

## Masculine animate as a subgender of masculine in Polish: Evidence from psycholinguistics

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**ABSTRACT**

This paper investigates grammatical gender and animacy distinctions in Polish. Differences in agreement morphology between masculine animate nouns and masculine inanimate nouns have long motivated debates regarding the number of gender categories in Polish. The present paper contributes to this discussion from the perspective of psycholinguistics. Evidence from native Polish speakers' gaze patterns collected during an eyetracking study using the Visual World Paradigm suggests that, during real-time language processing, when speakers hear an adjective suffixed with the masculine animate accusative morpheme *-ego*, this activates a masculine gender feature and an independent animacy feature. This constitutes evidence in support of treating gender and animacy as independent noun categorization systems in Polish.

**KEYWORDS** animacy · Polish · psycholinguistics · eyetracking

### 1 INTRODUCTION

Slavic languages have grammatical gender, a system of noun categorization that interacts with agreement patterns in the language (Stankiewicz 1986, Corbett 1991); the relevant categories are labeled masculine, feminine, and neuter. Which gender category a noun belongs to can sometimes be determined based on real-world properties of the referent (ex. Polish *kura* 'chicken(F)', *kogut* 'rooster(M)'), but for most inanimate nouns this categorization is largely arbitrary. Nevertheless, this category information is important to the grammar, as a noun's category information interacts with the syntax in determining agreement morphology on other elements in the clause, both in the nominal domain (demonstratives, adjectives) and in the verbal domain on verbs in certain tenses. In languages with case, a noun's gender category information may also be relevant to which declensional class it belongs to.

Many Slavic languages also have a secondary system of noun categorization that intersects with the first – nouns in languages such as Polish, Russian, and Czech may be categorized for animacy (for an overview, see Stankiewicz 1986, Kosta 2003). However, unlike the broader categorization by grammatical gender, distinctions in animacy seem to be fairly restricted – they typically arise only for nouns in the masculine category and typically only have reflexes in a restricted part of the case paradigm, though details vary between Slavic languages (Kosta 2003 provides an overview of the specifics, and notes that the animacy distinctions are distributed much differently in Southern Slavic languages from the other Slavic languages).

This empirical picture has raised a number of questions in the morphosyntactic literature on Slavic languages regarding the status of grammatical gender and animacy categorization and regarding the internal structure of gender features in these languages. This paper considers the case of Polish, in which animacy distinctions arise in the masculine accusative singular. The differences in agreement morphology between masculine animate nouns and masculine inanimate nouns in Polish have motivated debates regarding whether categorization for animacy is really an independent (sub)categorization

	Singular			Plural		
	M	F	N	M	F	N
Nominative	zielony	zielona	zielone	zielone	zielone	zielone
Genitive	zielonego	zielonej	zielonego	zielonych	zielonych	zielonych
Dative	zielonemu	zielonej	zielonemu	zielonym	zielonym	zielonym
Accusative	zielony	zieloną	zielone	zielone	zielone	zielone
Instrumental	zielonym	zieloną	zielonym	zielonymi	zielonymi	zielonymi
Locative	zielonym	zielonej	zielonym	zielonych	zielonych	zielonych

Table 1: An illustration of the inflectional paradigm of three global (inanimate) genders in the singular and plural of six cases for the adjective *zielony* ‘green’.

system or whether masculine animate nouns in fact constitute their own grammatical gender category in this language (Corbett 1983, Mańczak 1956, Swan 2015, Szober 1963).

This paper contributes to this discussion from a psycholinguistic perspective using an eyetracking study in the Visual World Paradigm (Tanenhaus et al. 1995). Existing work on the processing of gender categories and agreement in gender allows clear predictions to be made that link hypotheses from the morphosyntactic literature regarding whether masculine animate nouns constitute their own gender category to patterns in eye movements during language processing that we would expect to observe under each hypothesis. Based on the results, this study offers support for the claim that categorization for animacy is in fact independent of categorization for grammatical gender in Polish, and offers avenues for further exploration of the interplay between gender and animacy in this language.

## 2 BACKGROUND

### 2.1 GRAMMATICAL GENDER & ANIMACY DISTINCTIONS IN POLISH

Given that correspondence between gender category and noun morphophonology is not one-to-one, evidence for gender categorization is usually found in the inflectional paradigms of associated agreeing elements (Hockett 1958). In Polish, agreeing elements include predicative and attributive adjectives, demonstrative pronouns, relative pronouns, and verbs in the past tense (Swan 2015). These are inflected to agree with a head noun not only in grammatical gender but also in number and (with the exception of verbs) in case. This is illustrated in Table 1; how animacy plays a role in this paradigm will be introduced shortly.

One property of this paradigm that has fueled debates regarding gender categories in Polish is the amount of syncretism in inflectional suffixes across the gender categories. In the plural, for instance, the paradigms for masculine, feminine, and neuter are mostly syncretic (exceptions will be discussed below). In the singular, the inflectional suffixes for the feminine are distinct from the other two categories, while the masculine and neuter suffixes are syncretic in all but the nominative and accusative cases.

It is in the accusative case that distinctions in animacy arise. Recall that, in most Slavic languages, the scope of animacy is fairly restricted to small parts of the paradigm (Kosta 2003), and Polish is similar in this respect: animacy distinctions are evident only for masculine nouns, and specifically in the accusative singular (Table 2). An adjective agreeing with a masculine inanimate noun in the accusative singular will be suffixed with *-y* (or *-i*, based on phonological properties of the adjective), while an adjective agreeing with a masculine animate noun in the accusative singular will be suffixed with *-ego* (1-a), which in turn is syncretic with the masculine genitive singular agreement marker (Corbett 1983, Kosta 2003). Neuter and feminine nouns show no animacy distinctions, as in (1-b) and (1-c).

	Singular		Plural			
	Animate	Inanimate	Personal	De-virilized	Animate	Inanimate
Nominative	zielony	zielony	zieloni	zielone	zielone	zielone
Genitive	zielonego	zielonego	zielonych	zielonych	zielonych	zielonych
Dative	zielonemu	zielonemu	zielonym	zielonym	zielonym	zielonym
Accusative	zielonego	zielony	zielonych	zielonych	zielone	zielone
Instrumental	zielonym	zielonym	zielonymi	zielonymi	zielonymi	zielonymi
Locative	zielonym	zielonym	zielonych	zielonych	zielonych	zielonych

Table 2: An illustration of the inflectional paradigm for the adjective *zielony* ‘green’ of subtypes of masculine nouns.

- (1) a. masculine  
*zielony zegar* (NOM) → *zielony zegar* (ACC) ‘green clock’  
*zielony żółw* (NOM) → *zielonego żółwia* (ACC) ‘green turtle’
- b. feminine  
*zielona książka* (NOM) → *zieloną książkę* (ACC) ‘green book’  
*zielona żaba* (NOM) → *zieloną żabę* (ACC) ‘green frog’
- c. neuter  
*zielone jabłko* (NOM) → *zielone jabłko* (ACC) ‘green apple’  
*zielone zwierzę* (NOM) → *zielone zwierzę* (ACC) ‘green animal’

In the plural, again in the nominative and accusative case, a few other (semantic) properties of nouns become relevant to the inflectional paradigms (Table 2). The accusative plural agreement suffix for masculine personal nouns (ex. *mężczyzna* ‘man’, *artysta* ‘artist’) and masculine de-virilized nouns (masculine nouns that refer to humans but bear a pejorative connotation, ex. *brzydal* ‘ugly person’, *leń* ‘lazy person’) is *-ych*, syncretic with the genitive plural in all three genders. Adjectives agreeing with masculine personal nouns in the nominative plural have a unique inflectional suffix, *-i*. While the focus of the present paper is on the distinction between animate and inanimate masculine nouns in the singular, these additional distinctions in the plural may be a fruitful domain for future work following the vein established by the present study (cf. §4).

## 2.2 THE NUMBER OF GENDER CATEGORIES IN POLISH

Given that agreement markers are considered to be the most reliable method of determining gender category membership in a language, as mentioned previously (Hockett 1958, Corbett 1991, Kramer 2015), the patterns illustrated above have led to debate as to the precise number of gender categories in the Polish grammar. In question is whether the groups of nouns with minimally different inflection paradigms should constitute their own gender categories – essentially making Polish not a three-gender system but a gender system with four (or more) gender categories – or whether they are subdivisions of the masculine.

On the basis of accusative case marking on adjectives, Mańczak (1956) argues for a five-gender system: masculine personal (M1), masculine animate (M2), masculine inanimate (M3), feminine, and neuter. This is the system adapted also by the Polish grammar *Gramatyka współczesnego języka polskiego* (Dukiewicz & Urbańczyk 1984) and by Przepiórkowski’s 2003 analysis of the internal structure of Polish gender couched within the HPSG framework. In contrast, Szober (1963) and Swan (2015) do not consider the masculine animate to constitute its own category. Szober (1963) proposes a five-gender system wherein there are three genders in the singular (masculine, feminine, neuter) and two in the plural (personal vs all others); Swan (2015) suggests a four-gender system with categories masculine, feminine, neuter, and personal. On the basis of adjectival agreement paradigms in all syntactic cases, Corbett (1983) considers Polish

to have three global genders (masculine, feminine, and neuter), with masculine animate, masculine personal, and masculine de-virilized as “subgenders” of masculine, which he defines as noun classes with minimally different agreement paradigms which are not evident in the nominative singular.

The present paper contributes to this debate by bridging formal and psycholinguistic work. Formal work on the morphosyntax of gender in Polish and beyond (Hockett 1958, Corbett 1991) takes the paradigms of inflectional suffixes on agreeing elements to be primary evidence for gender categorization in a language. In this spirit, the present psycholinguistic study investigates what happens during language comprehension of these suffixes. Specifically, the study asks what gender feature(s) is/are activated when speakers encounter the masculine animate accusative singular suffix *-ego* in a sentence. Existing psycholinguistic work on grammatical gender has a good understanding of how grammatical gender categories are represented in the mental lexicon and how gender agreement marking is processed (see §2.4). Extending this work allows for clear predictions regarding the language processing of the relevant suffix, based on whether masculine animate nouns constitute their own gender category, or whether categorization for animacy constitutes an independent (sub)categorization of nouns in the language. By offering insight into what the status of these categories is in the mental lexicon of native Polish speakers, the present paper proposes to contribute to formal morphosyntactic debates concerning the number of genders in Polish. Before discussing the details of this study, however, the following section provides further discussion of animacy distinctions in Polish, in particular how these distinctions do not always align with semantic animacy.

### 2.3 ISSUES IN CATEGORIZATION BY “ANIMACY”

While typically referred to as “masculine animate”, the set of nouns in Polish – much like in other Slavic languages – that determine the “masculine animate” agreement paradigm (cf. Table 2) includes many nouns that are not in fact semantically animate. Consider for instance the examples in (2), which show that adjectives agreeing with semantically inanimate nouns such as *muchomor* ‘toadstool’ and *szampan* ‘champagne’ in the accusative singular unexpectedly take the suffix *-ego*.

- (2) a. Znalaz-ł-am piękn-ego muchomor-a.  
 find-PST-1SG.F beautiful-ANIM.ACC.SG toadstool(M)-ANIM.ACC.SG  
 ‘I found a beautiful toadstool.’  
 b. Kupi-ł-am drog-iego szampan-a.  
 buy-PST-1SG.F expensive-ANIM.ACC.SG champagne(M)-ANIM.ACC.SG  
 ‘I bought expensive champagne.’

These constitute just a few examples of semantically inanimate masculine nouns in Polish that behave in this way. Attempts to capture which types of nouns belong in this category have shown that while some of these nouns may have plausible ties to semantic animacy (ex. names of dead bodies), others are far from it (Bogusławski 1986, Kosta 2003, Fuchs 2014). Bogusławski (1986) provides the following list of masculine nouns that fall into the “animate” category (per the agreement morphology they determine) despite being semantically inanimate: “(a) name of a being, or (b) the name of a dead being, or (c) a name of a dead body, or (d) a name of a mushroom, or (e) a brand name of an automobile, or (f) a brand name of an airplane, or (g) a name of a game, or (h) a name of a kind of dance, or (i) a name of a monetary unit, or (j) a name of a cigarette...”. Kosta (2003) expands this list to include “(k) names of diseases ... (l) drinks ... and journals or buses”. Fuchs (2014) notes that recent loanwords from English as well as nonce words thought to be in English are productively treated as belonging to this category as well.

That some semantically inanimate nouns pattern with masculine animate nouns in the form of inflectional morphology they determine on agreeing elements adds an additional layer to the debate over masculine animate as a gender category of its own.

It is very typical, in languages with gender systems, for gender categories to contain not only a semantic core of nouns whose semantic or conceptual gender predictably places them in a certain category (ex. *kura* ‘chicken(F)’, *kogut* ‘rooster(M)’) but also a wide range of nouns whose semantic or real-world properties do not match the semantic core (ex. *dziewczę* ‘girl(N)’) or do not provide any semantic basis for categorization (ex. inanimate nouns such as *stół* ‘table(M)’ and *biurko* ‘desk(N)’) (Corbett 1991). If masculine animate constitutes a gender category in Polish, certainly the observation that it has both a semantic core of semantically animate nouns (ex. masculine animals such as *żółw* ‘turtle(M)’) and many nouns whose membership in this category is not predictable from the real-world properties of their referents (ex. *muchomor* ‘toadstool(M)’) would be consistent with such crosslinguistic observations regarding gender categorization systems.

Going forward in this paper, nouns for which agreeing adjectives in the accusative singular must be inflected with *-ego* will continue to be referred to as masculine animate, even though, as this section has shown, nouns in this category are far from exclusively semantically animate. In addition, in the experimental design, only masculine animate nouns that are semantically animate will be included, though future work may incorporate semantically inanimate nouns in this set into the experimental design to further explore the role of semantic features in the category distinctions discussed herein (see further discussion in §4).

#### 2.4 RESEARCH QUESTIONS & PREDICTIONS

The primary research question of this study is whether masculine animate nouns constitute a separate gender category or rather a subcategory of masculine nouns in the mental grammar of Polish speakers. Given that in the accusative the agreement suffix *-ego* is the one that distinguishes between agreement with nouns of these two types, the matter can be targeted in an experimental setting by investigating what agreement feature(s) are activated during language comprehension when listeners encounter this suffix in the speech stream.

The logic is as follows. We know from previous work (ex. Fuchs 2022), that when listeners encounter an adjective with a feminine agreement suffix (ex. *zielon-a* ‘green-F’), this activates a feminine feature, which for ease of exposition we will label [F].<sup>1</sup> This works analogously for neuter [N]. Now, if masculine animate nouns in fact constitute their own category, then *-ego* bears a single gender feature, which for ease of exposition we will label [M<sub>2</sub>], using the label corresponding to masculine animate nouns proposed by Mańczak (1956). Analogously, under this hypothesis, agreement with masculine inanimate items is featurally represented as [M<sub>3</sub>]. If, however, masculine animate nouns constitute some subdivision of masculine nouns based on an independent featural distinction, then we expect *-ego* to bear a masculine feature [M] in addition to the feature that makes the the animacy differentiation – here we will label it [+A]. Under this alternate hypothesis, analogously, agreement with masculine inanimate nouns will be featurally represented as [M] and [-A]. The crucial difference between the hypotheses then is the number and nature of features on the accusative singular agreement suffix *-ego*. If masculine animate nouns constitute their own gender category, then *-ego* carries a single gender feature [M<sub>2</sub>], and only this feature should be activated during real-time language processing; under the alternative hypothesis, *-ego* carries two features [M] and [+A], both of which should be activated during language processing.

An experimental paradigm well suited to test what features are activated by an agreement suffix is testing facilitative processing in the Visual World Paradigm (Tanenhaus et al. 1995). In this type of study, participants view a set of images on the screen and hear a prompt that includes an agreeing element that, crucially, precedes the target noun.

<sup>1</sup>I remain agnostic as to whether this is a privative or binary feature, i.e. [F] or [+F], as this matter is tangential to the goals of the present paper. The same goes for the other gender category features discussed herein.

Using an eyetracker, participants' gaze – assumed to reflect attention and consequently linguistic processing – is observed from the moment they hear the relevant agreement morpheme. It is commonly found that, even prior to hearing the target noun, participants direct their gaze more toward items on the screen that match the agreement feature(s) on the preceding element than toward those that do not (for work on Slavic languages, see Aumeistere et al. 2022, Fuchs 2022, Sekerina 2015). The mechanism understood to underly these effects is the following. In a language with grammatical gender, the mental lexicon has an abstract feature node corresponding to each gender category; each node is linked to all lemmas for nouns in the language that belong to that gender (Roelofs 1992, Levelt et al. 1999). When a listener encounters an agreement morpheme in the speech stream, it is thought that listeners are able to access this abstract agreement feature on the morpheme, which activates the relevant gender feature node in the mental lexicon. This spreads activation to all the nouns linked to that node, thus “pre-activating” nouns in that gender category. Once this happens, the listener may direct their gaze to the candidate(s) on the screen that align with the information that has been pre-activated.<sup>2</sup> Once the listener starts hearing the noun itself and has to search their mental lexicon, word recognition can proceed faster because a subset of nouns that includes the target noun has been pre-activated.

In this experimental setting then, we can investigate what features are activated when participants encounter an adjective in the accusative singular ending in *-ego* by observing what elements in the visual display participants direct their gaze to. If *-ego* realizes a single gender category agreement feature [M2], then when participants hear the suffix, it should pre-activate only those items that belong to this category. In other words, participants will mainly consider masculine animate nouns in the visual display; nouns that are masculine inanimate or feminine animate will not be considered by the participants, because they do not match the [M2] feature. If, on the other hand, *-ego* realizes two independent features [M] and [+A], then participants may consider masculine inanimate and feminine animate items. This is because, under this hypothesis, *-ego* activates the masculine gender node – spreading pre-activation to masculine nouns regardless of animacy – as well as an animate node, spreading pre-activation to all animate nouns, regardless of gender. Masculine inanimate nouns match in [M] but not in [+A], and feminine animate nouns match in [+A] but not in [M]. Thus, it is participants' gaze patterns to items on the screen that are partial-matches that will adjudicate between the two hypotheses regarding masculine animate in the Polish mental lexicon.

### 3 EXPERIMENT

#### 3.1 METHOD

To test what feature(s) is/are activated by accusative *-ego* during real-time processing using eyetracking in the Visual World Paradigm, the study involved participants looking at displays of three images at a time and being prompted by a sentence such as *Wskaż zielonego żółwia* ‘Indicate the green turtle.ACC.’ Participants were instructed to click on the image that corresponded to the noun in the prompt, i.e. the target item. The prompt always began with *wskaż* ‘indicate’ and was followed by a color adjective (*zielon-* ‘green’, *brązow-* ‘brown’, or *różow-* ‘pink’) inflected to agree with the target noun in gender, number (always singular), and case (always accusative); this adjective was followed by the target noun inflected always in the accusative singular. All auditory prompts were recorded by a male native speaker of Polish living in Poland. The Covered Box Paradigm (Schwarz et al. 2016) was also incorporated into this experimental method, with one of the three images covered by an opaque black square until zooms after the onset of

<sup>2</sup>This discussion assumes an interactive activation model of the mental lexicon (McClelland & Rumelhart 1981, Rumelhart & McClelland 1982). While the remainder of the discussion and proposal do not necessarily hinge on the exact model of the mental lexicon assumed, for concreteness the assumptions are made clear here.

the noun in the auditory prompt. In half of the trials, the box was over the target item (Figure 1). All critical conditions (see Table 3 below) involved the box being over the target item; for counter-balancing, in half of the trials the box was over a non-target item. The location of the target item in one of the three spots in the display was randomized.

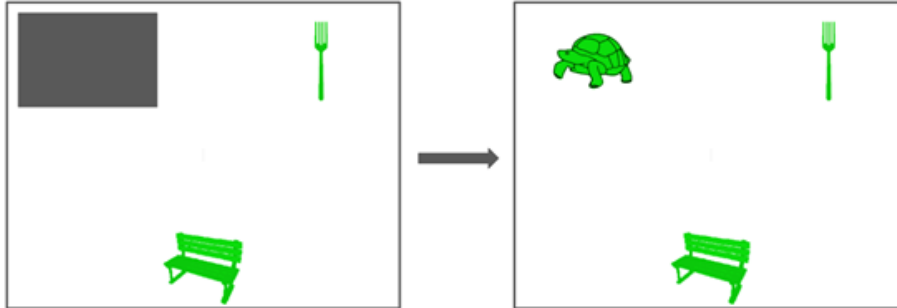


Figure 1: Sample visual display with target covered by box; the box disappears at 3500ms after the start of the trial.

40 images were selected and combined into displays. 20 of these images represented masculine nouns and 20 represented feminine nouns. Within each of these sets, 10 represented animals (animate items) and 10 represented inanimate items. There were a total of 320 displays; each participant saw 160 displays.

All conditions were appropriately counterbalanced. In the crucial experimental conditions, the target item was masculine animate and covered by the box, and the distractor was feminine inanimate, sharing no features – gender or animacy – with the target item. The third item – the competitor – crucially varied (Table 3). The no-match and full-match conditions were the control conditions. In the no-match condition, the competitor (like the distractor) was also feminine inanimate; it was expected that in this condition participants would most quickly anticipate the masculine animate target item under the box, as none of the visible candidate items match the feature content of the *-ego* suffix on the adjective, regardless of whether its featural content is [M2] or [M] and [+A]. In the full-match condition, the competitor (like the target) was also masculine animate; this condition was expected to have the slowest looks to the target item under the box, since until the onset of the noun in the auditory prompt, one of the items on the screen fully matched the available featural information (again, under either hypothesis) and was thus a plausible candidate. As soon as participants heard the first few phonemes of the noun, it would be clear that the visible items did not match what they were hearing, and only then would they direct their gaze to the box in anticipation of the target item being revealed. In addition to these baseline conditions, there were two partial-match conditions. In the partial-match-animacy condition, the competitor was feminine animate. If encountering *-ego* in the prompt activates a single [M2] feature, then a feminine noun (regardless of animacy) does not match this feature and thus the partial-match-animacy condition should be effectively equivalent to the no-match condition. If, however, *-ego* activates two independent features [M] and [+A], then participants' gaze may be drawn to the feminine animate competitor. This is because [M] would pre-activate all masculine nouns in the mental lexicon, regardless of animacy, while [+A] pre-activates all animate nouns in the mental lexicon, regardless of gender. Thus feminine animate competitors should receive some pre-activation, and thus under this hypothesis the partial-match-animacy condition should be crucially different than the no-match condition. The logic and predictions follow analogously for the partial-match-gender condition, in which the competitor was masculine inanimate.

For a table of all experimental conditions, as well as details of the experimental design, please see online repository (link given in the caption of Table 3). 46 native speakers

	(Covered) target		Competitor		Distractor	
	Gen.	Anim.	Gen.	Anim.	Gen.	Anim.
full-match	M	A	M	A	F	I
no-match	M	A	F	I	F	I
partial-match-animacy	M	A	F	A	F	I
partial-match-gender	M	A	M	I	F	I

Table 3: Critical experimental conditions. For a full list of conditions, see online repository at [https://osf.io/p9s8w/?view\\_only=19a68033c0774928a6ba08c38a58503c](https://osf.io/p9s8w/?view_only=19a68033c0774928a6ba08c38a58503c).

of Polish living in Warsaw, Poland, participated in the study, which was conducted at a university in Warsaw using an Eyelink Portable Duo. The eyetracker was calibrated using a 9-point calibration, and participants' heads were not stabilized. The session started with three practice trials, followed by three blocks of experimental trials. Participants could take a break between each block, and the eyetracker was recalibrated before starting the next block. Participants were compensated for their time.

### 3.2 RESULTS

The proportion of looks to the target item between the onset of the agreement suffix (2600ms) and the disappearance of the box (3500ms; 200ms after the onset of the noun in the auditory prompt) for trials in the critical conditions (Table 3) was analyzed and compared. Because these are looks that occur prior to the target item being visible on the screen, they can be assumed to reflect anticipatory processing, wherein participants have used featural information on the agreement suffix to pre-activate the noun in their mental lexicon and thus direct their gaze to where they expect the corresponding image to be revealed. Of particular interest is whether participants looked slower to the target item in the partial-match conditions than in the no-match conditions, which would suggest that the presence of a partial-match competitor slowed participants' gaze to the target item.

Figure 2 shows the proportion of looks to the target item compared between the full-match, no-match, and partial-match-animacy condition trials; Figure 3 shows the proportion of looks to the target item compared between the full-match, no-match, and partial-match-gender condition trials. A visual assessment of both plots suggests that looks to the target in the partial-match conditions are between those of looks to the full-match and no-match conditions, which will be statistically tested and verified below.

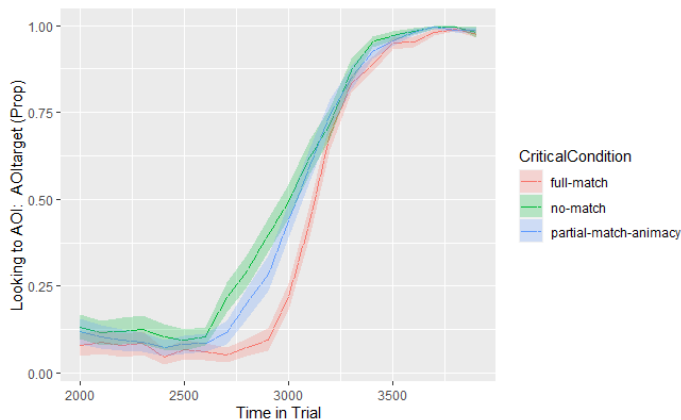


Figure 2: Looks to target for partial-match-animacy condition trials.



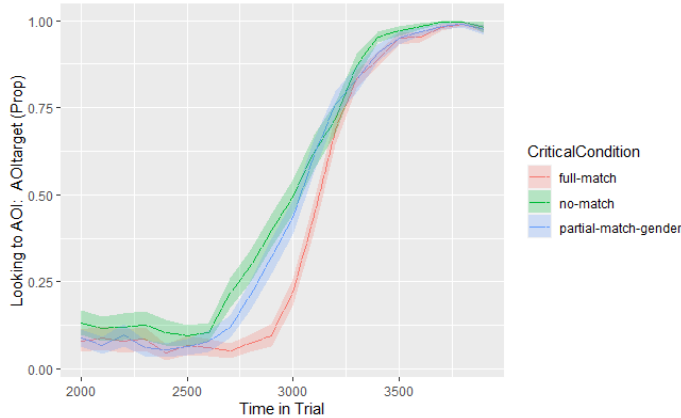


Figure 3: Looks to target for partial-match-gender condition trials.

Growth Curve Analysis (Mirman et al. 2008, Mirman 2014) was used to analyze target gaze data after the onset of the suffix *-ego* in the auditory prompt. This type of analysis models looks to the target item over time and is good for capturing changes in the curvilinear nature of the data. The time course of fixations to the target was modeled using a third-order orthogonal polynomial and a fixed effect of condition and its interaction with all time terms, as well as random intercepts grouped by participant and by item. Models with random slopes grouped by participant were fitted to the data but resulted in singular fit. Degrees of freedom and corresponding p-values were calculated using Satterthwaite's method.

First, a model was fitted to the data comparing the partial-match-gender condition to the full-match and no-match conditions (cf. Figure 3). Because the research question hinges on comparing the partial-match condition to each of the two control conditions, in this model the Condition variable was a three-level categorical variable simple-coded with partial-match-gender set as the reference level. The model found a marginal main effect of the full-match condition relative to the partial-match-gender condition ( $\beta = -0.42$ ,  $SE = 0.20$ ,  $t = -2.05$ ,  $p = 0.0503$ ). Crucially, the model found a significant difference in the effect of condition on the quadratic term for the full-match condition relative to the partial-match-gender condition ( $\beta = 1.97$ ,  $SE = 0.28$ ,  $t = 7.01$ ,  $p < 0.001$ ), indicating shallower curvature and thus slower word recognition of the target noun in the full-match condition. The model also found a significant difference in the effect of condition on the quadratic term for the no-match condition relative to the partial-match-gender condition ( $\beta = -0.71$ ,  $SE = 0.28$ ,  $t = -2.48$ ,  $p = 0.01$ ) indicating less shallow curvature and thus faster word recognition in the no-match condition. Full results of this model as well as of the model discussed below are available in the online repository at [https://osf.io/p9s8w/?view\\_only=19a68033c0774928a6ba08c38a58503c](https://osf.io/p9s8w/?view_only=19a68033c0774928a6ba08c38a58503c).

Second, a model was fitted to the data comparing the partial-match-animacy condition to the full-match and no-match conditions (cf. Figure 2). Once again the Condition variable was a three-level categorical variable, this time simple-coded with partial-match-animacy set as the reference level, in order to compare this condition to each of the control conditions. The model found a main effect of the full-match condition relative to the partial-match-animacy condition ( $\beta = -0.40$ ,  $SE = 0.19$ ,  $t = -2.15$ ,  $p = 0.04$ ). In addition, the model found a significant difference in the effect of condition on the quadratic term for the full-match condition relative to the partial-match-animacy condition ( $\beta = 1.63$ ,  $SE = 0.28$ ,  $t = 5.87$ ,  $p < 0.001$ ), indicating shallower curvature and thus slower word recognition in the full-match condition. The model also found a significant difference in the effect of condition on the quadratic term for the no-match condition relative to the partial-match-animacy condition ( $\beta = -1.06$ ,  $SE = 0.28$ ,  $t = -3.77$ ,  $p < 0.001$ ) indicating less

shallow curvature and thus faster word recognition in the no-match condition.

#### 4 DISCUSSION

The previous section presented the analysis of participants' looks to the target item in conditions in which the target item – covered by a box until after the onset of the noun in the auditory prompt – was masculine animate and thus preceded by an adjective suffixed with *-ego*. As expected, in no-match conditions in which both of the two visible images on the screen represented feminine inanimate nouns, after hearing *-ego* participants were fastest to look at the box in anticipation of the target item occurring there. The opposite is true for full-match conditions, in which the visible competitor was masculine animate (like the target), and thus participants were slowest to look at the box, since the visible competitor was a viable candidate until the onset of the noun in the auditory prompt. Crucially, in the partial-match conditions, in which the competitor matched the target item in either grammatical gender (masculine inanimate) or animacy (feminine animate) but not both, looks to the target item were reduced relative to the no-match condition but still faster than in the full-match condition. This suggests that participants do direct their attention to partial-match competitors during the process of word recognition in this experimental setting.

With respect to the research question, this pattern in participant gaze is consistent with an account in which *-ego* realizes two independent features – a gender feature [M] and an independent animacy feature [+A]. Recall that if masculine animate nouns in Polish constitute a single gender category and thus determine agreement in a single gender feature [M<sub>2</sub>], then partial-match conditions should have effectively patterned with no-match conditions. Instead, the results point to there not being a single category feature [M<sub>2</sub>] activated by accusative *-ego* during real time processing of this agreement suffix, as upon hearing the suffix participants do direct their gaze to competitors that are masculine but not animate, as well as to competitors that are animate but not masculine. It appears then that masculine animate nouns do not constitute a single gender category in the mental grammar of native Polish speakers. Instead, they are categorized as masculine nouns, with an additional and independent specification for (in)animacy. This is a claim about the structure of the mental lexicon of native speakers of Polish and what agreement features are activated during language processing of agreement morphemes, but it has implications for the debates in the morphosyntactic literature regarding the number of genders in Polish: It is consistent with proposals in which the list of genders in Polish does not include masculine animate as a separate gender category (Corbett 1983, Swan 2015, Szober 1963).

This is, of course, clearly and deliberately a first step in the investigation of what processing patterns of agreement morphemes in Polish can tell us about the mental representation of noun categorization in this language. Further questions arise in two directions. First is the matter of semantic animacy. As was made clear in §2.3, the masculine animate category contains a substantial number of nouns that are not in fact semantically animate. It may therefore be somewhat surprising that *-ego* may still be tracking some notion of semantic animacy, as evidenced by the results for the partial-match-animacy condition trials in this study, in which feminine animate nouns seemed to be partially pre-activated by the featural content of *-ego*. The experimental design presented in §3.1 selected only masculine animate nouns that represent semantically animate entities (animals), but a natural next step would be to incorporate into the experimental paradigm masculine animate nouns that represent semantically inanimate entities (ex. *muchomor* 'toadstool', *szampan* 'champagne') (cf. §2.3).

Second, the inflectional paradigm in the plural for masculine personal nouns (ex. *mężczyzna* 'man') (cf. Table 2) has sparked similar debates regarding status of these nouns as an independent gender category (Mańczak 1956, Szober 1963, Swan 2015) versus a subgender of the masculine (Corbett 1983). The experimental design presented here did

not include any nouns that determine the masculine personal agreement paradigm, but an additional next step would be to investigate what experimental evidence might reveal regarding this category. Questions to consider are how it is represented in the mental lexicon relative to the three global genders (masculine, feminine, and neuter) as well as relative to masculine animate nouns. I leave these matters for future work.

## 5 CONCLUSION

This paper investigated the mental representation of the gender system in Polish, focusing on the status of masculine animate nouns. These nouns are sometimes argued to constitute their own gender category, and sometimes argued to be a subcategory (or subgender) of the masculine. In formal morphosyntactic work, evidence for the existence of gender categories in a language is typically taken from the unique sets of agreement suffixes on associated words (ex. adjectives) that nouns in each category determine, following Hockett (1958). The psycholinguistic approach here builds on this by using eyetracking to investigate the real-time processing of these agreement suffixes. The results of the eyetracking study in the VWP show that, when Polish speakers encounter accusative *-ego* in the speech stream, they direct their gaze to partial-match competitors (masculine inanimate nouns and feminine animate nouns), suggesting that this suffix activates not a single category feature pertaining strictly to masculine animate nouns, but rather two features – a masculine gender feature and an independent animacy feature. This suggests that, there is no separate masculine animate category in the mental lexicon of native Polish speakers that would be on par with the global gender categories (masculine, feminine, neuter). Instead, the results align with proposals in which masculine animate nouns belong to the masculine gender category but with an independent (sub)specification for animacy. Future work will consider whether this extends to grammatically masculine animate nouns whose real-world referents are semantically inanimate (cf. §2.3), and will consider whether other subdivisions of the masculine (ex. masculine personal) are similarly represented in the mental lexicon.

## ABBREVIATIONS

ACC	accusative	M3	masculine inanimate
ANIM	animate	N	neuter
F	feminine	NOM	nominative
M	masculine	PST	past
M1	masculine personal	SG	singular
M2	masculine animate		

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