The role of noun termination in grammatical gender assignment in Polish

A psycholinguistic study

Kamil Długosz

Previous research has shown that speakers of a variety of languages benefit from formal gender cues, e.g. word ending, when assigning grammatical gender to nouns. However, the extent to which Polish speakers compute gender based on such cues has not yet been examined. Therefore, the goal of this study was to investigate the role of noun termination in gender assignment in Polish on psycholinguistic grounds. The paper reports on a timed Gender Decision Task which was carried out with 24 adult native speakers of Polish. Participants responded significantly faster to gender-transparent than to gender-opaque feminine nouns. However, no effect of noun termination was observed for masculine and neuter nouns. The results provide psycholinguistic evidence that the ending *-a* constitutes the strongest gender cue that Polish speakers can depend on when assigning gender to nouns, arguably because it is the only noun ending that shows high availability and reliability in parallel.

Keywords: grammatical gender; gender assignment; gender access; gender cues; Polish

Długosz, Kamil • Adam Mickiewicz University, Poznań • kamdlu@amu.edu.pl

Die Welt der Slaven 68 (2023) 2, 291–303 DOI: 10.13173/WS.68.2.291

1. Introduction

In a language with grammatical gender, nouns are assigned gender in the lexicon, while other elements, such as determiners, receive gender through agreement with the noun. Languages differ with respect to the principles governing gender assignment. Some languages, such as English, follow semantically-based gender assignment rules, where nouns are allotted to a gender in accordance with their membership in semantic fields and natural sex. In other languages, gender assignment is based on formal aspects of the noun (Kupisch et al. 2013). To illustrate, the word form is an important but not exclusive cue to gender in Russian; for example, nouns ending in a consonant are typically masculine and nouns ending in *-a* are typically feminine (Comrie 1999: 459). There is ample psycholinguistic evidence that speakers of a variety of languages make use of formal cues when assigning gender to nouns (e.g. Tucker et al. 1968, Desrochers et al. 1989, Hohlfeld 2006, Spalek et al. 2008, De Martino et al. 2011, Mastropavlou & Tsimpli 2011, among others). For example, in an offline gender decision task by Hohlfeld (2006), Ger-

man speakers relied on the mappings of noun endings to gender classes when assigning gender to non-words (e.g. *Nub-ung*$_F$).

The goal of the present study is to investigate access to the grammatical gender of inanimate nouns in Polish, a topic that has not been considered in previous research. Descriptive analyses of the Polish gender system (Zaron 2004, Stefańczyk 2007, 2019) clearly indicate that over 99% of all Polish nouns can be assigned to one of the three gender classes (i.e. masculine, feminine, and neuter) based on their ending in the nominative singular. Therefore, this study aims at testing the applicability of these formal gender cues on psycholinguistic grounds. To this end, twenty-four adult Polish speakers took part in a timed Gender Decision Task in which they assigned gender to eighty nouns with transparent and opaque gender marking. Since this study only concerns visual word processing, formal gender assignment rules are considered in terms of morphology, not phonology.

The paper is organised as follows: Section 2 gives an overview of previous research on the role of formal cues in gender access. Section 3 introduces the Polish grammatical gender system. The body of the study is presented in Section 4, and Section 5 discusses the findings.

2. The role of formal cues in gender access

According to the conventional view (e.g. Corbett 1991), there are three different types of gender assignment principles: semantic, morphological, and phonological. Languages with gender differ in the way they make use of these principles. With respect to morphological and phonological cues, languages show different degrees of transparency. Spanish, for example, is said to possess a highly transparent gender assignment system, in which the gender of almost all nouns can be determined based on their suffix (*-o* for masculine, e.g. *carro* 'car$_M$', and *-a* for feminine, e.g. *pelota* 'ball$_F$'; Harris 1991). In contrast, in some languages, such as Norwegian, gender assignment is considered to be opaque (Rodina & Westergaard 2017). That is, from just hearing nouns such as *bok* 'book', *hus* 'house', or *bil* 'car', it is impossible to know their gender.

Previous work on the impact of formal regularities on gender processing has been centred on the dichotomy between nouns with transparent versus opaque endings (e.g. Hohlfeld 2006, Spalek et al. 2008, De Martino et al. 2011, Mastropavlou & Tsimpli 2011). The interest in the relationship between gender and word ending dates back to 1968, when Tucker et al. investigated how native speakers of French assign gender to non-existent nouns. It turned out that participants relied on noun endings associated with the masculine or feminine gender in French. The reliance on formal cues was replicated in subsequent studies of many different languages.

Using a gender decision task, Desrochers et al. (1989) found that French speakers were faster in response to nouns with highly predictive endings compared to nouns with less predictive endings. A similar finding was obtained by Spalek et al.

(2008), who studied the relation between phonological regularities and gender access in French. Participants performed a gender decision task on the noun's gender-marked determiner for nouns presented auditorily. Noun endings with high predictive values were chosen. The nouns could either belong to the gender class indicated by their ending (congruent) or they could belong to the gender class that did not correspond to the predicted gender (incongruent). Participants made gender decisions faster for congruent nouns than for incongruent nouns.

Hohlfeld (2006) addressed the question of whether native speakers of German compute gender based on formal gender-marking regularities. In an offline gender decision task, participants benefited from gender cues when assigning gender to non-words. The important role of noun ending in gender access was also confirmed in Greek. Mastropavlou & Tsimpli (2011) examined whether native speakers of this language assign gender to nouns based on the morphophonological information encoded on noun suffixes. The results demonstrated that noun suffixes provided speakers with gender information, which they used when assigning gender to novel nouns. Importantly, the frequency of co-occurrence of a suffix with a stem turned out to be influential on the preferred interpretation assigned by speakers, which indicates that building gender representations of noun suffixes is frequency-driven.

However, even in languages with transparent gender assignment systems, formal cues are not always available. Therefore, Gollan & Frost (2001) have suggested two distinct mechanisms for accessing grammatical gender. The first mechanism derives gender from its correlation with the noun ending, while the second mechanism uses an abstract representation of grammatical gender without any involvement of formal gender indicators. For example, in the Polish sentence *sofa jest wygodna* 'the sofa$_F$ is comfortable', the noun *sofa* has the ending *-a*, which is strongly associated with the feminine gender. According to the two-mechanism approach, this gender-correlated ending provides an important cue facilitating gender access. While the lexical mechanism always provides the correct gender of a noun, the formal mechanism does not. This is affected by two factors. First, all nouns have their gender explicitly represented in the mental lexicon. Second, formal gender cues can be misleading or absent. In the case of gender-opaque nouns, the use of the formal mechanism is unprofitable or even costly (e.g. Caffarra et al. 2014).

Contrary to the findings discussed above, some researchers have suggested the presence of a single mechanism for gender processing (e.g. Levelt et al. 1999, Jescheniak & Levelt 1994). According to this line of research, gender is an abstract feature stored as part of the lemma entry in the mental lexicon. Since all phonological information is stored at the lexeme level, formal cues that indicate gender belong to this level. Due to the operating principles of discreteness, seriality, and unidirectionality, the proponents of this view claim that gender-marking regularities do not affect gender access (e.g. Hohlfeld 2009: 127). Note, however,

that even though gender is widely recognised as an abstract lexical feature represented in the mental lexicon, the evidence of the involvement of formal cues in gender access discussed above is abundant.

Probabilistic patterns in language use are claimed to play an important role in language acquisition and comprehension (e.g. MacWhinney 1987, Caffarra et al. 2017). When it comes to gender, Hopp (2016: 281) argues that children can rely on high co-occurrence probabilities between determiners and nouns to isolate noun units and map determiners' forms to abstract gender nodes in the lexicon and the remaining units to nouns. As a result, gender assignment is reliably encoded and gender-marked forms function as strong predictive cues for the associated nouns during processing. The stronger the probabilistic form-function mappings, the more easily speakers can detect and rely on them (Mills 1986). As Caffarra et al. (2017: 1069) put it, the strength of such mappings depends on their availability (i.e. how many linguistic items provide a consistent form-function correspondence in a given language?) and on their reliability (i.e. how consistent is the relation between form and function in a given language?). When a probabilistic pattern relates to a high number of items (i.e. high availability) and has few exceptions (i.e. high reliability), it constitutes a strong cue, which is assumed to play a pivotal role in language acquisition and comprehension.

3. Grammatical gender in Polish

The issue of how many gender classes there are in Polish is still a matter of debate in Polish linguistics. Polish distinguishes between masculine, feminine, and neuter, but standard grammar forms (e.g. Grzegorczykowa et al. 1998) tend to split masculine gender into three classes depending on animacy and virility in the accusative case (masculine virile, masculine animate/non-virile, masculine inanimate). However, this classification of nouns by gender is realised by way of their agreement. Since the present study is concerned with gender assignment in the nominative case, the three-way gender distinction is adopted.

The three gender classes are not equally distributed. According to Stefańczyk (2007: 48), masculine includes ca. 50% of all nouns, thus being the most frequent gender class, followed by feminine with a frequency of ca. 40%. Neuter is the least frequent in Polish as it only covers 10% of nouns. Based on an exhaustive corpus analysis, Stefańczyk (2007) points to a series of formal cues that indicate which gender class a noun belongs to. Accordingly, nouns ending in a consonant (-∅) are masculine, nouns ending in *-a* and *-(o)ść* are feminine, and nouns ending in *-o*, *-e*/*-ę*, and *-um* are neuter (see Table 1). Semantic factors, such as sex, also contribute to gender assignment, but the formal cues play a crucial role in this process in Polish.

These gender-to-ending regularities apply to approximately 99% of all nouns included in Stefańczyk's (2007) analysis, meaning that gender assignment in Polish is predictable from the morphological shape of the noun in the nominative singular.

Masculine			
Ending (cue)	-∅ (29 consonant endings)	*-a* (mainly derivatives)	*-o*
Approx. % of all masculine nous	94%	6%	< 0.1%
Example	*stół* 'table'	*doradca* 'adviser'	*misio* 'teddy bear'
Feminine			
Ending (cue)	*-a*	*-(o)ść*	*-yni/-ini*
Approx. % of all feminine nous	85%	14%	< 0.5%
Example	*lampa* 'lamp'	*miłość* 'love'	*bogini* 'goddess'
Neuter			
Ending (cue)	*-o*	*-e/-ę*	*-um*
Approx. % of all neuter nous	41%	53%	6%
Example	*oko* 'eye'	*zwierzę* 'animal'	*monstrum* 'monster'

Table 1: Noun endings in the three gender classes in Polish, prepared by the author based on the corpus analysis conducted by Stefańczyk (2007: 22–48)

However, the formal gender cues differ with respect to their availability (i.e. how often a specific cue is available in the lexicon, MacWhinney et al. 1984), but not so with respect to their reliability (i.e. how often a specific cue is associated with a given gender class, MacWhinney et al. 1984). As can be seen in Table 2, the zero ending (-∅) is the most available gender cue in Polish. However, the zero ending relates to 29 different consonants (i.e. *b*, *c*, *ć*, *d*, *f*, *g*, *h*, *j*, *k*, *l*, *ł*, *m*, *n*, *ń*, *p*, *r*, *s*, *ś*, *t*, *w*, *z*, *ż*, *ź*, *cz*, *dz*, *dż*, *dź*, *rz*, *sz*). Therefore, one may, in fact, distinguish 29

Ending (cue)	**Approx. number of nouns**	**Availability**	**Reliability**
-∅ (29 consonant endings)	19 043	45.8%	95 % (masculine)
-a	16 030	38.5%	92 % (feminine)
-(o)ść	2671	6.4%	99.9% (feminine)
-o	1600	3.8%	97 % (neuter)
-e *-ę*	1960 + 58	4.9%	99.9% (neuter)
-um	233	0.6%	98 % (neuter)
Total	41 595	100.0%	—

Table 2: The availability and reliability of formal gender cues in Polish, calculated by the author based on the corpus analysis conducted by Stefańczyk (2007: 22–48)

separate cues to masculine gender. The ending *-e* unambiguously indicates neuter gender, thus being the most reliable gender cue in Polish. All cues show a very high degree of reliability (> 92%).

Stefańczyk (2007: 47) points out that only 0.7% of all Polish nouns do not conform to any of these formal gender cues. Most of these exceptions are feminine nouns with a zero ending. The remaining exceptions to the gender-to-ending rules are masculine nouns with suffixes typical of feminine and neuter nouns. However, they are predominantly associated with virility and denote male humans (e.g. *doradca* 'adviser'). Taken together, the most efficient way to study gender assignment to gender-opaque inanimate nouns in Polish is to consider the small group of feminine nouns with zero ending.

The strength of gender cues also needs to be analysed in relation to gender agreement patterns, whose consistency varies between the three gender classes:

(1) *ten* *mał-y* *dom*
this.SG.M little-SG.M house.SG.M
'this little house'

(2) *to* *mał-e* *okno*
this.SG.N little-SG.N house.SG.N
'this little window'

(3) *ta* *mał-a* *sofa*
this.SG.F little-SG.F house.SG.F
'this little sofa'

As shown in (3), the feminine suffix *-a*, which corresponds to the noun ending *-a*, is used for both demonstratives and adjectives in the nominative. Regarding the other gender classes, such a correspondence is absent in masculine forms (see (1)). To indicate neuter gender, there are two options for nouns, namely *-o* and *-e*, but only *-o* for demonstratives and *-e* for adjectives (see (2)). Therefore, in terms of gender agreement, the ending *-a* should be considered the most reliable gender cue in Polish.

4. The present study

To investigate access to the grammatical gender of inanimate nouns in Polish, the present study used a Gender Decision Task, requiring explicit retrieval of the gender information from the mental lexicon (e.g. Radeau & Van Berkum 1996, Bobb et al. 2015). Given the previous studies showing the effects of formal principles on gender access in different languages (e.g. Tucker et al. 1968, Desrochers et al. 1989, Hohlfeld 2006, Spalek et al. 2008, De Martino et al. 2011, Mastropavlou & Tsimpli 2011), it is predicted that, in this study, noun termination will influence participants' gender decisions.

More specifically, the first hypothesis is that the ending *-a* will be the strongest gender cue facilitating gender access in Polish, since it shows the highest degree of availability among all gender cues (assuming that the zero ending equates to 29 different cues) and full correspondence with determiners and adjectives. The second hypothesis states that the gender of feminine nouns with opaque termination will be accessed more slowly relative to feminine nouns with gender-transparent termination. This is because the zero ending is strongly associated with the masculine gender. Therefore, the gender of feminine opaque nouns can only be retrieved based on their lexical representations. Finally, the third hypothesis is that the low availability of individual gender cues (ranging from 0.6% to 6.4%, except for the ending *-a*) will negatively affect access to grammatical gender in Polish. Note that all gender cues show a very high degree of reliability, but varying degrees of availability, i.e. frequency in the input. This may prevent Polish speakers from building gender representations based on the morphological information provided by the noun.

4.1 Participants

Twenty-four native speakers of Polish (18 females, 6 males) took part in the experiment. Their mean age was 24.2 years (*SD* = 4.1). All of them knew English at different levels of proficiency, which does not play a role in this study because English does not encode grammatical gender. Note that English is the dominant foreign language in Poland taught to over 96% of children at all levels of education (Statistics Poland 2019), which makes the task of finding participants with no knowledge of English nearly impossible.

4.2 Materials

Eighty Polish nouns were selected from the National Corpus of Polish (https://nkjp.pl/) for this experiment. Four conditions with twenty nouns each were created by dividing the nouns into four categories: masculine, neuter, feminine, and feminine opaque. All nouns were inanimate.

The following noun endings were used as cues to gender: a consonant (*-∅*) as a cue to masculine gender, the endings *-o* (10 nouns) and *-e* (10 nouns) as cues to neuter gender, and the ending *-a* as a cue to feminine gender. In the case of feminine opaque nouns, the ending *-(o)ść* (8 nouns) and different consonants (12 nouns) were used. Here, the six most frequent consonant endings that occur in feminine nouns were selected, with two occurrences each: *-ń*, *-ć*, *-l*, *-dź*, *-cz*, and *-ż* (Stefańczyk 2007: 26, 30). The feminine opaque condition was treated as the baseline; the effect of noun termination on gender access, if any, should manifest as shorter response times to gender-transparent nouns in the other conditions.

Condition	No. of items	No. of letters		Frequency	
		M	*SD*	*M*	*SD*
masculine	20	5.3	1.4	54.2	69.1
neuter	20	5.0	1.1	50.1	58.9
feminine	20	5.3	1.1	50.3	41.6
feminine opaque	20	5.0	1.2	50.0	64.9

Table 3: Characteristics of the noun materials for each of the three gender conditions

The four conditions were matched as closely as possible on number of letters and frequency in Polish, extracted from the National Corpus of Polish using the PELCRA search engine. Mean frequency was established as rounded word frequency per million word tokens in all types of texts available in the corpus. The characteristics of the nouns are summarised in Table 3.

A one-way ANOVA showed that the four conditions did not differ from one another with respect to number of letters ($F(3,76) = 0.15$; $p = 0.926$; $\eta^2 = 0.006$) and frequency ($F(3,76) = 0.01$; $p = 0.996$; $\eta^2 < 0.001$).

4.3 Procedure

The procedure for the Gender Decision Task was as follows: the participants were first presented with a fixation cross (+) for 500 ms on a computer screen. Then, they were visually presented with a Polish bare noun (e.g. *lampa* 'lamp') for 2,000 ms or until a key-press response was recorded. The participants were to make a gender decision on the target noun by pressing one of the response keys labelled "M" (masculine), "F" (feminine), or "N" (neuter) as quickly and accurately as possible. The inter-trial interval was 1,000 ms. The task began with a written instruction in Polish explaining the experimental procedure and a practice block. The presentation of the stimuli was randomised across participants. Stimuli presentation and data recording were controlled by PsyToolkit, web-based software for programming and running reaction-time experiments (Stoet 2010, 2017). The participants were tested individually and received gift cards for a bookstore for their participation.

4.4 Data analysis

The dependent variable in this study was the response time (RT) in milliseconds, which refers to the time needed to make a gender decision. Accuracy was not analysed as it was always in excess of 97%. Out of 1,680 responses, 15 had to be ruled out because they fell outside the 2-second response window (0.89%). Outliers were defined as any RT that was above 2 SDs of the mean. 71 responses met

this criterion and were excluded from the analysis (4.22%). RT values were averaged per participant for each condition.

The distribution of the data was checked based on the Shapiro-Wilk test. Since the assumption of normality was violated in the feminine condition (p = 0.035), the Kruskal-Wallis H test was used to compare the four conditions. For pairwise comparisons within the conditions, a two-sample independent t-test was applied.

4.5 Results

Table 4 presents the gender decision latencies for the four conditions. The Kruskal-Wallis H test provided evidence of a significant difference in RTs between the different groups ($H(3)$ = 29.31, p < 0.001, η^2 = 0.29, with a mean rank score of 51.89 for masculine, 22.17 for feminine, 58.04 for feminine opaque, and 60.06 for neuter nouns). The observed effect size was large (η^2 = 0.29). The post hoc Dunn's

Condition	RTs in milliseconds	
	M	*SD*
Masculine	966.0	134.4
Feminine	789.0	123.6
Feminine opaque	988.0	130.1
Neuter	981.0	116.8

Table 4: Mean RTs for the four conditions

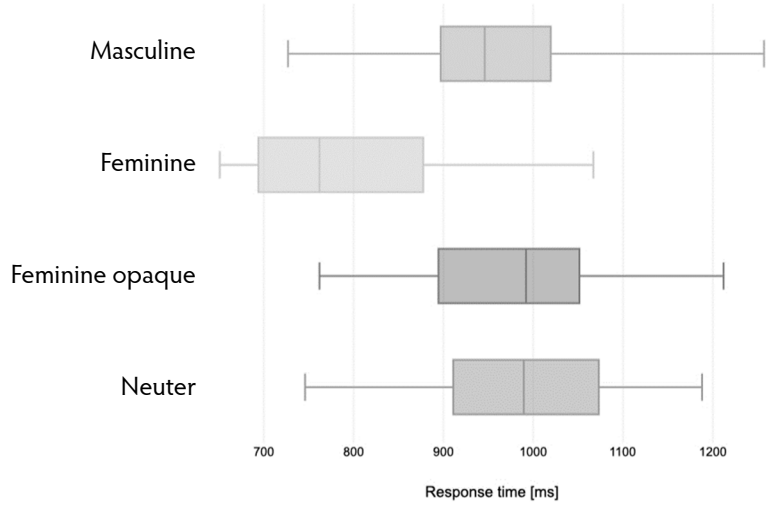

Figure 1: RTs for the four conditions

(The middle lines represent the median values, the boxes represent the first and third quartiles, and the whiskers extend from the minumum to the maximum values, excluding outliers.)

test using a Bonferroni corrected alpha of 0.0083 (0.05/6) indicated that the mean ranks of the following pairs were significantly different: feminine–masculine, feminine–feminine opaque, and feminine–neuter (all *p*s < 0.001). This means that the participants responded significantly faster to feminine nouns ending in *-a* compared to masculine, neuter, and opaque feminine nouns. No significant differences between the other conditions were observed. The RTs by condition are illustrated in Figure 1.

To check whether neuter nouns ending in *-o* were processed differently from those ending in *-e/ę*, and whether feminine nouns ending in *-(o)ść* were processed differently from those ending in another consonant, additional analyses within the neuter and feminine conditions were carried out. A two-sample independent *t*-test showed that the participants did not respond faster to neuter nouns ending in *-o* (M = 980.9, SD = 129.9) than to neuter nouns ending in *-e* (M = 1020.5, SD = 111.5; $t(40) = -1.70$, $p = 0.094$). Furthermore, a two-sample independent *t*-test provided no evidence of a difference between opaque feminine nouns ending in *-(o)ść* (M = 962.9, SD = 141.1) and those ending in another consonant (M = 993, SD = 128.2; $t(40) = 0.77$, $p = 0.221$).

5. Discussion

The aim of this study was to examine the role of noun termination in gender assignment in Polish on psycholinguistic grounds. The results show a very high accuracy in all conditions (always in excess of 97%). This finding clearly indicates that the participants had no trouble deciding the gender of transparent and opaque nouns. However, significant differences between the conditions were observed in the analysis of response time. They are discussed in more detail below with reference to the three hypotheses formulated in this study.

The first hypothesis that the ending *-a* would be the strongest gender cue facilitating gender access in Polish, due to the highest degree of availability among all gender cues and the full correspondence with determiners and adjectives, was supported by the analysis. The Polish speakers in this study needed less time to decide the gender of gender-transparent feminine nouns compared to gender-opaque feminine, masculine, and neuter nouns. This finding suggests that the participants used the ending *-a* as a cue in gender access.

According to the second hypothesis, the gender of feminine nouns with opaque termination would be accessed more slowly relative to feminine nouns with gender-transparent termination. Indeed, the participants were slower to make gender decisions on feminine nouns with a zero ending compared to nouns that end in *-a* (+ 199 ms).

Based on these findings, it is suggested that the two mechanisms for accessing gender proposed by Gollan & Frost (2001) are operative in Polish. This is mainly supported by the results regarding feminine gender. Here, the participants achieved

more than 97% accuracy, which means that they were able to correctly assign gender to both transparent and opaque nouns. Since no gender cues were available to the participants in the case of opaque nouns, they must have used the lexical mechanism to assign gender to these nouns. For transparent nouns, however, a facilitation effect was observed in the response time, suggesting the involvement of the formal mechanism for accessing gender. Therefore, the study confirms previous findings that formal gender cues play an important role in gender access and extends them to Polish.

The fact that the ending *-a* turned out to be the only cue facilitating gender access in Polish can also be explained by probabilistic patterns in language use. As Hopp (2016: 281) puts it, in the course of language development, speakers rely on high co-occurrence probabilities between determiners and adjectives on the one hand and nouns on the other to isolate noun units and map determiner and/or adjective forms to abstract gender nodes. As a result, gender assignment is reliably encoded and gender-marked forms can function as strong predictive cues for the associated nouns in processing. Under this logic, the correspondence between feminine nouns and targets they agree with, for example, demonstratives and adjectives, might be responsible for the facilitation effect observed in accessing feminine gender.

Finally, the third hypothesis stated that the low availability of individual gender cues (ranging from 0.6% to 6.4%, except for the ending *-a*) would negatively affect gender access in Polish. This hypothesis was also confirmed by the analysis, since the gender of masculine and neuter nouns was not retrieved faster relative to the baseline condition (i.e. opaque feminine nouns). Despite the very high reliability of the ending *-e/-ę*, the participants seemed not to use it as a cue when assigning gender to neuter nouns. It appears, therefore, that the frequency of individual gender cues plays a significant role in predicting whether a given cue affects gender access (e.g. Mastropavlou & Tsimpli 2011).

The findings of this study must be seen in the light of certain limitations. First of all, even though the gender decision task has been frequently employed in psycholinguistic literature, it has some drawbacks. It requires the speakers to bring the grammatical gender of the noun into consciousness in order to respond. In real-world settings, there is rarely any reason for having explicit access to gender information. Thus, one may criticise the gender decision task for being prone to task effects and not reflecting normal processing (e.g. Taft & Meunier 1997).

Finally, it was the objective of the study to make a first step towards a better understanding of gender access in Polish by using a Gender Decision Task. Nevertheless, future research should undoubtedly analyse this topic using tasks that do not require explicit access to gender information.

To sum up, this study has shown that the role of formal gender cues in gender access in Polish is limited. Polish speakers only profit from the ending *-a* when

assigning gender to feminine nouns. The other endings, such as the zero ending for masculine nouns and the endings *-o* and *-e/-ę* for neuter nouns, appear not to affect gender access in Polish, at least in a timed Gender Decision Task that requires explicit access to gender information.

References

Bobb, Susan & Kroll, Judith F. & Jackson, Carrie N. 2015. Lexical constraints in second language learning: Evidence on grammatical gender in German. *Bilingualism: Language and Cognition* 18(3). 502–523.

Caffarra, Sendy & Janssen, Niels & Barber, Horacio A. 2014. Two sides of gender: ERP evidence for the presence of two routes during gender agreement processing. *Neuropsychologia* 63, 124–134.

Caffarra, Sendy & Barber, Horacio A. & Molinaro, Nicola & Carreiras, Manuel. 2017. When the end matters: Influence of gender cues during agreement computation in bilinguals. *Language, Cognition and Neuroscience* 32(9). 1069–1085.

Comrie, Bernard. 1999. Grammatical gender systems: A linguist's assessment. *Journal of Psycholinguistic Research* 28(5). 457–466.

Corbett, Greville G. 1991. *Gender*. Cambridge: Cambridge University Press.

De Martino, Maria & Bracco, Giulia & Laudanna, Alessandro. 2011. The activation of grammatical gender information in processing Italian nouns. *Language and Cognitive Processes* 26(4–6). 745–776.

Desrochers, Alain & Paivio, Allan & Desrochers, Sylvie. 1989. L'effet de la fréquence d'usage des noms inanimés et de la valeur prédictive de leur terminaison sur l'identification du genre grammatical. *Revue Canadienne de Psychologie* 43. 62–73.

Gollan, Tamar H. & Frost, Ram. 2001. Two routes to grammatical gender: Evidence from Hebrew. *Journal of Psycholinguistic Research* 30(6). 627–651.

Grzegorczykowa, Renata & Laskowski, Roman & Wróbel, Henryk. 1999. *Gramatyka współczesnego języka polskiego: Morfologia*. Warszawa: PWN.

Harris, James W. 1991. The exponence of gender in Spanish. *Linguistic Inquiry* 22(1). 27–62.

Hohlfeld, Annette. 2006. Accessing grammatical gender in German: The impact of gender-marking regularities. *Applied Psycholinguistics* 27. 127–142.

Hopp, Holger. 2016. Learning (not) to predict: Grammatical gender processing in second language acquisition. *Second Language Research* 32(2). 277–307.

Jescheniak, Jörg D. & Levelt, Willem J. M. 1994. Word frequency effects in speech production: Retrieval of syntactic information and of phonological form. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 20(4). 824–843.

Kupisch, Tanja & Akpinar, Deniz & Stöhr, Antje. 2013. Gender assignment and gender agreement in adult bilinguals and second language learners of French. *Linguistic Approaches to Bilingualism* 3(2). 150–179.

Levelt, Willem J. M. & Roelofs, Ardi & Meyer, Antje S. 1999. A theory of lexical access in speech production. *Behavioral and Brain Sciences* 22(1). 1–75.

MacWhinney, Brian. 1987. The competition model. In MacWhinney, Brian (ed.), *Mechanisms of language acquisition*, 249–308. Hillsdale (NJ): Lawrence Erlbaum.

MacWhinney, Brian & Bates, Elizabeth & Kliegl, Reinhold. 1984. Cue validity and sentence interpretation in English, German, and Italian. *Journal of Verbal Learning and Verbal Behavior* 23(2). 127–150.

Mastropavlou, Maria & Tsimpli, Ianthi M. 2011. The role of suffixes in grammatical gender assignment in Modern Greek: A psycholinguistic study. *Journal of Greek Linguistics* 11. 27–55.

Mills, Anne E. 1986. *The acquisition of gender: A study of English and German*. Berlin: Springer.

Radeau, Monique & Van Berkum, Jos J. A. 1996. Gender decision. *Language and Cognitive Processes* 11. 605–610.

Rodina, Yulia & Westergaard, Marit. 2017. Grammatical gender in bilingual Norwegian-Russian acquisition: The role of input and transparency. *Bilingualism: Language and Cognition* 20(1). 197–214.

Spalek, Katharina & Franck, Julie & Schriefers, Herbert & Frauenfelder, Ulrich H. 2008. Phonological regularities and grammatical gender retrieval in spoken word recognition and word production. *Journal of Psycholinguistic Research* 37(6). 419–442.

Statistics Poland. 2019. *Education in the 2018/2019 school year*. https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5488/1/14/1/oswiata_i_wychowanie_w_roku_szkolnym_2018_2019_korekta_12-02-2020.pdf (retrieved 12 Feb 2022).

Stefańczyk, Wiesław T. 2007. *Kategoria rodzaju i przypadka polskiego rzeczownika*. Kraków: Wydawnictwo UJ.

Stefańczyk, Wiesław T. 2019. O rodzaju żeńskim we współczesnym języku polskim. *Kwartalnik Polonicum* 31/32. 46–51.

Stoet, Gijsbert. 2010. PsyToolkit: A software package for programming psychological experiments using Linux. *Behavior Research Methods* 42. 1096–1104.

Stoet, Gijsbert. 2017. PsyToolkit: A novel web-based method for running online questionnaires and reaction-time experiments. *Teaching of Psychology* 44(1). 24–31.

Taft, Marcus & Meunier, Fanny. 1997. Lexical representation of gender: A quasiregular domain. *Journal of Psycholinguistic Research* 27(1). 23–45.

Tucker, Richard G. & Lambert, Wallace E. & Rigault, André A. & Segalowitz, Norman. 1968. A psychological investigation of French speaker's skill with grammatical gender. *Journal of Verbal Learning and Verbal Behavior* 7. 312–316.

Zaron, Zofia. 2004. *Aspekty funkcjonalne polskiej kategorii rodzaju: Charakterystyka fleksyjna*. Warszawa, Puńsk: Aušra.

Appendix: Test items

Masculine: *stół, pociąg, cień, ekran, głód, list, błąd, początek, ogród, dworzec, most, dom, kwiat, chleb, pokój, koniec, środek, rower, przykład, prezent;*

neuter: *życie, okno, zdjęcie, serce, piwo, zboże, pole, światło, słowo, oko, jabłko, wesele, zadanie, zdrowie, mleko, pranie, miasto, łącze, ciało, niebo;*

feminine: *róża, decyzja, praca, prośba, ręka, grupa, firma, lalka, ulica, godzina, stopa, oferta, książka, droga, burza, rozmowa, głowa, cena, wojna, woda;*

feminine opaque: *część, treść, kość, korzyść, radość, pięść, ilość, wieść, dłoń, broń, sieć, postać, sól, stal, łódź, powódź, rozpacz, rzecz, młodzież, podróż.*