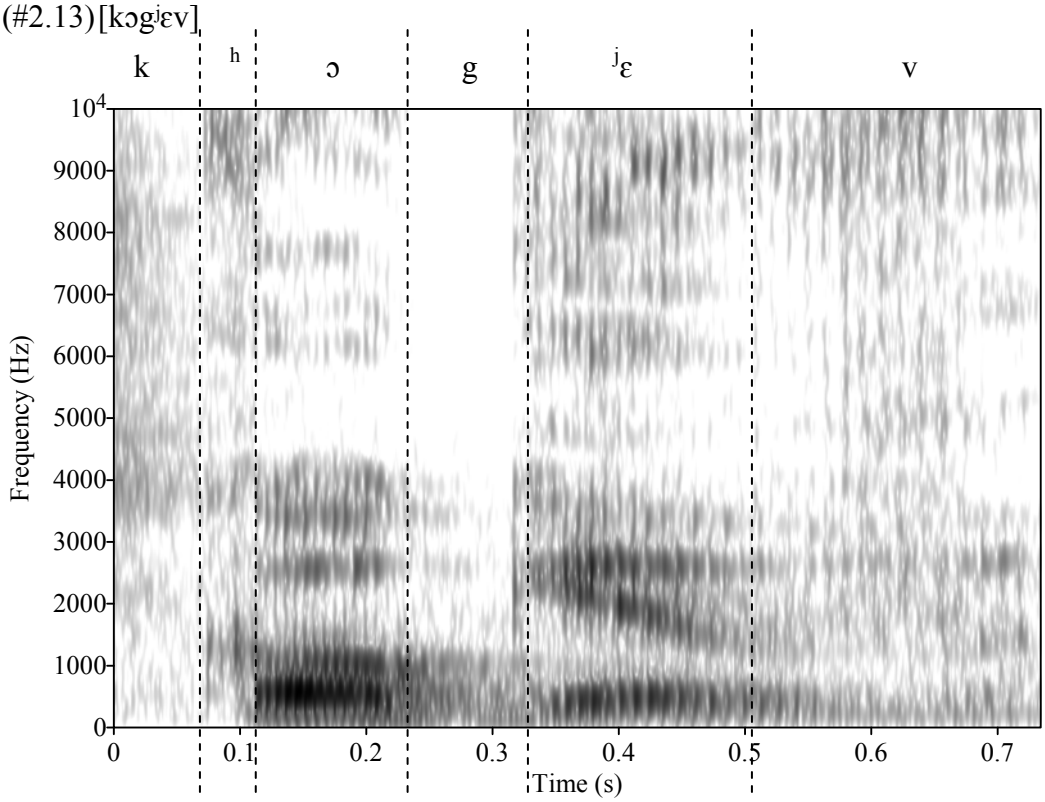
preference for one response over another, then their answer was marked as either category (1) or (2). (See the charts in Appendices D and E for a full overview of the results.)

It is important to note that in Polish it is auditorily apparent whether a coda cluster has exhibited vowel-zero or not. Therefore, the categorization of speaker responses was done impressionistically, without any in-depth acoustic analysis. The following spectrographs, extracted from the recording of TC's responses, show that a vowel that appears as a result of vowel-zero and a stem vowel are both of relatively equal length. Therefore, there is no question whether or not the final two consonants have a vowel between them. Compare for instance [kɔgv] (#2.12), where the stem vowel [ɔ] is ~0.12s, to [kɔgʲɛv] (#2.13), where the stem vowel [ɔ] is ~0.12s and the epenthetic vowel [ɛ] is ~0.16s. Furthermore, responses which did not have a vowel between the final two consonants were sometimes emphasized by speakers who would produce a short vocalic sound following the consonant cluster. Compare, for example, [ɕidzɛvr] (#2.14) to [ɕidzɛvɛr] (#2.15) and note how the [r] in the former ends in a burst whereas the latter trails off.

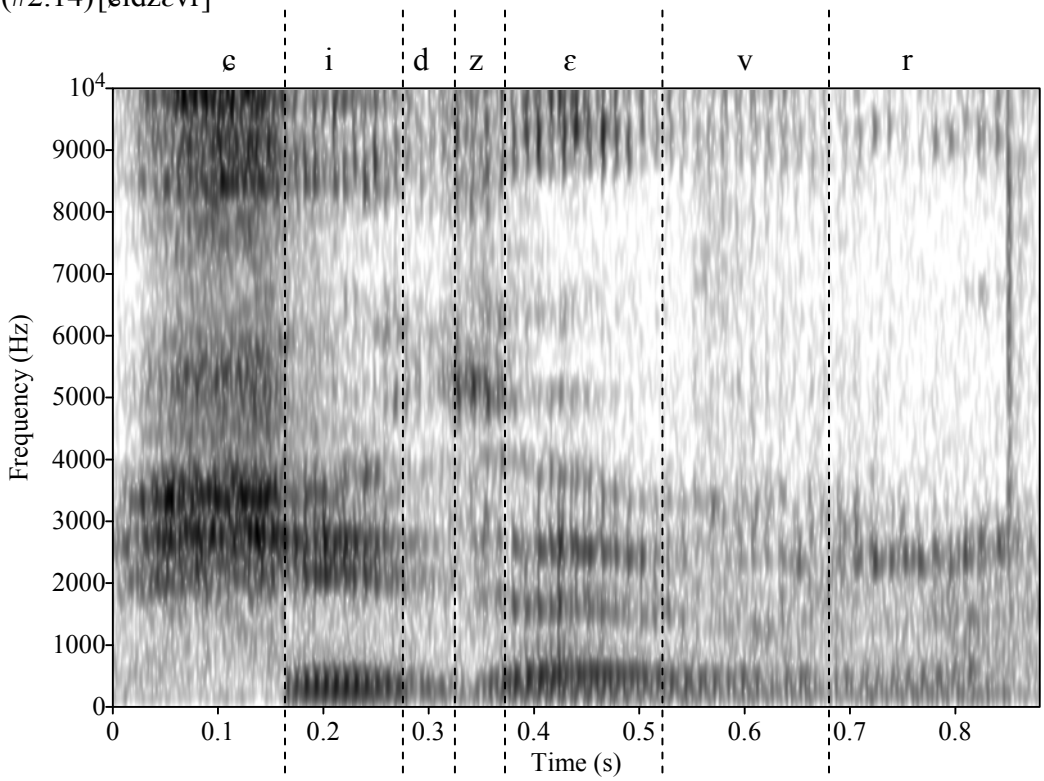
(#2.12)[kɔgv]



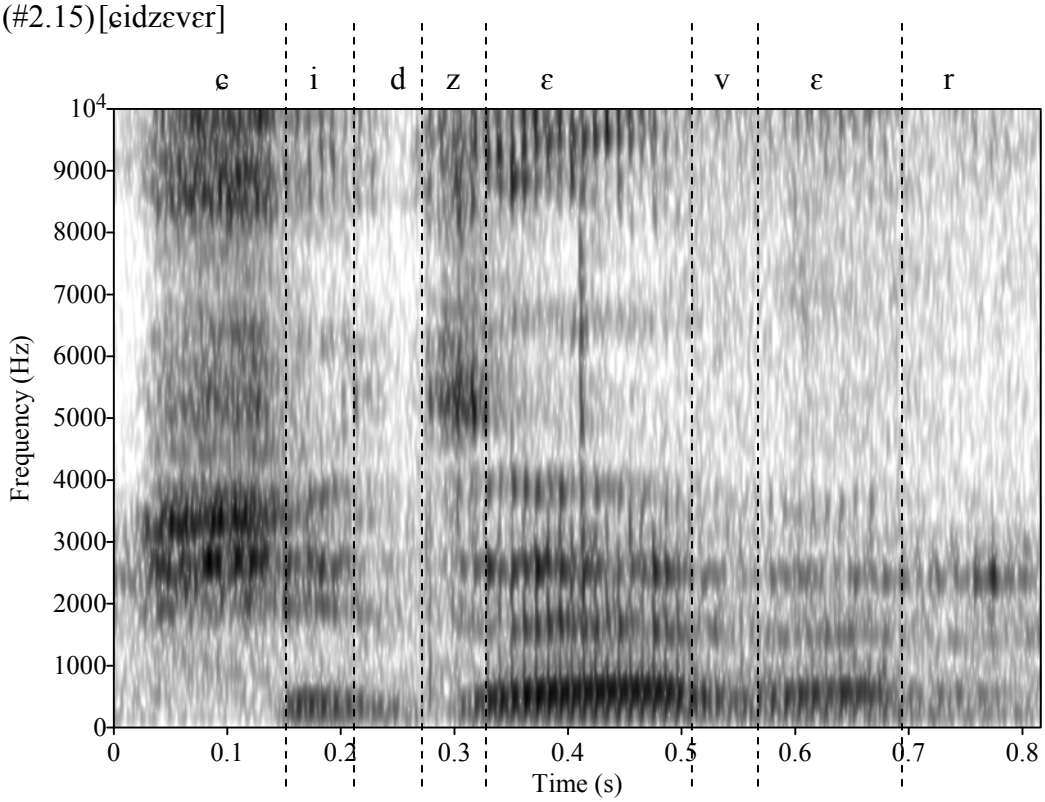
(#2.13)[kɔgʲɛv]



(#2.14)[ɕidzɛvr]



(#2.15)[ɕidzɛvɛr]



3.0 RESULTS

In this section, I look at the results of the experiment with an eye towards discovering patterns therein. I first give a brief overview of the results from each speaker, and compare speakers based on how often or how rarely they used vowel-zero in their responses (§3.1). At the same time, I calculate what the expected rate of vowel-zero should be based on my corpus of standard Polish vocabulary compiled from various dictionaries.[4] This allows me to compare each speaker's rate to this expected rate.

I then go on to examine the various linguistic variables that—as I hypothesised earlier—may affect the presence or absence of vowel-zero in a particular form (§3.2). These linguistic variables include: the sonority of the consonant segments in the stem-final cluster (§3.2.1); the grammatical gender of the stem (§3.2.2); the quality of the vowel immediately preceding the consonant cluster in the stem (§3.2.3); the number of syllables in the stem (§3.2.4); and the potential for interpreting the stem as being comprised of more than one morpheme (§3.2.5). I also briefly point out the apparent effect of voiced versus voiceless obstruents in stem-final clusters (§3.2.6), before summarizing the findings (§3.2.7). In analyzing the linguistic variables, I limit myself by using data from only four out of the five speakers tested. I return to look at the data from the fifth speaker (LC) in §3.3.

3.1 Overall Rate of Vowel-Zero

An important first step in determining whether the vowel-zero alternation is a productive process for Polish speakers is to look at how often each speaker employs vowel-zero with the nonsense forms in the present experiment.

[4] Throughout this chapter I use "standard Polish" to specifically refer to the way Polish lexemes are represented in dictionaries and grammar books with respect to vowel-zero. Generalizations made by these sources may or may not be in contrast to the way speakers produce specific lexemes in everyday speech (see end of section 4).

There are two ways of calculating this rate. The first method is useful for comparing the individual speakers to each other in order to see whether they use vowel-zero equally often. To calculate the rate using the first method, we look at their responses to all 320 nonsense forms. We then isolate three types of responses: a form with a vowel between the final two consonants (#3.1a); a form where the final two consonants form a cluster (#3.1c); and two forms are given as equally correct (#3.1b). Responses where the form has a vocalic suffix (e.g. #3.1d) or where the original consonants have been changed (e.g. #3.1e) are disregarded.

(#3.1) a. CVCɛC
b. CVCɛC and CVCC
c. CVCC

d. CVCC+i
e. /vɛ̃kno/ → [vɛ̃kɛɲ]

Responses with the shape in (#3.1a) receive one point each since they indicate that vowel-zero has been used, while responses with the shape in (#3.1c) receive zero points each since they indicate that vowel-zero has not been used. Responses where both forms are given (as in #3.1b) receive half a point each since they indicate that vowel-zero is optional. To derive the vowel-zero rate per speaker, the total number of points is divided by the total number of relevant responses. Table #3.2 below summarizes the responses and rates of all speakers.

(#3.2) *Overall vowel-zero response rates per speaker*

	TC		**EW**		**KP**		**AC**		**LC**	
	responses	points	responses	points	responses	points	responses	points	responses	points
CVCɛC	165	165	161	161	106	106	53	53	1	1
both	22	11	3	1.5	16	8	7	3.5	0	0
CVCC	125	0	144	0	186	0	249	0	227	0
Total	312	176	308	162.5	308	114	309	56.5	228	1
Rate	**176/312=**	**56.4%**	**162.5/308=**	**52.8%**	**114/308=**	**37.0%**	**56.5/309=**	**18.3%**	**1/228=**	**0.4%**

The table above shows that while all speakers employ vowel-zero, they do not all employ it to the same extent. There is a large range in rate: from 0.4% at the least, to 56.4% at the most. For the moment, we can attribute this to personal preference. However, the analyses discussed in section §3.2 shed light on some possible reasons for these differences between speakers.

Nonetheless, the first method of calculating the vowel-zero rate outlined above does not take into consideration the number of forms used to test each consonant cluster. For instance, if one speaker favours vowel-zero in forms with /tr/ and /dr/ clusters (of which there are 16 in total), his/her overall rate might be substantially higher than another speaker's rate, even if both speakers employ vowel-zero equally in forms with other clusters. Therefore, another way of calculating the rate of vowel-zero is to assign up to one point per cluster type. There are 186 cluster types used in the study. One point is given if all forms with that cluster exhibit vowel-zero, and zero points are given if none of the forms with that cluster exhibit vowel-zero. A decimal value is assigned if only a fraction of the forms with that cluster exhibit vowel-zero. For example, if there are 8 forms with the /sw/ or /zw/ cluster, and two of the forms exhibit vowel-zero, then the *sw/zw* cluster type would receive 0.25 points. The rates for each speaker based on this method of calculation are summarized in (#3.3) below.

(#3.3) *Adjusted vowel-zero response rates per speaker*

Speaker	**Rate**
TC	51.6%
EW	56.1%
KP	45.1%
AC	13.0%
LC	0.7%

This second method can also be used to determine the expected vowel-zero rate based on standard Polish vocabulary. If we assign one point to cluster types that always exhibit vowel-

zero, and 0.5 points to cluster types that may exhibit vowel-zero (depending on the lexeme), we get a rate of 51.9%. If we compare this rate to the individual rates seen in (#3.3) we see that three of the five speakers tested (TC, EW, and KP) exhibit a similar rate, and therefore we can expect that the results for the nonsense forms will parallel standard Polish data.

On the other hand, AC and LC have a substantially lower rate of vowel-zero. This is not surprising since nonsense forms may have been treated the same way as foreign words, which tend to remain faithful to the source language by maintaining their consonant clusters in the standard Polish data. Also note that AC's vowel-zero rate goes down from 18.3% in the method one calculation, to 13.0% in the method two calculation. Recall that if the experiment used more than one form for a given cluster type, it was because that cluster type exhibited variation in the standard Polish data. Therefore, the difference in rate between the two methods tells us that AC tends to use vowel-zero more in clusters that exhibit variation in the standard Polish data, and tends not to use vowel-zero in clusters that are fairly regular in the standard Polish data (even if in standard Polish these clusters regularly do exhibit vowel-zero).

3.2 Linguistic Variables

In this section I explore the effect of various linguistic variables on the use of vowel-zero. The section is divided into six subsections, each focusing on a specific subset of the data relevant to testing specific hypotheses. The questions are as follows:

- Does a rise in sonority between the first and the second consonant in a word-final cluster favour the use of vowel-zero? (§3.2.1)
- Do certain grammatical genders favour vowel-zero while other grammatical genders disfavour vowel-zero? (§3.2.2)

- Does the quality of the vowel immediately preceding the consonant cluster in the stem affect the use of vowel-zero? In particular, what effect does the weak vowel /ɛ/ have? (§3.2.3)
- Does a bisyllabic stem favour vowel-zero (in order to maintain stress on the same syllable throughout the paradigm)? (§3.2.4)
- Does morphological structure of the stem affect vowel-zero? (§3.2.5)
- Is there a difference in vowel-zero rate between consonant clusters with voiced obstruents and those with voiceless obstruents? (§3.2.6)

In exploring each of these questions, I use data from four of the five speakers tested. For the moment, I ignore data from speaker LC since she used vowel-zero only once throughout the experiment. The sections summarize the results of the study as they pertains to the specific linguistic variables. Refer to Appendices D and E to see details of the results. Appendix D presents an overview of the responses given by each speaker. Appendix E presents detailed results for consonant clusters that were tested using multiple nonce forms.

3.2.1 Sonority

Coda consonant clusters of rising sonority are disfavoured according to the Sonority Sequencing Generalization (see §1.2.3). To a certain extent, standard Polish data parallels this tendency as well since most noun stems that exhibit vowel-zero alternations end in a sonorant. Therefore, it is predicted that clusters ending in sonorants are expected to exhibit more vowel-zero alternations than clusters ending in obstruents. If our findings prove this to be true, then it is reasonable to argue that vowel-zero alternations are in fact prosodically-driven epenthesis.

As mentioned throughout this paper, a number of other linguistic variables can play a role in favouring or disfavouring vowel-zero alternations. Therefore, in examining sonority, it is important to minimize these effects so that we can be sure that the difference between forms with *consonant+sonorant* clusters and forms with *consonant+obstruents* cluster is in fact a result of sonority and not some other property of the forms. It is for this reason that I choose to focus my analysis of sonority by comparing Cl clusters to Ct clusters only. Both /l/ and /t/ are coronal, and therefore essentially differ only in manner/sonority. Furthermore, nonsense forms with Cl and Ct clusters used in the experiment were designed so that their stems are monosyllabic, their stem vowels are random, they are marked for masculine gender, and they can only be analyzed as monomorphemic.

Because stems with Cl and Ct clusters can only be analyzed as monomorphemic, the standard Polish data involving these clusters exhibits a very clear pattern. Table #3.4 below summarizes the data for the four speakers under discussion. Here and throughout the paper, the combined shading and symbol in the cell indicate:

+	cluster exhibits vowel-zero
*	mixed/word-specific application of vowel-zero for that cluster
-	cluster does not exhibit vowel-zero

(#3.4) *Vowel-zero in Polish Cl and Ct clusters*

		SECOND CONSONANT	
		l	t
FIRST CONSONANT	p b	+	-
	t d	+	
	k g	*	-
	ts	+	+
	tʂ		*
	tɕ dʑ		
	f v	*	-
	s z	+	-
	ʂ ʐ	+	-
	x	+	-
	ɕ ʑ	-	
	m	-	
	n		-
	ɲ		
	r	-	-
	l	-	-
	j	-	-
	w		-

Cl clusters mainly exhibit vowel-zero alternations when the /l/ is preceded by an obstruent (resulting in rising sonority), but not when the /l/ is preceded by a sonorant (resulting in steady or falling sonority). In contrast, Ct clusters generally do not exhibit vowel-zero alternations. The only exceptions are when /t/ is clustered with another coronal [-continuant] segment, which may be an effect of the Obligatory Contour Principle (OCP). The OCP states that "At the melodic level, adjacent identical elements are prohibited" (Yip 1988:66), and it has been argued to block and trigger phonological rules (cf. McCarthy 1986, and Yip 1988). In the case of Polish Ct clusters, the OCP can be said to trigger epenthesis in order to prevent two adjacent coronal [-continuant] segments from surfacing.

The experiment results from each speaker also follow similar patterns, as the tables below summarize. Here, a plus-or-minus <+/-> on a medium background indicates that both vowel-zero and null responses were given for the same form. A cross <x> on a white background indicates an irrelevant response.

(#3.5) *Vowel-zero in nonce forms with Cl and Ct clusters*

a.

	TC	
	l	t
p b	+	-
t d	+	
k g	*	-
ts	+	-
tʂ	+	-
tɕ		
f v	+	-
s z	+	-
ʂ ʐ	+	-
x	+	-
ɕ ʑ	x	
m	+	-
n		-
ɲ		
r	-	-
l		-
j	+	-
w		-

b.

	EW	
	l	t
p b	+	-
t d	+	
k g	*	-
ts	+	+
tʂ	+	-
tɕ		
f v	+/-	-
s z	-	-
ʂ ʐ	-	+
x	+	-
ɕ ʑ	+	
m	-	-
n		-
ɲ		
r	-	-
l		-
j	+	-
w		-

c.

	KP	
	l	t
p b	+	-
t d	+	
k g	*	-
ts	+	-
tʂ	+	-
tɕ		
f v	+	-
s z	+	-
ʂ ʐ	+	-
x	+	-
ɕ ʑ	+	
m	+/-	+
n		-
ɲ		
r	+/-	-
l		-
j	+	-
w		-

d.

	AC	
	l	t
p b	-	-
t d	+	
k g	-	-
ts	-	-
tʂ	-	-
tɕ		
f v	+	-
s z	-	-
ʂ ʐ	-/+	-
x	-	-
ɕ ʑ	-	
m	-	-
n		-
ɲ		
r	-	-
l		-
j	-	-
w		-

Each speaker exhibits substantially more vowel-zero alternations in Cl clusters than in Ct clusters. In fact, three speakers (TC, EW, KP) extend the application of vowel-zero to some *sonorant+l* clusters—something that is not found in the real world data. All speakers exhibited vowel-zero in at least some *obstruent+l* clusters. When vowel-zero was used in Ct clusters, it was only used with certain *coronal+t* clusters (speaker EW), or with /mt/, a cluster not found in the real world (speaker KP).

3.2.2 Grammatical gender

Grammatical gender of the noun appears to have an effect on the rate of vowel-zero alternations, though not in the way that was initially expected. Recall from §2.1 that for Cr clusters, Laskowski (1975) observed that masculine nouns tend to exhibit vowel-zero (with a rate of approximately 75%), feminine nouns tend not to exhibit vowel-zero (with a rate of

approximately 20%), and neuter nouns (with one exception *dobro* 'good') must exhibit vowel-zero (with a rate of almost 100%).

The results of the present study tell a different story. Table #3.6 below summarizes each speaker's use of vowel-zero in monosyllabic Cr stems. It expresses their use as a fraction of responses with vowel-zero divided by the total number of responses in the category. It then calculates the fraction into a percentage rate.

(#3.6) *Vowel-zero in nonce forms with Cr clusters by grammatical gender*

	Masculine		**Feminine**		**Neuter**	
Speaker	*fraction*	*rate*	*fraction*	*rate*	*fraction*	*rate*
TC	9/18	**50%**	9/18	**50%**	11.5/18	**64%**
EW	8/18	**44%**	10/18	**56%**	12.5/17	**74%**
KP	2.5/18	**14%**	1/18	**6%**	12/18	**67%**
AC	0/18	**0%**	5.5/17	**32%**	7.5/16	**47%**

Based on these results we can conclude that while it is true that neuter nouns favour vowel-zero, it is not true that feminine nouns disfavour vowel-zero. For three of the speakers (TC, EW, and KP), feminine nouns have a rate very similar to that of masculine nouns; while for the remaining speaker (AC), feminine nouns actually favour vowel-zero substantially more than masculine nouns.

Furthermore, it appears that for most speakers, the grammatical gender differences above are not only true for Cr clusters, but also carry over to other consonant clusters. The present experiment also tested masculine versus feminine gender in *sonorant+n* sequences. Table #3.7 below summarizes each speaker's responses to masculine versus feminine *sonorant+n* sequences, and expresses their use of *vowel-zero* as a fraction of total responses before converting it into a percentage rate.

(#3.7) *Vowel-zero in nonce forms with Cn clusters by grammatical gender*

	Masculine		Feminine	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	2/5	**40%**	2.5/5	**50%**
EW	2/5	**40%**	4/5	**80%**
KP	0/5	**0%**	0/5	**0%**
AC	0/5	**0%**	1/5	**20%**

If we compare the responses to *sonorant+n* clusters to the responses to *consonant+r* clusters, certain patterns emerge. In both types of clusters, TC appears to treat masculine and feminine nouns relatively equally. On the other hand, EW and AC clearly favour vowel-zero with feminine nouns. The results for KP are impossible to interpret since she generally disfavours vowel-zero with Cn clusters.

The difference between masculine and feminine is also supported by data which tested masculine versus feminine forms with Ctɛ and Cɲ clusters. The prediction was that these forms could be considered as having suffixes which behave differently depending on the gender of the suffix. Based on this, masculine nouns were expected to exhibit more vowel-zero than feminine nouns. However, this pattern is not supported in the data. The masculine versus feminine patterns established above are better predictors of how individual speakers treat these forms. Table #3.8 below summarizes each speaker's rate of vowel-zero in Ctɛ and Cɲ clusters.

(#3.8) *Vowel-zero in nonce forms with Ctɛ and Cɲ clusters by grammatical gender*

	Masculine		Feminine	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	5/11	**45.4%**	4.5/11	**40.9%**
EW	4/10	**40%**	7/10	**70%**
KP	6.5/7	**92.9%**	0/7	**0%**
AC	1/15	**6.7%**	2/15	**13.3%**

TC still appears to treat masculine and feminine nouns relatively equally. EW and AC still favour vowel-zero with feminine nouns, while this time KP overwhelmingly favours vowel-

zero with masculine nouns. KP's results for these particular clusters mirror the morphological predictions regarding these clusters and are therefore not necessarily due to grammatical gender alone (see §3.2.5).

We can also verify whether the difference between masculine and neuter nouns found in Cr clusters is also found in other cluster types. The present experiment tested masculine versus neuter gender in Cw sequences, and Table #3.9 below summarizes each speaker's responses to Cw stimuli. As with the data for Cn clusters, KP's responses cannot be interpreted since she generally disfavours vowel-zero with Cw clusters, too. However, all other speakers are consistent in favouring vowel-zero with neuter nouns.

(#3.9) *Vowel-zero in forms with Cw clusters by grammatical gender*

	Masculine		**Neuter**	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	3/5	**60%**	5/5	**100%**
EW	1/5	**20%**	2/5	**40%**
KP	0/5	**0%**	0/5	**0%**
AC	0/5	**0%**	4/5	**80%**

3.2.3 Vowel Quality

Further consistencies among speakers can also be seen in the effect of vowel quality on vowel-zero. Recall from §2.1.3, the vowel /ɛ/ immediately preceding the consonant cluster in the stem is expected to have an effect on *vowel-zero*, since [ɛ] is also the quality of the epenthetic vowel. Table #3.10 below summarizes each speaker's rate of *vowel-zero* in Cr clusters when the preceding stem vowel is /a/ versus when the preceding stem vowel is /ɛ/. Table #3.11 summarizes the same information for Cv clusters. In both types of clusters, and for all speakers, nouns with /ɛ/ in the stem disfavour *vowel-zero*.

(#3.10) *Vowel-zero in nonce forms with Cr clusters by stem vowel*

	/a/		/ɛ/	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	25/36	**69.4%**	18.5/36	**51.4%**
EW	21.5/36	**59.7%**	12/36	**33.3%**
KP	9.5/36	**26.4%**	6/36	**16.7%**
AC	10.5/36	**29.2%**	3.5/35	**10.0%**

(#3.11) *Vowel-zero in nonce forms with Cv clusters by stem vowel*

	/a/		/ɛ/	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	2.5/4	**62.5%**	2.5/4	**50%**
EW	3/4	**75%**	3/4	**50%**
KP	1.5/4	**37.5%**	1.5/4	**0%**
AC	3/4	**75%**	3/4	**50%**

Although the results for /a/ versus /ɛ/ seem promising, it is difficult to draw any conclusions about the relative effect of other vowels given the data. For instance, it was found that /tn/ clusters preceded by /ɛ̃/ and /kl/ clusters preceded by /ɨ/ both disprefer vowel-zero (see Appendix E-2 and E-4). However, based on just one response per person, we cannot rule out the possibility that speakers were just making analogies to words they know. Similarly, although all five vowels were tested with *stop+v* clusters, it only amounted to four forms per stem vowel, which is again not enough to base any conclusions on. In general, more research needs to be done and additional data needs to be collected to determine the overall effect of other vowels in the language (see §4.2 for a further discussion).

3.2.4 Stem Length

Based on the results of this study, the effects of stem length appears to be dependent on the speaker. Table #3.12 compares the rate of vowel-zero in monosyllabic versus bisyllabic stems with Cr clusters, while Table #3.13 compares the rate of vowel-zero in monosyllabic versus bisyllabic stems with Cv clusters. It may be important to mention that forms with Cr

clusters are masculine, while forms with Cv clusters are feminine, since gender has been proven to affect vowel-zero as well (§3.2.2).

(#3.12) *Vowel-zero in masculine nonce forms with Cr clusters by stem length*

	Monosyllabic		**Bisyllabic**	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	9/18	**50%**	14/18	**77.8%**
EW	8/18	**44.4%**	3/18	**16.7%**
KP	2.5/18	**13.9%**	0/18	**0%**
AC	0/18	**0%**	1/17	**5.9%**

(#3.13) *Vowel-zero in feminine nonce forms with Cv clusters by stem length*

	Monosyllabic		**Bisyllabic**	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	2.5/4	**62.5%**	4/4	**100%**
EW	3/4	**75%**	2/4	**50%**
KP	1.5/4	**37.5%**	0/4	**0%**
AC	3/4	**75%**	0/4	**0%**

Although not all speakers share the same pattern, they are for the most part consistent within themselves. EW and KP clearly favour vowel-zero with monosyllabic stems. TC on the other hand clearly favours vowel-zero with bisyllabic stems.

At first glance, AC appears to be inconsistent. However, recall that AC very strongly disfavours vowel-zero in masculine nouns, and favours it in feminine nouns. Combine this with the fact that the 5.9% rate for bisyllabic stems with Cr clusters actually represents only one response, it is possible that his rate for masculine monosyllabic vs. masculine bisyllabic is actually equal.

To a lesser extent, /sp/ clusters also tested monosyllabic versus bisyllabic stems. In this case, both AC and EW inserted a vowel in a monosyllabic stem, but not in any of the bisyllabic stems. TC on the other hand inserted a vowel in a bisyllabic stem, but not in any of the monosyllabic stems.

3.2.5 Morphology

As shown in §3.2.2, for most speakers, grammatical gender is better than morphology at predicting vowel-zero in Cw, Ctɛ, Cɲ clusters. In the case of Cw clusters, both masculine and neuter stems had the same potential for bimorphemic analysis, and yet TC, EW, and AC all showed a preference for using vowel-zero with neuter forms. In the case of stems with Ctɛ and Cɲ clusters, it was expected that only masculine stems would exhibit vowel-zero due to the masculine /-ɛɲ/ suffix. However, TC, EW, and AC all preferred to use vowel zero with feminine stems rather than masculine stems. The only speaker whose responses were consistent with a morphological analysis of the stems was KP. In particular note that although it is possible for masculine stems ending in Ctɛ or Cɲ to be monomorphemic and thereby not exhibit vowel-zero, it is clear that KP preferred to analyze such stems as bimorphemic since the majority of her responses to these stems did exhibit vowel-zero.

There is not enough data to determine whether other morphemes such as /-izn+a/, /-izm/, or /-isk+o/ have an effect. Furthermore, we cannot be certain whether it is these particular morphemes that disprefer vowel-zero, or whether it is the quality of the vowel or the quality of the first consonant in the cluster that makes the real difference.

Nonetheless, very common and productive affixes do have an effect for some speakers. Consider Table #3.14 below which summarizes a pattern found in the real language. Since the first consonant in each cluster is a sonorant and the second consonant in each cluster is a stop, words with these clusters should not exhibit vowel-zero if we consider only the sonority scale. However, in the real language, some stems that end in /ts/ and /k/ exhibit vowel-zero, while others do not. This can be explained through the two masculine nominalising suffixes, /-ɛts/ and

/-ɛk/, which can be found in hundreds of Polish nouns. Therefore, it is only those stems which are interpreted as bimorphemic which exhibit vowel-zero. Since there are no suffixes which are composed of /g/ or /t/, stems that end in those consonants have no reason to ever exhibit vowel-zero.

(#3.14) *Vowel-zero with morphemic (ts & k) versus nonmorphemic (g & t) word-final stops*

	ts	k	g	t
n	-	-	-	-
r	-	*	-	-
l	*	*	-	-
j	+	*	-	-
w		*	-	-

Looking at the results from each speaker, three patterns clearly emerge: one where stems ending in /ts/ and /k/ sometimes exhibit vowel-zero (#3.15); one where stems ending in /ts/ and /k/ always exhibit vowel-zero (#3.16); and one where stems ending in /ts/ and /k/ never exhibit vowel-zero (#3.17).

(#3.15) *Word-final stops in nonce words – some morphemic effect*

TC	ts	k	g	t
n	-	+	-	-
r	-	-	-	-
l	+	+	-	-
j	+	+	-	-
w	-	+	-	-

(#3.16) *Word-final stops in nonce words – strong morphemic effect*

EW	ts	k	g	t
n	+	+	-	-
r	+	+	-	-
l	+	+	+	-
j	+	+	-	-
w	+	+	-	-

KP	ts	k	g	t
n	+	+	-	-
r	+	+	-	-
l	+	+	-	-
j	+	+	-	-
w	+	+	-	-

(#3.17) *Word-final stops in nonce-words – no morphemic effect*

AC	ts	k	g	t
n	-	-	-	-
r	-	-	-	-
l	-	-	-	-
j	-	-	-	-
w	-	-	-	-

TC therefore follows the standard Polish pattern quite closely and gives morpheme status to some but not all /ts/ and /k/ segments. EW and KP on the other hand both analyse /ts/ and /k/ to be strongly indicative of morphology. The third possibility is seen in ACs responses. Since the experiment involved nonsense words, without making reference to what these words might mean, AC did not consider /k/ and /ts/ to be morphemes and therefore treated those forms the same way as any other stop consonant.

3.2.6 Voicing

Although this was not originally a variable that was thought to have any effect, after having run the experiment with several speakers it appears that clusters involving obstruents may behave differently depending on whether the obstruent is voiced or voiceless. The most obvious example from this in the data can be seen by comparing forms with Cp and Cb clusters.

(#3.18) *Vowel-zero in words with voiceless (Cp) versus voiced (Cb) clusters*

	/p/		**/b/**	
Speaker	*fraction*	*rate*	*fraction*	*rate*
TC	3.5/14	**25.0%**	6.5/14	**46.4%**
EW	4/14	**28.6%**	7/14	**50.0%**
KP	1/15	**6.7%**	0.5/14	**3.6%**
AC	3/13	**23.1%**	5/13	**38.5%**

Except for KP, who treats both types of clusters relatively equally, all speakers were more likely to exhibit vowel-zero with Cb clusters. There is no evidence in the real language for

why this might be so—there is only one lexeme in each cluster which exhibits vowel-zero—therefore these results are worthy of future study.

3.2.7 Summary of findings

There therefore are a few generalizations that can be made regarding how these linguistic variables affect the use of vowel-zero by the four speakers TC, EW, KP, and AC. Each of these is summarized in (#3.19).

(#3.19) a. *Sonority*
Sonorant-final clusters exhibit more vowel-zero than obstruent-final clusters.

b. *Gender*
Feminine nouns exhibit either more vowel-zero (for EW and AC) or the same amount of vowel-zero (for TC and KP) in comparison to masculine nouns. Neuter nouns exhibit more vowel-zero than Feminine nouns.

c. *Vowel quality*
Consonant clusters that are preceded by [a] exhibit more vowel-zero than consonant clusters that are preceded by [ɛ].

d. *Length*
For most speakers (EW, KP, and AC), monosyllabic stems exhibit more vowel-zero than bisyllabic stems. The direction of the effect is opposite for TC.

e. *Morphology*
More speakers interpret segments as morphemic if the morpheme is more common.

f. Voicing
For most speakers (TC, EW, and AC), clusters ending in voiced obstruents exhibit more vowel-zero than clusters ending in voiceless obstruents. There is no difference between the two clusters for KP.

3.3 Evidence from LC

Finally, I come to discussing LC, the fifth speaker tested for the experiment. LC's results are unusual since she has used vowel-zero only once during the whole experiment. Nonetheless, the fact that she used vowel-zero at all supports the hypothesis that this is in fact a productive process. However, the rarity with which she uses vowel-zero is only part of the reason why she is such an interesting subject for this study. In comparison to the other speakers, who responded

to only a few (9-12) prompts with a form that had a vocalic suffix, LC responded to 94 prompts with a form that had a vocalic suffix. In particular, although all of her responses to prompts for the masculine nominative singular ended in a zero suffix, this was not true of her responses to prompts for the genitive plural of feminine or neuter stems.

Polish has a number of genitive plural allomorphs. The three most common and productive are: /-Ø/, /-i/, and /-uf/. Only nouns ending in a "soft"[5] consonant can be marked with an /-i/ suffix, and this is true regardless of grammatical gender. The other two allomorphs are gender-specific. The zero suffix /-Ø/ can only attach to feminine and neuter nouns. Thus, the genitive plural of the neuter noun *biuro* 'office' must be [biur] and not *[biuruf]. The suffix /-uf/ on the other hand can only attach to masculine nouns. Thus, the genitive plural of the masculine noun *kwiat* 'flower' must be [kfʲatuf] and not *[kfʲat]. This is a regular part of the grammar, and in fact LC performed correctly when asked to inflect real Polish words in the pre-experiment trial. However, during the experiment, many of her feminine and neuter nonce forms exhibited the masculine suffix in the genitive plural.

Using the masculine genitive plural suffix has the result of eliminating the context for vowel-zero—the consonant cluster no longer appears word-finally. Therefore, if a consonant cluster would make a badly formed coda, then adding a vocalic suffix such as /-uf/ at the end or employing vowel-zero by inserting a vowel /ɛ/ between the two segments both achieve the same thing. It is my hypothesis that LC's use of the masculine suffix with feminine and neuter forms is not a mistake, but rather a variant of the vowel-zero process—another way of resolving badly-formed codas.

[5] "Soft" consonants in traditional Polish phonology generally refer to postalveolar segments /tɕ dʑ ɕ ʑ tʂ dʐ ʂ ʐ/ as well as alveolar /ts, dz/ and the sonorants /l, ɲ/. They may also include palatalized labial consonants /pʲ, bʲ, fʲ, vʲ/.

To support this hypothesis I look at two types of evidence. First, if LC uses the masculine suffix in only environments where other speakers would normally use vowel-zero, then this is evidence that she only employs the masculine suffix after consonant clusters that are judged to be problematic by Polish speakers in general. We can see evidence of this being true in her responses to feminine and neuter forms with Cn clusters. The first observation about these responses is that if we divide them into two groups—*obstruent+n* and *sonorant+n*—we find that the majority of the *obstruent+n* clusters have the /-uf/ suffix, while the majority of the *sonorant+n* clusters do not. This follows previous observations that contexts of rising sonority will exhibit more vowel-zero than contexts of steady or falling sonority. Similarly, LC uses the /-uf/ suffix more often in forms with Cb clusters than forms with Cp clusters. Recall from §3.2.6 that most speakers show a similar preference for using vowel-zero with Cb clusters as opposed to Cp clusters. Furthermore, if we compare her responses to *obstruent+n* clusters to the responses from other speakers, we find that her responses follow those of KP exactly. In (#3.19) below, she uses the masculine /-uf/ suffix (marked with <w>) with the same clusters that KP uses vowel-zero with (marked with <+>).

(#3.20)*LC's use of the masculine suffix versus KP's use of vowel-zero*

	KP n	**LC** n
p b	+	w
t d	*	*
k g	+	w
ts	-	-
t̪s	-	-
f v	+	+
s z	-	*
ʂ ʐ	+	w
x	-	-

The second piece of evidence lies in checking whether other speakers at any point used the masculine /-uf/ suffix with feminine or neuter nouns too, and in which contexts they used it in. As it turns out, TC, EW, and AC all used the masculine genitive plural suffix to some extent. Therefore, LC's use of the masculine suffix is only unusual in the extent to which she used it. Nonetheless, what is interesting to note is that the majority of the /-uf/ suffixes used by the three other speakers are used in contexts that are similar to those in which they used vowel-zero. This includes situations of rising sonority and neuter forms in particular. Also, whenever a response with the /-uf/ suffix was listed alongside another possible response to the same nonce form, only 8 of those responses did not exhibit vowel-zero, while 14 of the responses did.

Therefore, because responses with the /-uf/ suffix are found in environments similar to those where we find vowel-zero, we can conclude that both processes are used to resolve unacceptable codas. LC appears to strongly prefer to keep the stem of the nonce form faithful, which is perhaps why she steers away from the vowel-zero alternation in preference for the masculine suffix.

4.0 DISCUSSION

In the present section, I discuss some of the conclusions that can be drawn from the results outlined above. I first present a summary of the relative weight of the linguistic variables examined in the study (§4.1). The purpose of this summary is to be able to compare the relative strength of these factors for each of the speakers. Next I discuss the implications that these results have on understanding the Polish lexicon (§4.2). In particular I look at how the results of the study can help interpret the patterns found in the real world. Finally I conclude by pointing out the direction for future research suggested by these results (§4.3).

4.1 Relative significance of linguistic factors

In the previous section (§3), we saw that a variety of different linguistic variables exhibited trends in relation to vowel-zero. However, at this point we cannot tell which factors are most important, and whether they are equally important for all speakers. Being able to rank factors in order of significance is useful for understanding the grammar of vowel-zero and for determining whether this grammar is the same among speakers. In order to get at this type of information, we can compare the rates of vowel-zero for two variants of a linguistic variable to determine whether they are significantly different from each other.

R statistical software was used to create 2x2 contingency tables for each linguistic variable per speaker. The rows indicated the linguistic variants, while the two columns indicated the number of responses with a vowel and the number of responses without a vowel. The values in the tables were then multiplied by 2 in order to eliminate decimal values. Subsequently, Pearson's chi-squared test with Yates' continuity correction was performed on each data set to determine the p-value, which is interpreted as an indication of significance.

The table below summarizes the data that went into each equation, along with the chi-squared value and p-value given in the output.

(#4.1)

	TC		**EW**		**KP**		**AC**	
Sonority	V	Ø	V	Ø	V	Ø	V	Ø
/l/	13.5	1.5	10.5	5.5	14	2	2.5	13.5
/t/	0	14	2	12	1	13	0	14
χ^2	43.601		14.151		35.424		2.946	
p	**<0.00001**		**0.00017**		**<0.00001**		**0.08607**	
Gender *(Cr + Cn)*	V	Ø	V	Ø	V	Ø	V	Ø
masculine	11	12	10	13	2.5	20.5	0	23
feminine	11.5	11.5	14	9	1	22	6.5	15.5
χ^2	0		2.135		0.619		13.585	
p	**1**		**0.144**		**0.4316**		**0.00023**	
Gender *(Cr + Cw)*	V	Ø	V	Ø	V	Ø	V	Ø
masculine	12	11	9	14	2.5	20.5	0	23
neuter	16.5	6.5	14.5	7.5	12	11	11.5	9.5
χ^2	2.951		5.435		16.315		31.326	
p	**0.0858**		**0.01974**		**0.00005**		**<0.00001**	
Vowel *(Cr + Cv)*	V	Ø	V	Ø	V	Ø	V	Ø
/a/	27.5	12.5	24.5	15.5	11	29	13.5	26.5
/ɛ/	20.5	19.5	14	26	6	34	5.5	33.5
χ^2	4.401		10.014		3.025		7.214	
p	**0.03592**		**0.00155**		**0.08198**		**0.00734**	
Length *(Cr + Cv)*	V	Ø	V	Ø	V	Ø	V	Ø
monosyllabic	11.5	10.5	11	11	4	18	3	19
bisyllabic	18	4	5	17	1.5	20.5	1	20
χ^2	7.406		5.942		1.662		1.092	
p	**0.0065**		**0.01478**		**0.1973**		**0.2961**	
Voicing	V	Ø	V	Ø	V	Ø	V	Ø
/p/	3.5	10.5	4	10	1	14	3	10
/b/	6.5	7.5	7	7	0	13.5	5	8
χ^2	1.944		1.872		0.004		0.8125	
p	**0.1632**		**0.1713**		**0.9511**		**0.3674**	
Morphology	V	Ø	V	Ø	V	Ø	V	Ø
morphemic	11	10	14	6	16.5	0.5	1	24
non-morphemic	4.5	16.5	8	12	0	17	2	23
χ^2	7.362		6.111		60.287		0.1773	
p	**0.00666**		**0.01343**		**<0.00001**		**0.6737**	

If we list the variables from most significant to least significant for each speaker, we find the rankings summarized in Table (#4.2). Significant effects are considered to be those with $p<0.05$, while strongly significant effects are considered to be those with $p<0.01$. In the table below, variables listed below a double line indicate a non-significant effect. Variables listed above a single line indicate a strongly significant effect. (A triple line indicates a single line and a double line combined.)

(#4.2)

TC	EW	KP	AC
sonority	sonority	morphology	gender: m/n
length	vowel	sonority	gender: m/f
morphology	morphology	gender: m/n	vowel
vowel	length	vowel	sonority
gender: m/n	gender: m/n	length	length
voicing	gender: m/f	voicing	voicing
gender: m/f	voicing	gender: m/f	morphology

While at first glance it may appear that the rankings of factors for all the speakers are different, upon further inspection we can see that some generalizations can be made. Sonority appears to be the most significant variable across speakers: three out of four speakers consider it to be strongly significant. The second variable with a strong effect is neuter gender: it is significant for three speakers, and is in fact strongly significant for two of these three speakers.

The other variables listed above are both weaker and less widespread among the speakers. Notably, voicing was found to be non-significant for all four speakers. Also notable is the fact that feminine gender is strongly significant for AC, and yet is non-significant for the other three speakers. With respect to variables that are only significant for a small portion of the speakers, it is possible that these linguistic variables are indicative of social factors that only some speakers share (see §4.3 for discussion).

4.2 Implications of results on the Polish lexicon

The observations above have some strong implications for interpreting real world data. The strong significance of sonority in nonce words, coupled with the sonority-based patterns in real words, suggest that speakers are learning phonological rules regarding the environment of vowel-zero. Barring any special considerations, coda clusters of rising sonority will have vowel-zero, while coda clusters of falling sonority will not. Words that exhibit otherwise are therefore memorized exceptions.

One type of exception may stem from the "foreignness" of the word. This is supported by numerous foreign—especially rarely used—borrowings in Polish, which have coda clusters of rising sonority that remain faithful. For instance, common words that end in /tl/ clusters, such as the word <butla> 'bottle' ([butla] nom.sg.~[butɛl] gen.pl.), often exhibit vowel-zero. Words with /tl/ clusters which do not exhibit vowel-zero, such as the word <pejotl> 'peyote' ([pɛjotl] nom.sg.~[pɛjotla] gen.sg.), are rare and often scientific. The results from AC also support the "foreignness" hypothesis. Since nonce words by definition are rarely used, when speakers first encounter such words, they may automatically class them together with other rare, scientific, foreign words and consequently avoid using vowel-zero.

Another type of exception may stem from the morphological analysis of the stem. If a stem is thought to contain a suffix which regularly exhibits vowel-zero, then the speaker will produce vowel-zero even in cases of a coda cluster of falling sonority. If on the other hand the stem is thought to contain a suffix or morpheme which regularly does not exhibit vowel-zero, then the speaker will not produce vowel-zero even in cases of a coda cluster of rising sonority. During the experiment for this study, this tendency was particularly true for very common

morphemes. This is not surprising since more common and productive morphemes are more readily available in our minds; an unfamiliar form is more likely to be interpreted as having a common morpheme than an uncommon one. /-ɛk/ and /-ɛts/ are much more common morphemes than /-ɛtɕ/ or /-ɛɲ/. This would explain why three speakers appeared to assign morpheme status to stem-final /k/ and /ts/, but only one speaker appeared to assign morpheme status to stem-final /tɕ/ and /ɲ/.

After sonority and morphology, grammatical gender proved to also influence vowel-zero. This in itself was not surprising since the reason for studying this factor in the first place resulted from Laskowski's (1975) observations about the different rates of vowel-zero in forms of various genders with Cr clusters. However, what is surprising about the findings is that gender affected vowel-zero in not only Cr clusters, but also in other types of clusters such as Cn, Ctɕ, and Cɲ. Furthermore, the rate of vowel-zero for each gender did not always match the rates given by Laskowski for the Polish lexicon. Laskowski stated that feminine nouns will exhibit vowel-zero least often. However, the results of this experiment show that feminine forms either were equally likely as masculine forms to exhibit vowel-zero (as was the case for TC and KP), or they exhibited vowel-zero more often than masculine forms (as was the case for EW and AC). In vowel-zero, a vowel appears in the genitive plural of feminine and neuter nouns, whereas in masculine nouns a vowel appears in the nominative singular. Therefore, if for some speakers the data from feminine and neuter forms pattern together, it may also be possible to conclude that for these speakers vowel-zero is dependent on case. Specifically, genitive plural case prefers vowel-zero, while nominative singular case disprefers vowel-zero.

Aside from the three factors discussed above—sonority, morphology, and grammatical gender—no other factors proved to be significant for the majority of speakers. It is possible,

however, that after testing more speakers sociolinguistic trends involving these factors may emerge. For instance, in comparing monosyllabic stems with bisyllabic stems, TC preferred to use vowel-zero with bisyllabic stems while EW, KP, and AC all preferred to use it with monosyllabic stems. Because TC is at least 20 years older than the other three speakers, this may be an indication of age differences. On the other hand, these individual differences could simply indicate the different possible ways speakers can make sense of and find patterns in a very variable input.

4.3 Directions for future research

The results of this study raise many questions which would benefit from further research. As mentioned in the previous section, further research needs to be done with more speakers in order to determine whether social factors have an effect. In particular, speakers should be controlled for age, gender, and region for origin. Furthermore, at least two speakers should be tested for each combination of social factors (e.g. two young females from Warsaw) in order to ensure that the results are not simply indicative of the idiosyncrasies of just one speaker.

In addition, more forms should be used to test various linguistic factors. For instance, the results for grammatical gender and stem length—with only 22-23 forms per factor—would benefit from more tokens for better statistical strength. Similarly, forms with a variety of consonant cluster types should be used to test each factor. For instance, it was only possible to test sonority by comparing forms with Cl and Ct clusters. To get a better picture of sonority, comparable forms (i.e. forms that also have the same number of syllables, the same gender, etc.) ending in other consonant clusters (for instance Cn or Cs) should be tested. Likewise, to

determine whether voicing is a significant factor, comparisons of voiced versus voiceless should be done with clusters beyond Cp and Cb.

Finally, additional factors within each factor group can be tested. In particular, the present study got a lot of results for forms with /ɛ/ versus /a/ in the stem vowel. However, not much information was collected regarding other vowels. It would be very promising to in particular test /i/ or /ɨ/ as the stem vowel. The two vowels can be considered as allophones of each other, and their realization often depends on the preceding consonant. Many of the morphemes which reportedly never exhibit vowel-zero are composed of /i/ or /ɨ/ plus a consonant cluster. This includes words in the Polish lexicon that end in the suffixes: /-isko/, /-izn/, /-izm/, and /mɨsw/. These are in contrast to other words with /sk/, /zn/, /zm/ and /sw/ clusters which do exhibit vowel-zero. Furthermore, many other lexemes, such as <cykl> and <pisk>, which unlike other words with the same final cluster do not exhibit vowel-zero, also have /i/ or /ɨ/ in the stem.

Aside from adjusting the types of forms used in the nonce experiment, it would also be useful to perform different types of tests. For instance, many of the forms used in the present experiment were designed to resemble words with particular morphemes. It would therefore be useful to better get at whether the speakers really did interpret these forms as being composed of these particular morphemes. Asking speakers to speculate on the possible meaning of nonce forms can help achieve that. If, for example, a speaker speculates that a word ending in /k/ has the diminutive meaning then it is safe to assume that the speaker is interpreting /k/ as the diminutive morpheme. If a speaker speculates that a feminine word ending in /ɲ/ could be the name of a place, then it is safe to assume that the speaker is interpreting /ɲ/ as the place name morpheme.

Additionally, two other types of tests would be helpful. The present experiment tests speakers' production; another option is to test speakers' perception. When given two optional responses—one which exhibits vowel-zero and one which does not—will speakers judge both as equally grammatical or will they choose one to be more grammatical than the other. This type of test allows us to better get at the collective grammar of Polish since it indicates what speakers expect to hear from other Polish speakers as opposed to what they personally say.

Finally, additional research needs to be done on the variation in the Polish lexicon. In particular, it is important to determine whether the claims made in dictionaries and grammar books regarding certain lexemes hold true for speakers in life. For instance, when faced with the nonce form *żykwa* /ʐɨkva/ speaker KP replied: "I think it's six /ʐɨkv/ because it sounds like *brzytwa* /bʐɨtva/ and you say six *brzytw* /bʐɨtv/". However, dictionaries say that this word does exhibit vowel-zero and should be *brzytew* /bʐɨtɛv/. Not surprisingly, dictionaries do not reflect common usage. A test which presents speakers with real words and asks them to conjugate them with a zero suffix would therefore be very revealing.

5.0 CONCLUSION

In conclusion, the results of this experiment show that vowel-zero cannot be a purely lexically-driven process. First of all, when faced with nonce forms, all speakers apply vowel-zero even when no input suggests that it should be so. Furthermore, vowel-zero is not applied at random. It has been demonstrated that there are clear trends regarding the types of environments where vowel-zero is likely to occur, and the types of environments where it is not.

The primary linguistic factor that appears to constrain vowel-zero is sonority. Sonority was shown to be significant, in fact most significant, for three out of four speakers: TC, EW, and KP. Furthermore, LC's results show a similar pattern with respect to the environments where she chose to use the masculine genitive plural suffix /-uf/ with feminine and neuter nouns rather than the more grammatically appropriate feminine and neuter genitive plural zero suffix. Overall, these results suggest that vowel-zero is used as a strategy to avoid badly-formed coda clusters, which makes this process similar to other processes of epenthesis found in the world's languages.

Appendix A: Polish consonant clusters

The chart below gives an overview of all the final consonant clusters found in Polish lexemes. It indicates which clusters behave regularly (marked with "+" or "-"), and which behave irregularly (marked with "*"). The first consonant in the cluster is listed from lowest sonority at the top, to highest sonority at the bottom. The second consonant in the cluster is listed from highest sonority on the left, to lowest sonority on the right. The high concentration of vowel-zero in the top-left corner indicates that vowel-zero is predominantly found in coda clusters of rising sonority.

SECOND CONSONANT

FIRST CONSONANT

	w	j	l	r	ɲ (m)	ɲ (f)	n	m	ɕ ʑ	x	ʂ ʐ	s z	f v	tɕ (m)	tɕ (f)	tʂ dʐ	ts (m)	ts (f/n)	k	g	t d	p	b
p b	+		+	*	*		+				-	-		+	-		+		+		-		
t d	+		+	*	+		-	-			-		*				+		+				
k g	+		*	*	+		+	-			-	-	*	+							-		
ts dz		+	+																*		+	-	
tʂ dʐ					+			-											+		*		-
tɕ	+				+		+	*									+		+				
f v	+		*	*		-	*								-			-	+		-		
s z	*		+				*	*		-			-					-	*	-	-	*	-
ʂ ʐ	+		+		+		+	*		-			+			-	+			-	-		-
x	+		+				+	-					*	+							-		
ɕ ʑ	+		-		+	-	+	-						-	-		+		+				-
m			-	*	-		*			-	*	-	-		-				+			-	-
n							-			-	-	-	-			-	-		-	-	-		
ɲ							+								-	-	+	-	+				-
r	+		-		+	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
l			-			-		-		-	-	-	-				*		*	-	-	-	-
j	-		-	+		-	*	*		-	-	-	-			-	+	-	*	-	-	-	-
w	-					-	*	-		-	-	-	-	+	-	-			*	-	-	-	-

[-cons] [+son, -nas] [+son, +nas] [-son, +cont] [-son, -cont]

+	lexemes exhibit vowel-zero
-	lexemes do not exhibit vowel-zero
*	some lexemes exhibit vowel-zero, other lexemes do not
	no lexeme with this cluster exists

Appendix B: Detailed overview of consonant clusters tested during the experiment

In the following sub-sections, I outline in greater detail all the coda consonant clusters tested. For each consonant cluster, I provide the background on how the cluster behaves in real Polish lexemes; I then outline the particular types of nonce forms created for the present experiment, mentioning specifically the relevant linguistic factors; and finally I predict how speakers will respond to these nonce forms. In each case, I show that the way a cluster behaves in real lexemes motivates the creation of these nonce forms and is reflected in the predictions.

B.1 Cw

Background

In general, lexemes with *consonant+w* clusters, such as *miotła* [mʲɔtwa] 'broom', tend to exhibit vowel-zero. A few lexemes with *sonorant+w* clusters form the exception; for instance *pójło* [pujwɔ] 'drink for animals, nom. sg.' ends in a consonant cluster in the genitive plural [pujw]. Additionally, lexemes that are comprised of the /-mɨsw/ masculine morpheme (e.g. *przemysł* 'industry' and *pomysł* 'idea') and the related /-mʲɔsw/ neuter morpheme (e.g. *rzemiosło* 'craft') do not exhibit *vowel-zero* either.

Tests

For the current study, I focus on the behaviour of /sw/ clusters in the masculine and neuter morphemes. To test whether the grammar of *vowel-zero* will be affected by morphological factors, I created forms that look like they might be composed of one of the morphemes and compared them to forms that have a different shape. These forms were meant to test whether forms similar to the suffix would also pattern with the suffix by not exhibiting *vowel-zero*. If so, which aspect of the morpheme form is most important: the vowel or the consonants? In addition, because the test involved syllabic morphemes that had to be preceded by additional segments, all forms were based on bisyllabic stems.

Appendix B: Detailed overview of consonant clusters tested during the experiment

There were five masculine forms: (1) included the /-mɨsw/ suffix <kamysł>; (2) altered the suffix by changing the vowel into /a/ <namasł>; (3) altered the suffix by changing the consonant into /z/ <numyzł>; (4) altered the suffix by changing the vowel and consonant <bykazł>; and (5) ended in /tw/, a cluster that has dozens of exemplars and, unlike /sw/, is constant in exhibiting *vowel-zero* in the real language.

There were also five neuter forms: (1) included the /-mʲɔsw/ suffix <numiosł>; (2) altered the suffix by changing the vowel into /a/ <kumasł>; (3) altered the suffix by changing the consonant into /z/ <kamiozł>; (4) altered the suffix by changing the vowel and consonant <nabazł>>; and (5) ended in /tw/.

Predictions

It is predicted that nonce forms with /tw/ clusters will exhibit vowel-zero. Forms ending in /-azw/, which have a different vowel and consonant from the morpheme, are also predicted to exhibit vowel-zero. Forms with the same shape as the morpheme, and forms that only differ from the morpheme in one segment are expected to lack *vowel-zero* or perhaps exhibit variability.

B.2 Cl

Background

Except for some borrowed forms such as *cykl* [tsɨkl] 'cycle' and its derivatives, Polish nouns with *obstruent+l* clusters exhibit vowel-zero. On the other hand, no *sonorant+l* clusters exhibit vowel-zero.

Appendix B: Detailed overview of consonant clusters tested during the experiment

Tests

All *obstruent+l* clusters were tested, and all *sonorant+l* clusters found in the real language were tested. All forms used were marked for masculine gender, since this is also the predominant gender of forms with *consonant+l* clusters in the real language. Additional tests were done on /kl/ clusters to determine whether similarity to the borrowing *cykl* 'cycle' had an effect on the presence of vowel-zero. Four forms were created: (1) one form that has the same vowel and consonant as the borrowing <dzykl>; (2) one that has a different vowel but the same consonant <gakl>; (3) one that has the same vowel but a different consonant <pygl>; and (4) one that has both a different vowel and a different consonant <chagl>.

Predictions

It is predicted that forms with *obstruent+l* clusters will exhibit vowel-zero, while *sonorant+l* clusters will not exhibit vowel-zero. However, one form, <dzykl>, might not exhibit vowel-zero through analogy to the real word *cykl*.

B.3 Cr

Background

Vowel-zero alternations in words with *consonant+r* clusters exhibit no discernible pattern. Although they appear to be very lexeme dependent, Laskowski (1975) did observe that masculine nouns tend to exhibit vowel-zero, feminine nouns tend not to exhibit vowel-zero, while neuter nouns always exhibit vowel-zero. Out of the nouns he looked at, 75% of masculine nouns had vowel-zero, only 20% of feminine nouns had vowel-zero, while almost 100% of neuter nouns had vowel-zero.

Appendix B: Detailed overview of consonant clusters tested during the experiment

Tests

The experiment tested forms with all *consonant+r* clusters found in Polish: /pr/, /br/, /tr/, /dr/, /kr/, /gr/, /fr/, /vr/, and /mr/. Additional tests were done to determine whether three linguistic variables—grammatical gender, stem vowel quality, stem length—affect the likelihood of vowel-zero. Each cluster appeared in eight forms. Four of the forms had masculine gender, two were feminine, and two were neuter. The feminine and neuter forms were all monosyllabic; however, out of the four masculine forms, only two were monosyllabic, while the other two were bisyllabic. Therefore, there were four pairs of forms based on grammatical gender and stem length combinations. Each pair of forms had one form where the stem vowel preceding the consonant cluster was /ɛ/, and one form where the stem vowel preceding the consonant cluster was /a/.

Predictions

The motivation for testing grammatical gender with each type of consonant cluster was due to Laskowski's (1975) observation outlined above. Therefore, the prediction is that feminine forms will exhibit vowel-zero the least, while neuter forms will exhibit vowel-zero the most. On the other hand, the Polish stress pattern was the motivation for testing stem length. Stress in Polish appears on the penultimate syllable. Therefore, if a bisyllabic stem was to lose its vocalic suffix, the stress would shift from the second syllable to the first (#2.2a). Bisyllabic stems that exhibit vowel-zero would not be affected by this stress shift (#2.2b), nor would monosyllabic stems (#2.1c-d).

(#2.2) a. CVCV́CC+a → CV́CVCC
b. CVCV́CC+a → CVCV́CɛC
c. CV́CC+a → CV́CC
d. CV́CC+a → CV́CɛC

Finally, stem vowel quality was tested to determine whether the vowel /ɛ/ in the stem might have an effect. As an epenthetic vowel in this language, /ɛ/ is therefore considered to be a light or unmarked vowel. Its status as a light vowel may perhaps attract vowel-zero in order to give certain "weight" to the word it appears in. Alternatively, /ɛ/ in the stem might resist vowel-zero because the grammar wants to avoid having two light vowels or two vowels of the same quality in a row.

B.4 Cɲ

Background

Stems that end in /ɲ/ behave differently depending on if they are masculine or feminine. The suffix /-ɛɲ/ (which takes part in vowel-zero) is a common masculine nominalizing suffix. It can be found in words such as *dureń* [durɛɲ] 'a stupid person', which is derived from the adjective *durny* [durnɨ] 'stupid, masc.sg.'. On the other hand, /-ɲ/ (which does not take part in vowel-zero) is a feminine suffix that denotes a place name. It can be found in words such as *kawiarnia* [kavʲarɲa] 'café', which is derived from the noun *kawa* [kava] 'coffee'. Furthermore, feminine nouns ending in /ɛɲ/ and /ʑɲ/ sequences exhibit an irregular inflectional paradigm. Whereas most feminine nouns take /-a/ as their nominative singular suffix and zero as their genitive plural suffix, these nouns have a zero nominative singular suffix and take /-i/ as their genitive plural the suffix.

Tests

All consonant clusters were tested, except for /tɛɲ/, /sɲ/,/nɲ/ and /ɲɲ/, which were deemed to be phonotactically impossible. These clusters were all embedded in masculine forms,

however only *sonorant+ɲ* clusters were embedded in feminine forms since few *obstruent+ɲ* clusters exist in real feminine nouns.

Predictions

Overall, masculine forms are predicted to exhibit vowel-zero, while feminine nouns are predicted to not exhibit vowel-zero.

B.5 Cn

Background

There is no clear-cut pattern with *consonant+n* clusters in Polish lexemes. Nonetheless, there is a tendency for *obstruent+n* clusters to exhibit *vowel-zero*, while *sonorant+n* clusters do not. There are only two exceptions to *vowel-zero* in *obstruent+n* clusters. There are only two words in Polish that end in the /tn/ cluster (/pʲɛ̃tnɔ/ 'birthmark, nom.sg.' and /tɛ̃tnɔ/ 'pulse, nom.sg.'), and neither of these words exhibits *vowel-zero* (/pʲɛ̃tn/ 'gen.sg.' and /tɛ̃tn/ 'gen.sg.'). Also, there are several words in Polish that end in the /zn/ cluster, and when this cluster comprises the /-izn+a/ suffix, the word does not exhibit *vowel-zero* either.

Finally, there seems to be a gender-based trend regarding *vowel-zero* alternations in *sonorant+n* clusters. Masculine nouns with these clusters do not exhibit *vowel-zero* (e.g *kombajn* 'combine harvester'). On the other hand, 7 out of 10 feminine and neuter nouns with these clusters at least optionally exhibit *vowel-zero* (e.g *wojna* 'war, nom.sg.' ~ *wojen* 'gen.pl').

Tests

All clusters except /nn/ /ɲn/ /tɕn/ /ɕn/ were tested, since the consonants in these particular clusters are neutralized and therefore would be indistinguishable from other clusters on the

surface. All forms with *obstruent+n* clusters had neuter gender (since most Polish words with these clusters are also neuter), and additional tests were done on /tn/ and /zn/ clusters.

Since there are only two Polish words with the /tn/ cluster, and they are both so similar to each other, it is important to determine whether words with /tn/ or /dn/ clusters in general will not exhibit vowel-zero or whether it is something particular about the form of those two lexemes that disprefers vowel-zero. Note that the stems of both lexemes are monosyllabic and end in the same three segments /ɛ̃tn/. The experiment used five forms to test which aspect of these lexemes is most important for the grammar of *vowel-zero*: (1) one form is nearly identical to the two Polish lexemes <fętno>; (2) one alters the stem vowel from /ɛ̃/ to /a/ <ciatno>; (3) one alters the length of the stem from monosyllabic to bisyllabic <sozętno>; (4) one alters the voicing feature of the first consonant in the cluster from /t/ to /d/ <gędno>; and (5) one alters the place of articulation feature of the first consonant in the cluster from /t/ to /k/ <wękno>.

Additional tests were also done for /zn/ clusters, which have morphological exceptions. The experiment used five forms to test whether similarity to the morpheme /-izn+a/ would affect vowel-zero: (1) <ciubizna> is most similar to Polish lexemes that have the morpheme; (2) <lizna> is monosyllabic and therefore is unlikely to be bimorphemic; (3) <dygazna> alters the vowel of the suffix from /i/ to /a/; (4) <jefisna> alters the consonant of the suffix from /z/ to /s/; and (5) <żogizno> alters the gender marker on the suffix from the feminine /-a/ to the neuter /-o/.

Finally, each *sonorant+n* cluster had two corresponding forms, one masculine and one feminine, in order to test for gender effects.

Predictions

It is predicted that with *sonorant+n* clusters, masculine forms will not exhibit vowel-zero while some feminine forms will. Also, forms with *obstruent+n* clusters will exhibit *vowel-zero*, except for some /tn/ and /zn/ clusters.

B.7 Cm

Background

Nouns with *consonant+m* clusters generally do not exhibit *vowel-zero* (e.g. [kartʂma] 'tavern, nom.sg.' ~ [kartʂm] 'gen.pl.'. There are only a few exceptions to this. Three lexemes ([ɛɛdɛm] 'seven', [ɔɕɛm] 'eight', [najɛm] 'lease'), two of which are numerals, must exhibit *vowel-zero*. Furthermore, four lexemes are variable with respect to *vowel-zero*, meaning they are considered acceptable whether or not they exhibit *vowel-zero* (e.g. *zaćma* [zatɕma] 'eclipse, nom.sg.' can be expressed as [zatɕm] or [zatɕɛm] in the genitive plural). Nonetheless, one group of lexemes which can never exhibit vowel-zero is composed of lexemes that end in the /-ɨzm/ 'ism' suffix.

Tests

All forms with the Cm cluster used in this experiment had a masculine gender. The experiment only tested clusters which are found in one or more lexemes in the real language, and the first consonant in the cluster included both voiced and voiceless counterparts of the palatal obstruents /tɕ dʑ ɕ ʑ/.

Additional forms with /zm/ clusters were used to test whether forms which might be interpreted as having the 'ism' suffix behave differently from forms which may not be interpreted as having that suffix. To that effect, three forms were used: (1) one form that could

be interpreted as having the suffix <deszyzm>; (2) one that could not be interpreted as having the suffix because it is monosyllabic <wizm>; and (3) one that could not be interpreted as having the suffix because the vowel is /a/ rather than /i/ <bowazm>.

Predictions

Though it would not be surprising to find a few random instances of *vowel-zero*, it is predicted that forms with Cm clusters will overwhelmingly not exhibit the alternation.

B.7 Cę/Czą

Background

All but one lexeme with a Cę and Czą cluster fail to exhibit *vowel-zero*. The one exception is *komża* [kɔmzą] 'robe, nom.sg.' which variably exhibits vowel-zero (i.e. both [kɔmzⱡ] and [kɔmɛzⱡ] are acceptable genitive plural variants). This exception is in contrast to another word with the mzⱡ/mę cluster—*zamsz* [zamę] 'velvet', which never exhibits vowel-zero.

Tests

Only /mzⱡ/ and /mę/ clusters were tested to determine which aspect of the difference between *komża* and *zamsz* makes the first more likely to have vowel-zero. Four forms—two feminine and two masculine—tested their differences. One feminine <chamża> and one masculine <gamże> form had a voiced obstruent follow the /m/, while one feminine <kamsza> and one masculine <czamsze> form had a voiceless obstruent follow the /m/.

Predictions

Because other Cę and Czą clusters do not exhibit vowel-zero, I do not expect any of the four forms tested to exhibit it either. This will prove that *komża* is a memorized exception.

Appendix B: Detailed overview of consonant clusters tested during the experiment

B.8 Cf/Cv

Background

Polish lexemes with *sonorant+f* or *sonorant+v* clusters, such as *bulwa* [bulva] 'tuber, nom.sg.' which becomes [bulv] 'gen.pl', never exhibit vowel-zero. With *obstruent+f* and *obstruent+v* clusters, on the other hand, vowel-zero is lexically dependent. For instance, *kotwa* [kɔtfa] 'anchor' obligatorily exhibits vowel-zero (c.f. [kɔtɛf] 'gen.pl.'); *płetwa* [pwɛtfa] 'fin' obligatorily does not exhibit vowel-zero (c.f. [pwɛtf] 'gen.pl.'); whereas *bitwa* [bitfa] 'battle' optionally exhibits vowel-zero (c.f. [bitf] and [bitɛf] 'gen.pl.').

Tests

All Cv and Cf clusters that occur in Polish lexemes were tested in the experiment. This includes: /tv/, /dv/, /kv/, /gv/, /zv/, /ʂv/, /ʐv/, /xv/, /mf/, /nv/, /rv/, /lv/, and /wv/.

Since *stop+v* clusters exhibit the greatest lexical variation, additional tests were performed to determine if linguistic factors influence vowel-zero with these factors in particular. Each cluster appeared in six forms: one form was bisyllabic and the remaining five forms were monosyllabic. Bisyllabic stems had /a/ precede the consonant cluster, while each of the monosyllabic stems had a different vowel in the stem.

Predictions

It is predicted that forms with *sonorant+v* and *sonorant+f* clusters will not exhibit vowel-zero. On the other hand, *obstruent+v* clusters are expected to be highly variable, and to perhaps exhibit the same trends regarding stem length and stem vowel quality as forms with Cr clusters (see §B.3 above).

Appendix B: Detailed overview of consonant clusters tested during the experiment

B.9 Ctɕ

Background

Just as with Cɲ clusters (§B.4), stems that end in /tɕ/ behave differently depending on if they are masculine or feminine. Masculine nouns, particularly those that end in *obstruent+tɕ* clusters, tend to exhibit vowel-zero. For instance, *paznokieć* [paznɔkʲɛtɕ] 'fingernail, nom.sg.' becomes [paznɔktɕɛ] in the plural. On the other hand, all feminine nouns which end in *obstruent+tɕ* clusters are composed of the feminine diminutive suffix /-tɕ/ and do not exhibit vowel-zero. For many nouns which end in *sonorant+tɕ* cluster, /tɕ/ is not interpreted as a suffix. Furthermore, feminine nouns ending in /ɕtɕ/ /rtɕ/ and /wtɕ/ sequences exhibit an irregular inflectional paradigm. Whereas most feminine nouns take /-a/ as their nominative singular suffix and zero as their genitive plural suffix, these nouns have a zero nominative singular suffix and take /-i/ as their genitive plural the suffix.

Tests

All clusters, except those where /tɕ/ is preceded by another coronal segment, were deemed phonotactically possible and were therefore tested. Each cluster had a masculine and a feminine form.

Predictions

It is predicted that feminine forms will not exhibit vowel-zero, while most masculine forms will. The only masculine forms which might not exhibit vowel-zero are those with *sonorant+tɕ* clusters.

Appendix B: Detailed overview of consonant clusters tested during the experiment

B.10 Cts

Background

There are a few feminine and neuter lexemes with *consonant+ts* clusters in Polish, and these never exhibit vowel-zero. On the other hand, masculine lexemes with *consonant+ts* clusters predominantly do exhibit vowel-zero. For instance, the neuter word *lejce* [lɛjtsɛ] 'reins' becomes [lɛjts] 'gen.pl.' and feminine *trójca* [trujtsa] 'trinity' becomes [trujts] 'gen.pl.'. However, masculine *kojec* [kɔjɛts] 'animal pen, nom.sg.' alternates with [kɔjtsɛ] 'nom.pl'. This is because /-ɛts/ is a masculine nominalising morpheme that always exhibits vowel-zero, and most masculine lexemes with *consonant+ts* clusters are composed of this morpheme. Nonetheless, a few masculine lexemes that do not exhibit vowel-zero can be found in Polish. A few of these end in /vts/ clusters, while the rest end in *sonorant+ts* clusters. It is important to note that most of the lexemes that end in *sonorant+ts* clusters are borrowings from other languages.

Tests

The experiment tested only masculine forms, since that is where most of the variation exists. All clusters were tested except for /kts/, which is judged to be phonotactically impossible.

Predictions

It is predicted that most of the responses to these forms will exhibit vowel-zero. Those that do not are expected to have a sonorant precede the final /ts/.

B.11 Ck/Cg

Background

There are several lexemes with *consonant+g* clusters in Polish, and these never exhibit vowel-zero. On the other hand, many lexemes with *consonant+k* clusters do exhibit vowel-zero. Similarly to the situation described for Cts in §B.10 above, one of the reasons why Ck prefers to exhibit vowel-zero is that /-ɛk/ is a very common suffix that always exhibits vowel-zero. It functions as both a nominalising suffix, as well as a diminutive suffix, for all three grammatical genders.

Nevertheless, not all lexemes with *consonant+k* clusters are composed of this suffix, and therefore there are some lexemes which do not exhibit vowel-zero. These predominantly end in /tsk/ clusters (e.g. *Łuck* [wutsk] 'town name'), /sk/ clusters (e.g. *pisk* [pisk] 'squeak'), or *sonorant+k* clusters (e.g. *wilk* [vilk] 'wolf'). Many lexemes which end in /sk/ clusters are derived from verbs and are monosyllabic. Also, some neuter lexemes end in /-isk+o/, a suffix which denotes place name and does not exhibit vowel-zero.

Tests

The experiment tested only masculine forms. Forms ending in /k/ were tested for all clusters, while forms ending in /g/ were tested only for /zg/ and *sonorant+g* clusters. Additional tests were performed on /sk/ clusters. Forms with these clusters were controlled for whether or not they were masculine or neuter, whether or not they had monosyllabic or bisyllabic stems, and whether or not the stem vowel was /i/ or /a/. This produced eight forms in total, and one form <mefisko> (whose stem is neuter, bisyllabic, and has the vowel /i/) closely resembles words with the /-isk+ɔ/ suffix.

Appendix B: Detailed overview of consonant clusters tested during the experiment

The two vowel qualities, /i/ and /a/ were also tested in two forms ending in /zg/. Furthermore, while most obstruents preceding /k/ were also voiceless, one form <sazki> had a voiced obstruent precede /k/ to determine whether agreement in voicing affected the morphemic interpretation of /k/.

Predictions

It is predicted that forms ending in /g/ will never exhibit vowel-zero. This is in contrast to forms ending in /k/ which are predicted to exhibit vowel-zero most of the time. Some forms ending in Ck are expected to not exhibit vowel-zero: some masculine monosyllabic forms ending in /sk/; neuter forms ending in /-isk+ɔ/; forms ending in /zk/; and some forms ending in *sonorant+k*.

B.12 Ct/Cd

Background

Lexemes with Ct and Cd final clusters predominantly do not exhibit vowel-zero. There are only three exceptions to this—[ɔtsɛt] 'vinegar', [pɔtʂɛt] 'historical unit of soldiers', and [ɔsɛt] 'thistle'—and in each of these words the consonant preceding /t/ is coronal.

Tests

Lexemes ending in /d/ are rare, therefore the experiment only tested forms with Ct clusters. Furthermore, the experiment tested masculine forms since most forms with this cluster are marked for this gender. Forms ending in /t/ were preceded by all other consonants except for palatal ones, which are considered to violate Polish phonotactics when they are followed by a plain coronal.

Predictions

It is predicted that forms with Ct clusters will not exhibit vowel zero and that the three exceptions listed in the background section above will not have any particular effect.

B.13 Cp/Cb

Background

Lexemes ending in Cp or Cb clusters predominantly do not exhibit vowel-zero. There are only two exceptions to this in the entire language: [puwvɨspɨ]~[puwvɨsɛp] 'peninsula, nom.pl.~nom.sg.' and [tɔrba]~[tɔrɛb] 'bag, nom.sg.~gen.pl.'.

Tests

Both Cp and Cb clusters were tested in this experiment. The /p/ in Cp clusters was preceded by each of the voiceless obstruents and each of the sonorants except for /n/; while the /b/ in Cb clusters was preceded by each of the voiced obstruents and each of the sonorants except for /n/. The interesting thing about the form that exhibits vowel-zero and ends in the /sp/ cluster is that it is a compound of the word /puw/ 'half' and /vɨspa/ 'island'. Therefore, four forms were used to test whether [puwvɨsɛp] behaves differently because of linguistic factors such as having two syllables in the stem or being masculine.

Predictions

Just as with Ct clusters outlined in §B.12 above, it is predicted that forms with Cp and Cb clusters will not exhibit vowel-zero at all. This will prove that the two exceptions are in fact exceptions.

Appendix C: List of phrases and prompts

1	dwa two$_{MASC/NEUT}$	baratły baratły$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
2	trzy three	namasły namasły$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
3	cztery four	kamysły kamysły$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
4	jedno one$_{NEUT}$	rabatło rabatło$_{nom.sg.NEUT}$	pięć five	_____
5	jedno one$_{NEUT}$	kumasło kumasło$_{nom.sg.NEUT}$	pięć five	_____
6	jedno one$_{NEUT}$	numiosło numiosło$_{nom.sg.NEUT}$	pięć five	_____
7	trzy three	bykazły bykazły$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
8	dwa two$_{MASC/NEUT}$	numyzły numyzły$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
9	jedno one$_{NEUT}$	nabazło nabazło$_{nom.sg.NEUT}$	sześć six	_____
10	jedno one$_{NEUT}$	kamiozło kamiozło$_{nom.sg.NEUT}$	sześć six	_____
11	jedno one$_{NEUT}$	bepno bepno$_{nom.sg.NEUT}$	dziesięć ten	_____
12	jedno one$_{NEUT}$	ciatno ciatno$_{nom.sg.NEUT}$	pięć five	_____
13	jedno one$_{NEUT}$	fętno fętno$_{nom.sg.NEUT}$	pięć five	_____
14	jedno one$_{NEUT}$	gędno gędno$_{nom.sg.NEUT}$	pięć five	_____
15	jedno one$_{NEUT}$	sozętno sozętno$_{nom.sg.NEUT}$	sześć six	_____
16	jedno one$_{NEUT}$	wękno wękno$_{nom.sg.NEUT}$	sześć six	_____
17	jedno one$_{NEUT}$	chykno chykno$_{nom.sg.NEUT}$	dziesięć ten	_____

Appendix C: List of phrases and prompts

18	jedno one$_{NEUT}$	kicno kicno$_{nom.sg.NEUT}$	dziesięć ten	_____
19	jedno one$_{NEUT}$	łaczno łaczno$_{nom.sg.NEUT}$	dziesięć ten	_____
20	jedno one$_{NEUT}$	niowno niowno$_{nom.sg.NEUT}$	dziesięć ten	_____
21	jedna one$_{FEM}$	lizna lizna$_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
22	jedna one$_{FEM}$	jefisna jefisna$_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
23	jedna one$_{FEM}$	dygazna dygazna$_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
24	jedna one$_{FEM}$	ciubizna ciubizna$_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
25	jedno one$_{NEUT}$	szogizno szogizno$_{nom.sg.NEUT}$	sześć six	_____
26	jedno one$_{NEUT}$	reżno reżno$_{nom.sg.NEUT}$	dziewięć nine	_____
27	jedno one$_{NEUT}$	sychno sychno$_{nom.sg.NEUT}$	dziewięć nine	_____
28	dwa two$_{MASC/NEUT}$	siumny siumny$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
29	dwa two$_{MASC/NEUT}$	tolny tolny$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
30	dwa two$_{MASC/NEUT}$	wajny wajny$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
31	trzy three	zerny zerny$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
32	trzy three	ziłny ziłny$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
33	dwie two$_{FEM}$	żomny żomny$_{nom.pl.MASC/FEM}$	dziewięć nine	_____
34	dwie two$_{FEM}$	bulny bulny$_{nom.pl.MASC/FEM}$	dziewięć nine	_____

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35	dwie two$_{FEM}$	cajny cajny$_{nom.pl.MASC/FEM}$	dziewięć nine	_____
36	jedna one$_{FEM}$	ciurna ciurna$_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
37	jedna one$_{FEM}$	dełna dełna$_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
38	dwa two$_{MASC/NEUT}$	zapry zapry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
39	dwa two$_{MASC/NEUT}$	wepry wepry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
40	dwa two$_{MASC/NEUT}$	tabry tabry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
41	dwa two$_{MASC/NEUT}$	siebry siebry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
42	dwa two$_{MASC/NEUT}$	satry satry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
43	dwa two$_{MASC/NEUT}$	retry retry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
44	trzy three	padry padry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
45	trzy three	niedry niedry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
46	trzy three	nakry nakry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
47	trzy three	mekry mekry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
48	trzy three	łagry łagry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
49	trzy three	legry legry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
50	cztery four	kafry kafry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
51	cztery four	jefry jefry$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____

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52	cztery four	chawry chawry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
53	cztery four	gewry gewry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
54	cztery four	famry famry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
55	cztery four	demry demry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
56	cztery four	biniapry biniapry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
57	cztery four	cepepry cepepry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
58	cztery four	cianabry cianabry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
59	cztery four	dumebry dumebry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
60	cztery four	fołatry fołatry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
61	cztery four	giletry giletry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
62	trzy three	chejadry chejadry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
63	trzy three	jakedry jakedry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
64	trzy three	luchakry luchakry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
65	trzy three	łogekry łogekry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
66	trzy three	mifagry mifagry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
67	trzy three	nedegry nedegry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
68	dwa two$_{\text{MASC/NEUT}}$	niaciafry niaciafry$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____

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69	dwa $two_{MASC/NEUT}$	pucefry $pucefry_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
70	dwa $two_{MASC/NEUT}$	robawry $robawry_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
71	dwa $two_{MASC/NEUT}$	sidzewry $sidzewry_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
72	dwa $two_{MASC/NEUT}$	seczamry $seczamry_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
73	dwa $two_{MASC/NEUT}$	taszemry $taszemry_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
74	jedna one_{FEM}	ciapra $ciapra_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
75	jedna one_{FEM}	cepra $cepra_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
76	jedna one_{FEM}	babra $babra_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
77	jedna one_{FEM}	szebra $szebra_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
78	jedna one_{FEM}	dziatra $dziatra_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
79	jedna one_{FEM}	czetra $czetra_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
80	jedna one_{FEM}	dżadra $dżadra_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
81	jedna one_{FEM}	dzedra $dzedra_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
82	jedna one_{FEM}	żakra $żakra_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
83	dwie two_{FEM}	ziekry $ziekry_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
84	dwie two_{FEM}	jagry $jagry_{nom.pl.MASC/FEM}$	pięć five	_____
85	dwie two_{FEM}	chegry $chegry_{nom.pl.MASC/FEM}$	sześć six	_____

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86	dwie two_{FEM}	gafry $gafry_{nom.pl.MASC/FEM}$	dziewięć nine	_____
87	dwie two_{FEM}	fefry $fefry_{nom.pl.MASC/FEM}$	dziesięć ten	_____
88	dwie two_{FEM}	dawry $dawry_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
89	dwie two_{FEM}	ciewry $ciewry_{nom.pl.MASC/FEM}$	pięć five	_____
90	dwie two_{FEM}	camry $camry_{nom.pl.MASC/FEM}$	sześć six	_____
91	dwie two_{FEM}	bemry $bemry_{nom.pl.MASC/FEM}$	dziewięć nine	_____
92	jedno one_{NEUT}	lapro $lapro_{nom.sg.NEUT}$	sześć six	_____
93	jedno one_{NEUT}	łepro $łepro_{nom.sg.NEUT}$	dziewięć nine	_____
94	jedno one_{NEUT}	mabro $mabro_{nom.sg.NEUT}$	dziesięć ten	_____
95	jedno one_{NEUT}	nebro $nebro_{nom.sg.NEUT}$	dwanaście twelve	_____
96	jedno one_{NEUT}	niatro $niatro_{nom.sg.NEUT}$	pięć five	_____
97	jedno one_{NEUT}	petro $petro_{nom.sg.NEUT}$	sześć six	_____
98	jedno one_{NEUT}	radro $radro_{nom.sg.NEUT}$	dziewięć nine	_____
99	jedno one_{NEUT}	sedro $sedro_{nom.sg.NEUT}$	dziesięć ten	_____
100	jedno one_{NEUT}	siakro $siakro_{nom.sg.NEUT}$	dwanaście twelve	_____
101	jedno one_{NEUT}	tekro $tekro_{nom.sg.NEUT}$	pięć five	_____
102	jedno one_{NEUT}	wagro $wagro_{nom.sg.NEUT}$	sześć six	_____

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103	jedno one$_{NEUT}$	zegro zegro$_{nom.sg.NEUT}$	dziewięć nine	_____
104	jedno one$_{NEUT}$	ziafro ziafro$_{nom.sg.NEUT}$	dziesięć ten	_____
105	jedno one$_{NEUT}$	żefro żefro$_{nom.sg.NEUT}$	dwanaście twelve	_____
106	jedno one$_{NEUT}$	dzawro dzawro$_{nom.sg.NEUT}$	pięć five	_____
107	jedno one$_{NEUT}$	dżewro dżewro$_{nom.sg.NEUT}$	sześć six	_____
108	jedno one$_{NEUT}$	szamro szamro$_{nom.sg.NEUT}$	dziewięć nine	_____
109	jedno one$_{NEUT}$	czemro czemro$_{nom.sg.NEUT}$	dziesięć ten	_____
110	dwa two$_{MASC/NEUT}$	czopcie czopcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
111	dwa two$_{MASC/NEUT}$	dżokcie dżokcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
112	dwa two$_{MASC/NEUT}$	dzyfcie dzyfcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
113	dwa two$_{MASC/NEUT}$	dziechcie dziechcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
114	trzy three	bamcie bamcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
115	trzy three	cuńcie cuńcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
116	trzy three	ciolcie ciolcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
117	cztery four	dyście dyście$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
118	cztery four	fejcie fejcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
119	cztery four	charcie charcie$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____

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120	cztery four	gułcie gułcie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
121	jedna one$_{\text{FEM}}$	jopcia jopcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
122	jedna one$_{\text{FEM}}$	kikcia kikcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
123	jedna one$_{\text{FEM}}$	lefcia lefcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
124	jedna one$_{\text{FEM}}$	łachcia łachcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
125	jedna one$_{\text{FEM}}$	mumcia mumcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
126	jedna one$_{\text{FEM}}$	nońcia nońcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
127	jedna one$_{\text{FEM}}$	nilcia nilcia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
128	pięć five	peści peści$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
129	pięć five	sajci sajci$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
130	pięć five	zurci zurci$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
131	pięć five	rołci rołci$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
132	dwa two$_{\text{MASC/NEUT}}$	cioble cioble$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
133	dwa two$_{\text{MASC/NEUT}}$	dutle dutle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
134	dwa two$_{\text{MASC/NEUT}}$	fedle fedle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
135	trzy three	gakle gakle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
136	cztery four	chagle chagle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____

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137	trzy three	dzykle dzykle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
138	cztery four	pygle pygle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
139	dwa two$_{\text{MASC/NEUT}}$	jocle jocle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
140	trzy three	kudzle kudzle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
141	cztery four	leczle leczle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
142	sześć six	muflów muflów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
143	dwa two$_{\text{MASC/NEUT}}$	niesle niesle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
144	cztery four	roszle roszle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
145	sześć six	ziachlów ziachlów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
146	siedem seven	pemlów pemlów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
147	dwa two$_{\text{MASC/NEUT}}$	szyśle szyśle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
148	trzy three	żujle żujle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
149	trzy three	czarle czarle$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
150	dwa two$_{\text{MASC/NEUT}}$	fipnie fipnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
151	cztery four	jutnie jutnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
152	sześć six	łeknie łeknie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
153	dwa two$_{\text{MASC/NEUT}}$	locnie locnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____

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154	cztery four	niacznie niacznie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
155	siedem seven	towniów towniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
156	pięć five	wiżniów wiżniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
157	sześć six	zochniów zochniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
158	siedem seven	ziumniów ziumniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
159	dwa two$_{\text{MASC/NEUT}}$	żelnie żelnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
160	trzy three	dzośnie dzośnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
161	cztery four	dżaźnie dżaźnie$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
162	pięć five	cyjniów cyjniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
163	sześć six	burniów burniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
164	siedem seven	dziołniów dziołniów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
165	jedna one$_{\text{FEM}}$	szamnia szamnia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
166	jedna one$_{\text{FEM}}$	czylnia czylnia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
167	pięć five	ciuśni ciuśni$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
168	pięć five	deźni deźni$_{\text{nom.pl.MASC/FEM}}$	jedna one$_{\text{FEM}}$	_____
169	jedna one$_{\text{FEM}}$	fojnia fojnia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
170	jedna one$_{\text{FEM}}$	charnia charnia$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____

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171	jedna one_{FEM}	gyłnia $gyłnia_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
172	cztery four	kodmy $kodmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
173	trzy three	ługmy $ługmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
174	pięć five	ciedżmów $ciedżmów_{nom.pl.MASC}$	jeden one_{MASC}	_____
175	dwa $two_{MASC/NEUT}$	medasmy $medasmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
176	dwa $two_{MASC/NEUT}$	cobismy $cobismy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
177	dwa $two_{MASC/NEUT}$	wizmy $wizmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
178	dwa $two_{MASC/NEUT}$	bowazmy $bowazmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
179	dwa $two_{MASC/NEUT}$	deszyzmy $deszyzmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
180	cztery four	geżmy $geżmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
181	pięć five	lichmów $lichmów_{nom.pl.MASC}$	jeden one_{MASC}	_____
182	trzy three	cholmy $cholmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
183	cztery four	mućmy $mućmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
184	pięć five	padźmów $padźmów_{nom.pl.MASC}$	jeden one_{MASC}	_____
185	trzy three	reśmy $reśmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
186	cztery four	dziźmy $dziźmy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
187	pięć five	tojmów $tojmów_{nom.pl.MASC}$	jeden one_{MASC}	_____

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188	trzy three	surmy surmy$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
189	cztery four	załmy załmy$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
190	dwa two$_{\text{MASC/NEUT}}$	czamsze czamsze$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
191	dwa two$_{\text{MASC/NEUT}}$	gamże gamże$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
192	jedna one$_{\text{FEM}}$	kamsza kamsza$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
193	jedna one$_{\text{FEM}}$	chamża chamża$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
194	jedna one$_{\text{FEM}}$	satwa satwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
195	jedna one$_{\text{FEM}}$	badwa badwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
196	jedna one$_{\text{FEM}}$	pakwa pakwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
197	jedna one$_{\text{FEM}}$	jagwa jagwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
198	jedna one$_{\text{FEM}}$	mecatwa mecatwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
199	jedna one$_{\text{FEM}}$	nifadwa nifadwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
200	jedna one$_{\text{FEM}}$	pochakwa pochakwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
201	jedna one$_{\text{FEM}}$	rulagwa rulagwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
202	jedna one$_{\text{FEM}}$	szetwa szetwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	pięć five	_____
203	jedna one$_{\text{FEM}}$	ciedwa ciedwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	sześć six	_____
204	jedna one$_{\text{FEM}}$	czekwa czekwa$_{\text{nom.sg.FEM/nom.pl.NEUT}}$	dziewięć nine	_____

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205	jedna one$_{FEM}$	dziegwa dziegwa$_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
206	jedna one$_{FEM}$	rytwa rytwa$_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
207	jedna one$_{FEM}$	zydwa zydwa$_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
208	jedna one$_{FEM}$	rzykwa rzykwa$_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
209	jedna one$_{FEM}$	dzygwa dzygwa$_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
210	jedna one$_{FEM}$	motwa motwa$_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
211	jedna one$_{FEM}$	todwa todwa$_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
212	jedna one$_{FEM}$	nokwa nokwa$_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
213	jedna one$_{FEM}$	kogwa kogwa$_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
214	dwie two$_{FEM}$	łutwy łutwy$_{nom.pl.MASC/FEM}$	dziewięć nine	_____
215	dwie two$_{FEM}$	dzudwy dzudwy$_{nom.pl.MASC/FEM}$	dziesięć ten	_____
216	dwie two$_{FEM}$	lukwy lukwy$_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
217	dwie two$_{FEM}$	cugwy cugwy$_{nom.pl.MASC/FEM}$	pięć five	_____
218	dwie two$_{FEM}$	tyzwy tyzwy$_{nom.pl.MASC/FEM}$	dziesięć ten	_____
219	dwie two$_{FEM}$	roszwy roszwy$_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
220	dwie two$_{FEM}$	mużwy mużwy$_{nom.pl.MASC/FEM}$	pięć five	_____
221	dwie two$_{FEM}$	lachwy lachwy$_{nom.pl.MASC/FEM}$	sześć six	_____

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222	dwie two$_{FEM}$	kemfy kemfy$_{nom.pl.MASC/FEM}$	dziewięć nine	_____
223	dwie two$_{FEM}$	gilwy gilwy$_{nom.pl.MASC/FEM}$	dziesięć ten	_____
224	dwie two$_{FEM}$	forwy forwy$_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
225	dwie two$_{FEM}$	dunwy dunwy$_{nom.pl.MASC/FEM}$	dziesięć ten	_____
226	dwie two$_{FEM}$	bałwy bałwy$_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
227	trzy three	bapce bapce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
228	trzy three	dytce dytce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
229	trzy three	guczce guczce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
230	trzy three	kiwce kiwce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
231	trzy three	josce josce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
232	trzy three	nieżce nieżce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
233	cztery four	pichce pichce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
234	cztery four	lomce lomce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
235	cztery four	łuńce łuńce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
236	cztery four	ralce ralce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
237	cztery four	sećce sećce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____
238	cztery four	tośce tośce$_{nom.pl.MASC/FEM}$	jeden one$_{MASC}$	_____

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239	cztery four	ziajce ziajce$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
240	cztery four	werce werce$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
241	cztery four	zynce zynce$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
242	cztery four	dzołce dzołce$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
243	trzy three	dziapki dziapki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
244	trzy three	czytki czytki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
245	trzy three	zucki zucki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
246	cztery four	seczki seczki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
247	cztery four	wofki wofki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
248	dwa two$_{\text{MASC/NEUT}}$	baski baski$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
249	dwa two$_{\text{MASC/NEUT}}$	dziski dziski$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
250	dwa two$_{\text{MASC/NEUT}}$	sazki sazki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
251	dwa two$_{\text{MASC/NEUT}}$	gefaski gefaski$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
252	dwa two$_{\text{MASC/NEUT}}$	chosiski chosiski$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
253	jedno one$_{\text{NEUT}}$	zasko zasko$_{\text{nom.sg.NEUT}}$	dziewięć nine	_____
254	jedno one$_{\text{NEUT}}$	wisko wisko$_{\text{nom.sg.NEUT}}$	dziewięć nine	_____
255	jedno one$_{\text{NEUT}}$	jusasko jusasko$_{\text{nom.sg.NEUT}}$	dziewięć nine	_____

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256	jedno one_{NEUT}	mefisko $mefisko_{nom.sg.NEUT}$	dziewięć nine	_____
257	dwa $two_{MASC/NEUT}$	razgi $razgi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
258	dwa $two_{MASC/NEUT}$	wizgi $wizgi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
259	pięć five	żaszków $żaszków_{nom.pl.MASC}$	jeden one_{MASC}	_____
260	pięć five	cychków $cychków_{nom.pl.MASC}$	jeden one_{MASC}	_____
261	pięć five	ciomków $ciomków_{nom.pl.MASC}$	jeden one_{MASC}	_____
262	pięć five	fuńków $fuńków_{nom.pl.MASC}$	jeden one_{MASC}	_____
263	dwa $two_{MASC/NEUT}$	galki $galki_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
264	dwa $two_{MASC/NEUT}$	kilgi $kilgi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
265	sześć six	chećków $chećków_{nom.pl.MASC}$	jeden one_{MASC}	_____
266	sześć six	dżośków $dżośków_{nom.pl.MASC}$	jeden one_{MASC}	_____
267	trzy three	bojgi $bojgi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
268	trzy three	pargi $pargi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
269	cztery four	dengi $dengi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
270	cztery four	rułgi $rułgi_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
271	trzy three	dzajki $dzajki_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
272	trzy three	lerki $lerki_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____

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273	cztery four	sinki sinki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
274	cztery four	jołki jołki$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
275	dwa two$_{\text{MASC/NEUT}}$	czepty czepty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
276	trzy three	dziokty dziokty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
277	cztery four	dżacty dżacty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
278	cztery four	zieczty zieczty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
279	pięć five	siftów siftów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
280	dwa two$_{\text{MASC/NEUT}}$	żusty żusty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
281	trzy three	seszty seszty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
282	cztery four	rochty rochty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
283	pięć five	niumtów niumtów$_{\text{nom.pl.MASC}}$	jeden one$_{\text{MASC}}$	_____
284	dwa two$_{\text{MASC/NEUT}}$	nalty nalty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
285	dwa two$_{\text{MASC/NEUT}}$	mejty mejty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
286	trzy three	lirty lirty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
287	trzy three	łonty łonty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
288	cztery four	kułty kułty$_{\text{nom.pl.MASC/FEM}}$	jeden one$_{\text{MASC}}$	_____
289	dwie two$_{\text{FEM}}$	mutpy mutpy$_{\text{nom.pl.MASC/FEM}}$	sześć six	_____

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290	dwie two_{FEM}	nodby $nodby_{nom.pl.MASC/FEM}$	dziewięć nine	_____
291	dwie two_{FEM}	nikpy $nikpy_{nom.pl.MASC/FEM}$	dziesięć ten	_____
292	dwie two_{FEM}	pegby $pegby_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
293	dwie two_{FEM}	racpy $racpy_{nom.pl.MASC/FEM}$	sześć six	_____
294	dwie two_{FEM}	sudzby $sudzby_{nom.pl.MASC/FEM}$	dziewięć nine	_____
295	dwie two_{FEM}	sioczpy $sioczpy_{nom.pl.MASC/FEM}$	dziesięć ten	_____
296	dwie two_{FEM}	tydżby $tydżby_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
297	dwa $two_{MASC/NEUT}$	baspy $baspy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
298	dwa $two_{MASC/NEUT}$	ciechaspy $ciechaspy_{nom.pl.MASC/FEM}$	jeden one_{MASC}	_____
299	jedna one_{FEM}	faspa $faspa_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
300	jedna one_{FEM}	gazba $gazba_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
301	jedna one_{FEM}	kuszaspa $kuszaspa_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
302	dwie two_{FEM}	weszpy $weszpy_{nom.pl.MASC/FEM}$	sześć six	_____
303	dwie two_{FEM}	zażby $zażby_{nom.pl.MASC/FEM}$	dziewięć nine	_____
304	dwie two_{FEM}	ziuchpy $ziuchpy_{nom.pl.MASC/FEM}$	dziesięć ten	_____
305	jedna one_{FEM}	łemba $łemba_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
306	jedna one_{FEM}	szuńba $szuńba_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____

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307	jedna one_{FEM}	wolba $wolba_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
308	jedna one_{FEM}	żompa $żompa_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
309	jedna one_{FEM}	bińpa $bińpa_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
310	jedna one_{FEM}	celpa $celpa_{nom.sg.FEM/nom.pl.NEUT}$	sześć six	_____
311	dwie two_{FEM}	fućpy $fućpy_{nom.pl.MASC/FEM}$	dziewięć nine	_____
312	dwie two_{FEM}	godźby $godźby_{nom.pl.MASC/FEM}$	dziesięć ten	_____
313	dwie two_{FEM}	ciśpy $ciśpy_{nom.pl.MASC/FEM}$	dwanaście twelve	_____
314	dwie two_{FEM}	cheźby $cheźby_{nom.pl.MASC/FEM}$	sześć six	_____
315	jedna one_{FEM}	kejba $kejba_{nom.sg.FEM/nom.pl.NEUT}$	dziewięć nine	_____
316	jedna one_{FEM}	lirba $lirba_{nom.sg.FEM/nom.pl.NEUT}$	dziesięć ten	_____
317	jedna one_{FEM}	czałba $czałba_{nom.sg.FEM/nom.pl.NEUT}$	dwanaście twelve	_____
318	jedna one_{FEM}	dzujpa $dzujpa_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
319	jedna one_{FEM}	dżorpa $dżorpa_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____
320	jedna one_{FEM}	dziłpa $dziłpa_{nom.sg.FEM/nom.pl.NEUT}$	pięć five	_____

Appendix D-1: Results for speaker TC

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (n) n (m)	n (n) n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		+	*	+		-					+	w	+	+		-		
t d	+	+	*	+		+		-		*			+	+			+/-	+
k g		*	*	+		+		-		*	+	-				-	-	+
ts		+		+		+								+		-	-	+
tʂ		+		+		+		+					+	+		-	+	+
tɕ dʑ								+ +/-					+	+			+	-/w
f v		+	*	+		-/w					-	-	+	+		-		
s z	*	+				*		*		+			+	*	-	-	*	-
ʂ ʐ		+		+		+		-		+			+	+		-	-	-
x		+		+		+		+		-	+	-	-	+		-	-	
ɕ ʑ		o		+ -	a			- +			-	-	+	+			-	+/-
m		+	*	-	-	-	-		-	-	-	-	+/-	+		-	-	-
n										+/-			-	+	-	-		
ɲ											-	w	+/-	+			-	+
r		-		-	+/-	-	+	+		+	-	a	-	-	-	-	+	-
l				+	+	+	+/-	-		-	-	+	+	+	-	-	-	+/-
j		+		+	+	-	-	-			-	a	+	+	-	-	-	-
w				+	+	+	+	-		-	-	a	-	+	-	-	-	+/-

+	response had a vowel
+/-	two responses given: one with vowel, one without
-	response did not have a vowel
*	various responses to various forms with the same cluster
x	irrelevant response
w	response (or one of the possible responses) had -ow masculine suffix

Appendix D-2: Results for speaker EW

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (n) n (m)	n (n) n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		+	*	+		+					+	+/w	+/-	+		-		
t d	+	+	*	+		*		-		*			+	+			-	+
k g		*	*	+		+		-		*	+	+				-	-	+
ts		+		+		+								+		+	-	-
tʂ		+		+		+		-					+	+		-	+	+
tɕ dʑ								+ -					+	+			-	+
f v		+/-	*	+		+					+	-	+	+		-		
s z	*	-				*		-		+			+	*	-	-	*	-
ʂ ʐ		-		-		+		+		+ -			+	+		+	-	+
x		+		-		+		+		+	-	+	+	+		-	+	
ɕ ʑ		+		- +	x			-			-	-	+	+			-	-
m		-	*	+	-	+	+		*	-	+	w	+	+		-	-	-
n										+			+	+	-	-		
ɲ											-	+	+	+			-	+
r		-		+	x	-	+	-		+	-	x	+	+	-	-	+	-
l				-	x	-	+	-		-	-	+	+	+	+	-	-	+
j		+		-	+	-	+	+			x	x	+	+	-	-	-	-
w				-	+	+	-	-		-	-	x	+	+	-	-	+	-

+	response had a vowel
+/-	two responses given: one with vowel, one without
-	response did not have a vowel
*	various responses to various forms with the same cluster
x	irrelevant response
w	response (or one of the possible responses) had -ow masculine suffix

Appendix D-3: Results for speaker KP

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (n) n (m)	n (n) n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		+	*	+		+					+	x	+	+		-		
t d	-	+	*	+		*		+/-		*			+	+			-	+/-
k g		*	*	+		+		-		*	+	x				-	-	-
ts		+		+		-								+		-	-	-
tʂ		+		+		-		+					+	+		-	+/-	-
tɕ dʑ								- +					+	+			-	-
f v		+	*	+		+					+	-	+	+		-		
s z	-	+				-		-		-			+	*	*	-	-	-
ʂ ʐ		+		+		+		-		-			+	+		-	-	-
x		+		+		-		+		-	+	-	-	+		-	-	
ɕ ʑ		+		+ -	- x			-/+ -			x	-	+	+			+/-	-
m		+/-	*	+	x	-	-		-	-	+	x	+	+		+	-	-
n										-			+	+	-	-		
ɲ											+	-	+	+			-	-
r		+/-		+	x	-	x	-		+	+/-	x	+	+	-	-	-	-
l				+/-	-	-	-	-		-	+	-	+	+	-	-	-	-
j		+		+	x	-	-	-			-	x	+	+	-	-	-	-
w				+	-	-	-	-		-	+	x	+	+	-	-	-	-

+	response had a vowel
+/-	two responses given: one with vowel, one without
-	response did not have a vowel
*	various responses to various forms with the same cluster
x	irrelevant response
w	response (or one of the possible responses) had -ow masculine suffix

Appendix D-4: Results for speaker AC

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (n) n (m)	n (n) n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		-	*	-		-					-	-	-	-		-		
t d	-	+	*	-		*		-		*			-	-			+	-
k g		-	*	-		*		-		*	x	-				-	-	-
ts		-		-/+		+								-		-	+	w
tʂ		-		+		+		-					-	-		-	-	-
tɕ dʑ								-					-	-			-	+
f v		+	*	-		-					-	-	-	-		-		
s z	*	-				-		-		-			-	*	-	-	*	+
ʂ ʐ		-/+		-		-/w		-		*			-	-		-	-/w	-
x		-		-		-		-		+	-	+	-	-		-	-	
ɕ ʑ		-		-	-			-			-	x	-	-			-	-
m		-	*	-	-	-	-		*	-	-	-	-	-		-	w	-
n										-			-	-	-	-		
ɲ											-	-	-	-			-	+/w
r		-		-	-	-	+	-		-	-	-	-	-	-	-	+/w	-
l				-	+/w	-	-	-		+	-	-	-	-	-	-	-	+
j		-		-	-	-	-	-			-	-	-	-	-	-	-	-
w				-/+	-	-	-	-		-	-/+	-	-	-	-	-	-	+/w

+	response had a vowel
+/-	two responses given: one with vowel, one without
-	response did not have a vowel
*	various responses to various forms with the same cluster
x	irrelevant response
w	response (or one of the possible responses) had -ow masculine suffix

Appendix D-5: Results for speaker LC

SECOND CONSONANT

FIRST CONSONANT	w	l	r	ɲ (m)	ɲ (f)	n (n) n (m)	n (n) n (f)	m	ʂ ʐ	f v	tɕ (m)	tɕ (f)	ts (m)	k	g	t	p	b
p b		-	*	-		w					-	w	-	-		-		
t d	*	-	*	-		*		-		*			-	-			-	w
k g		-	*	-		w		-		*	-	w				-	w	w
ts		-		-		-								-		-	-	-
tʂ		-		-		-		-					-	-		-	-	-
tɕ dʑ								-					-	-			-	w
f v		-	*	-		+					-	i	-	-		-		
s z	*	-				*		-		-			-	*	-	-	-	-
ʂ ʐ		-		-		w		-		w -			-	-		-	w	w
x		-		-		-		-		-	-	w	-	-		-	-	
ɕ ʑ		-		-	-			-			-	-	-	-			-	w
m		-	*	-	w	-	-		*	-	-	i	-	-		-	-	w
n										-			-	-	-	-		
ɲ											-	i	-	-			-	w
r		-		-	-	-	-	-		w	-	a	-	-	-	-	-	w
l				-	i	-	-	-		-	-	i	-	-	-	-	w	w
j		-		-	w	-	w	-			-	-	-	-	-	-	w	w
w				-	-	-	w	-		w	-	-	-	-	-	-	w	-

+	response had a vowel
+/-	two responses given: one with vowel, one without
-	response did not have a vowel
*	various responses to various forms with the same cluster
x	irrelevant response
w	response (or one of the possible responses) had -ow masculine suffix

Appendix E-1: Results for Cw clusters

The following 10 forms with consonant+w clusters were tested. Only the two shown were predicted not to exhibit vowel-zero.

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		rabatło	
sw	namasły	kamysły	kumasło	numiosło
zw	bykazły	numyzły	nabazło	kamiozło

vowel
both vowel and no vowel
no vowel
-ow masculine suffix

The following tables summarize the responses given by each speaker.

TC

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		rabatło	
sw	namasły	kamysły	kumasło	numiosło
zw	bykazły	numyzły	nabazło	kamiozło

EW

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		rabatło	
sw	namasły	kamysły	kumasło	numiosło
zw	bykazły	numyzły	nabazło	kamiozło

KP

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		rabatło	
sw	namasły	kamysły	kumasło	numiosło
zw	bykazły	numyzły	dynazło	kamiozło

AC

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		rabatło	
sw	namasły	kamysły	kumasło	numiosło
zw	bykazły	numyzły	nabazło	kamiozło

LC

	Masculine		Neuter	
	/a/	/ɨ/	/a/	/ɨ/
tw	baratły		*rabatło*	
sw	namasły	kamysły	kumasło	*numiosło*
zw	bykazły	numyzły	nabazło	*kamiozło*

Appendix E-2: Results for /kl/ and /gl/ clusters

The following 4 forms with /kl/ and /gl/ clusters were tested. Only the form with <-ykl>, due to its similarity to <cykl> 'cycle', is expected not to exhibit vowel-zero.

stem vowel	first consonant: /k/	first consonant: /g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

vowel
both vowel and no vowel
no vowel

The following tables summarize the responses given by each speaker.

TC	/k/	/g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

EW	/k/	/g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

KP	/k/	/g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

AC	/k/	/g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

LC	/k/	/g/
/a/	gakle	chagle
/ɨ/	dzykle	pygle

Appendix E-3: Results for Cr clusters

The following summarizes each speaker's responses to forms with Cr clusters. Forms with each consonant cluster were controlled for grammatical gender, number of syllables in the stem, and the quality of the stem vowel.

Legend

vowel
both vowel and no vowel
no vowel
-ow masculine suffix
irrelevant response

TC

Consonant Cluster	MASCULINE				FEMININE		NEUTER	
	monosyllabic		***bisyllabic***		***monosyllabic***		***monosyllabic***	
	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/
/pr/	zapry	wepry	biniapry	cepepry	ciapra	cepra	lapro	łepro
/br/	tabry	siebry	cianabry	dumebry	babra	szebra	mabro	nebro
/tr/	satry	retry	fołatry	giletry	dziatra	czetra	niatro	petro
/dr/	padry	niedry	chejadry	jakedry	dżadra	dzedra	radro	sedro
/kr/	nakry	mekry	luchakry	łogekry	żakra	ziekra	siakro	tekro
/gr/	łagry	legry	mifagry	nedegry	jagra	chegra	wagro	zegro
/fr/	kafry	jefry	niaciafry	pucefry	gafra	fefra	ziafro	żefro
/vr/	chawry	gewry	robawry	sidzewry	dawra	ciewra	dzawro	dżewro
/mr/	famry	demry	seczamry	taszemry	camra	bemra	szamro	czemro

EW

Consonant Cluster	MASCULINE				FEMININE		NEUTER	
	monosyllabic		***bisyllabic***		***monosyllabic***		***monosyllabic***	
	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/
/pr/	zapry	wepry	biniapry	cepepry	ciapra	*cepra*	*lapro*	łepro
/br/	tabry	siebry	cianabry	dumebry	babra	szebra	mabro	nebro
/tr/	satry	retry	fołatry	giletry	dziatra	czetra	niatro	*petro*
/dr/	padry	niedry	chejadry	jakedry	dżadra	dzedra	radro	*sedro*
/kr/	nakry	mekry	luchakry	łogekry	żakra	ziekra	siakro	tekro
/gr/	łagry	legry	mifagry	nedegry	jagra	chegra	wagro	*zegro*
/fr/	kafry	jefry	niaciafry	pucefry	gafra	fefra	ziafro	żefro
/vr/	chawry	gewry	robawry	sidzewry	dawra	ciewra	dzawro	*dżewro*
/mr/	famry	demry	seczamry	taszemry	camra	bemra	*szamro*	czemro

Appendix E-3: Results for Cr clusters

KP

Consonant Cluster	MASCULINE				FEMININE		NEUTER	
	monosyllabic		***bisyllabic***		***monosyllabic***		***monosyllabic***	
	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/
/pr/	zapry	wepry	biniapry	cepepry	ciapra	cepra	lapro	łepro
/br/	tabry	siebry	cianabry	dumebry	babra	szebra	mabro	nebro
/tr/	satry	retry	fołatry	giletry	dziatra	czetra	niatro	petro
/dr/	padry	niedry	chejadry	jakedry	dżadra	dzedra	radro	sedro
/kr/	nakry	mekry	luchakry	łogekry	żakra	ziekra	siakro	tekro
/gr/	łagry	legry	mifagry	nedegry	jagra	chegra	wagro	zegro
/fr/	kafry	jefry	niaciafry	pucefry	gafra	fefra	ziafro	żefro
/vr/	chawry	gewry	robawry	sidzewry	dawra	ciewra	dzawro	dżewro
/mr/	famry	demry	seczamry	taszemry	camra	bemra	szamro	czemro

AC

Consonant Cluster	MASCULINE				FEMININE		NEUTER	
	monosyllabic		***bisyllabic***		***monosyllabic***		***monosyllabic***	
	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/
/pr/	zapry	wepry	biniapry	cepepry	ciapra	cepra	lapro	łepro
/br/	tabry	siebry	cianabry	dumebry	babra	szebra	mabro	*nebro*
/tr/	satry	retry	fołatry	giletry	dziatra	czetra	niatro	petro
/dr/	padry	niedry	chejadry	jakedry	dżadra	dzedra	radro	sedro
/kr/	nakry	mekry	luchakry	łogekry	*żakra*	ziekra	*siakro*	tekro
/gr/	łagry	legry	mifagry	nedegry	jagra	chegra	wagro	*zegro*
/fr/	kafry	jefry	niaciafry	pucefry	gafra	fefra	*ziafro*	*żefro*
/vr/	chawry	gewry	robawry	sidzewry	dawra	ciewra	dzawro	*dżewro*
/mr/	famry	demry	seczamry	taszemry	camra	bemra	*szamro*	czemro

LC

Consonant Cluster	MASCULINE				FEMININE		NEUTER	
	monosyllabic		***bisyllabic***		***monosyllabic***		***monosyllabic***	
	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/	/a/	/ɛ/
/pr/	zapry	wepry	biniapry	cepepry	*ciapra*	*cepra*	*lapro*	*łepro*
/br/	tabry	siebry	cianabry	dumebry	*babra*	*szebra*	*mabro*	nebro
/tr/	satry	retry	fołatry	giletry	*dziatra*	czetra	*niatro*	*petro*
/dr/	padry	niedry	chejadry	jakedry	dżadra	*dzedra*	radro	*sedro*
/kr/	nakry	mekry	luchakry	łogekry	*żakra*	*ziekra*	*siakro*	*tekro*
/gr/	łagry	legry	mifagry	nedegry	*jagra*	*chegra*	*wagro*	*zegro*
/fr/	kafry	jefry	niaciafry	pucefry	*gafra*	*fefra*	ziafro	żefro
/vr/	chawry	gewry	robawry	sidzewry	*dawra*	*ciewra*	*dzawro*	*dżewro*
/mr/	famry	demry	seczamry	taszemry	*camra*	*bemra*	szamro	*czemro*

Appendix E-4: Results for /tn/ /zn/ and /zm/ clusters

The following summarizes each speaker's responses to forms with /tn/ /zn/ and /zm/ clusters. In each case there is a "model" form, which most closely resembles lexemes in the real language which do not exhibit vowel-zero. Additional forms differ from the model form in particular linguistic features.

Legend

vowel
both vowel and no vowel
no vowel
-ow masculine suffix
irrelevant response

TC

	/tn/	/zn/	/zm/
Model form:	fętno	ciubizna	deszyzmy
Difference: Vowel:	ciatno	dygazna	bowazmy
Difference: Syllable:	sozętno	lizna	wizmy
Difference: Voicing:	gędno	jefisna	cobismy
Difference: Place:	wękno	żogizno	
Difference: Vowel & voicing:			medasmy

EW

	/tn/	/zn/	/zm/
Model form:	fętno	ciubizna	deszyzmy
Difference: Vowel:	ciatno	dygazna	bowazmy
Difference: Syllable:	sozętno	lizna	wizmy
Difference: Voicing:	gędno	jefisna	cobismy
Difference: Place:	wękno	żogizno	
Difference: V&V:			medasmy

KP

	/tn/	/zn/	/zm/
Model form:	fętno	ciubizna	deszyzmy
Difference: Vowel:	ciatno	dygazna	bowazmy
Difference: Syllable:	sozętno	lizna	wizmy
Difference: Voicing:	gędno	jefisna	cobismy
Difference: Place:	wękno	żogizno	
Difference: V&V:			medasmy

AC

	/tn/	/zn/	/zm/
Model form:	fętno	ciubizna	deszyzmy
Difference: Vowel:	ciatno	dygazna	bowazmy
Difference: Syllable:	sozętno	lizna	wizmy
Difference: Voicing:	gędno	jefisna	cobismy
Difference: Place:	wękno	żogizno	
Difference: V&V:			medasmy

LC

	/tn/	/zn/	/zm/
Model form:	*fętno*	ciubizna	deszyzmy
Difference: Vowel:	*ciatno*	dygazna	bowazmy
Difference: Syllable:	sozętno	*lizna*	wizmy
Difference: Voicing:	*gędno*	*jefisna*	cobismy
Difference: Place:	*wękno*	żogizno	
Difference: V&V:			medasmy

Appendix E-5: Responses for /mę/ /mz̨/ and /sp/ clusters

The following forms with /mę/ /mz̨/ and /sp/ clusters were tested.
On the one hand, we wanted to test whether a feminine lexeme with a /mz̨/ cluster was unique in exhibiting vowel-zero in Polish because it was feminine, or because the second consonant in the cluster was /z̨/ and not /ę/, or both.
On the other hand, we wanted to test whether a bisyllabic masculine lexeme with a /sp/ cluster was unique in exhibiting vowel-zero in Polish because it was masculine, or because it was bisyllabic, or both.

Legend

vowel
both vowel and no vowel
no vowel
-ow masculine suffix
irrelevant response

Expected pattern based on real language:

	MASC	FEM
ę	czamsze	kamsza
z̨	gamże	chamża

	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

Responses from each speaker:

TC	MASC	FEM
ę	czamsze	kamsza
z̨	gamże	chamża

TC	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

EW	MASC	FEM
ę	czamsze	kamsza
z̨	gamże	chamża

EW	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

KP	MASC	FEM
ę	czamsze	kamsza
z̨	gamże	chamza

KP	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

AC	MASC	FEM
ę	czamsze	kamsza
z̨	gamże	*chamża*

AC	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

LC	MASC	FEM
ę	czamsze	*kamsza*
z̨	gamże	chamża

LC	MASC	FEM
1 syll	baspy	faspa
2 syll	ciechaspy	kuszaspa

Appendix E-6: Results for Cv clusters

The following summarizes each speaker's responses to forms with Cv clusters. Forms with each consonant cluster were controlled for number of syllables in the stem, and the quality of the stem vowel.

Legend

vowel
both vowel and no vowel
no vowel
-ow masculine suffix

TC	bisyllabic	monosyllabic				
	/a/	/a/	/ɛ/	/ɨ/	/ɔ/	/u/
/tv/	mecatwa	satwa	szetwa	rytwa	motwa	łutwa
/dv/	nifadwa	badwa	ciedwa	zydwa	todwa	dzudwa
/kv/	pochakwa	pakwa	czekwa	rzykwa	nokwa	lukwa
/gv/	rulagwa	jagwa	dziegwa	dzygwa	kogwa	cugwa

EW	bisyllabic	monosyllabic				
	/a/	/a/	/ɛ/	/ɨ/	/ɔ/	/u/
/tv/	mecatwa	satwa	szetwa	rytwa	motwa	łutwa
/dv/	nifadwa	badwa	ciedwa	zydwa	todwa	dzudwa
/kv/	pochakwa	pakwa	czekwa	rzykwa	nokwa	lukwa
/gv/	rulagwa	jagwa	dziegwa	dzygwa	kogwa	cugwa

KP	bisyllabic	monosyllabic				
	/a/	/a/	/ɛ/	/ɨ/	/ɔ/	/u/
/tv/	mecatwa	satwa	szetwa	rytwa	motwa	łutwa
/dv/	nifadwa	badwa	ciedwa	zydwa	todwa	dzudwa
/kv/	pochakwa	pakwa	czekwa	rzykwa	nokwa	lukwa
/gv/	rulagwa	jagwa	dziegwa	dzygwa	kogwa	cugwa

AC	bisyllabic	monosyllabic				
	/a/	/a/	/ɛ/	/ɨ/	/ɔ/	/u/
/tv/	mecatwa	satwa	szetwa	rytwa	motwa	łutwa
/dv/	nifadwa	badwa	*ciedwa*	zydwa	todwa	dzudwa
/kv/	pochakwa	pakwa	czekwa	rzykwa	nokwa	lukwa
/gv/	rulagwa	jagwa	dziegwa	dzygwa	kogwa	cugwa

LC	bisyllabic	monosyllabic				
	/a/	/a/	/ɛ/	/ɨ/	/ɔ/	/u/
/tv/	*mecatwa*	satwa	*szetwa*	rytwa	motwa	*łutwa*
/dv/	*nifadwa*	badwa	*ciedwa*	*zydwa*	todwa	*dzudwa*
/kv/	pochakwa	*pakwa*	*czekwa*	*rzykwa*	*nokwa*	lukwa
/gv/	*rulagwa*	*jagwa*	*dziegwa*	*dzygwa*	*kogwa*	cugwa

Appendix E-7: Results for /sk/ /zg/ and /zk/ clusters

The following 11 forms with /sk/ /zg/ and /zk/ clusters were tested. Only forms with /zg/ clusters, neuter forms with /sk/ clusters that resembled the location morpheme /-isko/, and monosyllabic masculine forms that resembled nouns derived from verbs were predicted to not exhibit vowel-zero.

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	jusasko	**razgi**	sazki
/i/	dziski	chosiski	wisko	**mefisko**	**wizgi**	

Legend

vowel
both vowel and no vowel
no vowel
-ow masculine suffix

The following tables summarize the responses given by each speaker.

TC

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	jusasko	**razgi**	sazki
/i/	dziski	chosiski	wisko	**mefisko**	**wizgi**	

EW

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	jusasko	**razgi**	sazki
/i/	dziski	chosiski	wisko	**mefisko**	**wizgi**	

KP

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	jusasko	**razgi**	sazki
/i/	dziski	chosiski	wisko	**mefisko**	**wizgi**	

AC

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	*jusasko*	**razgi**	sazki
/i/	dziski	chosiski	wisko	**mefisko**	**wizgi**	

LC

	/sk/				/zg/	/zk/
	MASC		NEUT		MASC	MASC
	1 syllable	2 syllables	1 syllable	2 syllables	1 syllable	1 syllable
/a/	baski	gefaski	zasko	*jusasko*	**razgi**	sazki
/i/	dziski	chosiski	*wisko*	***mefisko***	**wizgi**	