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Grammatical constraints on focus alternatives? The case of gender in Czech

ABSTRACT

This paper examines the interaction of grammatical gender and focus in speakers' linguistic competence and processing. We adopt the theory that analyses focus as the inducement of alternative meanings. Based on previous research on Romanian, we tested whether gender restricts focus alternatives through gender-marked numerals in Czech. However, the results of our acceptability judgement experiment found no effects of gender. We raised the possibility that the effects of gender were located in the processing of focus instead. We conducted a speeded acceptability judgment experiment, which found effects of gender but in the opposite direction; gender matched items were less acceptable. Finally, we conducted a probe recognition experiment to examine the representation of focus alternatives in the mind of comprehenders. The results revealed no effects of gender. Overall, the research reported in this paper make us decrease our credence in the hypothesis that gender interacts with focus alternatives.

KEYWORDS

focus alternatives; grammatical gender; probe recognition; acceptability judgements; Czech



1. Introduction

In order to successfully engage in communication, comprehenders must pay close attention not only to the literal meaning of sentences, but also to what is implied by the speaker. Speakers may choose to present the information they want to convey in many different ways, emphasising some parts of their utterances, presupposing others, and allowing listeners to infer the rest. The same information may thus be differently “packaged” (Chafe 1976). This packaging has been termed *information structure* in that it refers to the structuring of sentences that serves the purpose of conveying information to a hearer in a particular context.

Focus is an important cross-linguistically attested category of information structure (Büring 2009) and has been extensively studied ever since the first treaties on the matter were written by the linguists of the Prague Circle (Mathesius 1936; 1941; Firbas 1971; 1992). Conceived of as the non-presupposed and, therefore, new part of the information conveyed by utterances (Sgall et al. 1986), it has been contrasted with topic, which is said to be the old and known in an utterance (Lambrecht 1996). Both of these phenomena have been found to interact with other linguistic structures, such as syntax (Tuller 1992), prosody (Gussenhoven 2007), morphology (Nakanishi 2001), and most importantly semantic interpretation (Rooth 1985). It has been the interaction with semantics that has served as the basis for one of the formal definitions of focus. Rooth (1985; 1992) proposed a theory which says that the function of focus is to create an additional level of semantic interpretation for the syntactic constituent that receives focus status. This additional level consists in semantic alternatives to the focused element. Let us illustrate the theory on the following example (the focused element appears in capital letters):

(1) Peter saw JANE.

According to Rooth (1992), focusing *Jane* creates a set of alternatives to the meaning of *Jane* that would be contextually relevant. Suppose that sentence (1) is uttered in a context where there are four people present: Peter, Jane, Sally, and John. The set of alternatives would then include these and only these individuals. These are alternative meanings that, in a given context, could “replace” the focused element. In essence, focus is said to be the inducement of alternative meanings (Krifka 2008).



In this study, we will be exploring the processes of the creation and restriction of these alternative meanings. Specifically, we will be asking whether and, if so, how semantically inert phi-features such as grammatical gender interact with focus. Previous research on Romanian has suggested that in certain syntactic and contextual environments, gendered clitic pronouns play a role in the interpretation of focus in that they restrict the set of alternatives to only those of the same grammatical gender as the focused noun (Onea – von Heusinger 2009). We will test whether similar phenomena arise in Czech. Firstly, we will review the current research on focus alternative restrictions. After establishing that there is sufficient evidence for contextual restrictions, we will argue that there is some evidence suggesting that there is also a level of grammatical restrictions. We will then set up an acceptability judgment experiment testing whether there are effects of grammatical gender on focus alternatives in Czech that can be measured offline. In the other part of this paper, we will explore the literature on the processing of focus and ask whether grammatical gender plays any role in real-time focus comprehension. After reviewing the current research, we will put forward hypotheses about the role of gender that will be tested by two online tasks, namely by a speeded acceptability judgment task and a probe recognition task.

1.1 The theory of alternative semantics

Alternatives have been identified as a key phenomenon in many areas of language structure (Gotzner – Romoli 2022). In focus, the fundamental idea of alternative semantics is that in addition to their normal semantic value, focused elements are analysed as having an additional semantic value (Rooth 1985). This value is a set of propositions that are obtained by taking the ordinary semantic value of a sentence and substituting the focused element with its alternatives. This is perhaps best seen in the case of focus sensitive expressions (Krifka 2008). These are expressions such as *only*, *even*, or *also*. When focus is associated with these expressions, its placement can lead to truth-conditional differences between sentences that are the same except for their information structure. This effect of focus sensitive expressions has been called Association with Focus (Fox – Katzir 2011). Let us exemplify this with *only*:

(2) Peter only introduced JANE to Sally.

(3) Peter only introduced Jane to SALLY.

Our semantic intuition about these cases is that they differ in truth conditions. Suppose that Peter introduced both Jane and John to Sally. No other introductions were made. Whilst sentence (3) would be judged as true, sentence (2) would ring false. This is because the truth conditions for (2) are that Peter made a single introduction to Sally, namely that of Jane. On the other hand, (3) means that Sally was the only person that Jane was introduced to (Rooth, 1985). Alternative semantics explains how we get these differences in truth-conditions. What *only* contributes is an assertion about focus alternatives. Specifically, *only* negates all propositions that are derived by replacing the focused element with its alternatives and asserts that the proposition with the focused element in place is true. Here, the question of what counts as an alternative arises. According to Rooth (1985), the set of alternatives consists in all things that are of the same semantic type as the focused element. For example, the semantic type of a proper name like Jane in (1) is that of an individual, type *e*. Thus, in this case, all individuals are members of the set of alternatives.

1.2 Restricting focus alternatives

There is an issue with Rooth's theory as it stands. Since everything that is of the same semantic type as the focused element is included in the set of alternatives, the theory over-generates. In the following construction, the theory does not predict our semantic intuitions correctly:

(4) A: When he visited the zoo, Peter only saw the ELEPHANT.

B: #That's not true, he also saw the TRACTOR.

Since the meaning of tractor is of the same semantic type as the meaning of elephant, they are both included in the set of focus alternatives to the meaning of the expression *elephant*. However, B's response to A in (4) is judged to be infelicitous. This is because, intuitively, A's utterance is not about tractors, but is presumably restricted to animals and more specifically, to animals that one might find at a zoo. The content of sentence (4A) remains silent

on tractors. What speaker B utters might in fact be true (suppose there is maintenance work being done at the zoo), it is however semantically odd in the given context. What this shows is that the set of alternatives needs to be contextually restricted in order to correctly predict intuitions about semantic and discourse well-formedness (Zimmermann – Onea 2011). The set of alternatives needs to contain only those alternatives that are contextually relevant. The way Rooth's (1992) theory establishes this is by introducing a contextual variable that restricts the initial set of alternatives. This solves the issue on the level of a formal analysis. However, we may ask whether defining alternatives through the notion of semantic types with additional contextual restricting provides us with a sufficient account of focus. Some have suggested that this is not the case and that in addition to contextual restrictions, we require a level of grammatical restrictions (Onea – von Heusinger 2009; Fox – Katzir 2011).

1.3 The symmetry problem

Firstly, there is evidence suggesting that there is a level of grammatical restrictions in the generation of focus alternatives coming from semantics with regards to the issue of the Symmetry Problem. This problem originated in the debate concerning scalar implicatures (Fox, 2007). Fox and Katzir (2011) noticed that the Symmetry Problem does not only arise there, but also in certain cases of Association with Focus. Symmetry occurs when for some linguistic expression *E*, there are two alternatives *E*₁ and *E*₂ that contradict each other (Fox – Katzir 2011). This occurs in sentences involving *only* and a focused element of a different semantic type than *e*. Consider the following examples where the entire VP is focused and thus is of the semantic type $\langle e, t \rangle$:

- (5) Mary *only* READ 'ULYSSES'.

Due to the presence of *only*, sentence (5) entails that Mary did not watch a film. Let us see how the Symmetry Problem arises. Since the focused element is of the type $\langle e, t \rangle$, so will be its alternatives. Thus, sentence (14) could have the two following propositions among its alternatives:

- (6) Mary watched a film.

(7) Mary did not watch a film.

This is because both a VP and a negated VP are of the same type. This means that both (6) and (7) are included in the set. Fox and Katzir (2011) claim that this symmetry must be “broken” in a systematic way in order to arrive at the correct entailment of sentence (5). In other words, only (6) must remain as an alternative for (5). Otherwise, if both remained as alternatives, sentence (5) would be contradictory, since it would assert that both (6) and (7) are false. Rooth’s (1992) theory is forced to leave this to context only, since it claims that the set of alternatives (prior to contextual pruning) includes all alternatives that are of the same semantic type. However, Fox and Katzir (2011) argue that context is incapable of doing this. Consider, for example, cases where the symmetric alternative that needs to be eliminated is highly salient in the context.

Fox and Katzir (2011) propose a solution. They abandon Rooth’s idea that the set of alternatives is defined by semantic types and contextual restrictions only. Instead, their suggestion is to identify alternatives using the notion of structural complexity. They claim that there is a set of *formal alternatives* which includes the alternatives which are equally or less complex than the focused constituent.¹ This complexity is defined through the notion of syntactic constituents. Thus, no alternative can be more grammatically complex than the focused constituent. This works, since it eliminates (7) as an alternative, as it is more complex than (6). An important consequence of adopting this new theory of focus alternatives is therefore that the set of alternatives is informed by grammatical processes (Fox – Katzir 2011).

The fact that under this view, grammatical processes play a major role in restricting the set of alternatives allows us to hypothesise about what kind of grammatical phenomena might be involved in the formation of the set of formal alternatives. There could potentially be subtle effects of gender, animacy or number on the initial set of formal alternatives. It could be that for example, the distinction between marked and unmarked values of certain phi-features maps onto the notion of structural complexity in that marked forms would be considered more complex. Thus, these marked alternatives would be initially barred from the set.

1 They however allow for especially salient constituents that do not satisfy their condition of complexity to be included in the set of formal alternatives. Thus, contextual restrictions can override grammatical ones.

1.4 Grammatical gender restrictions

Onea and von Heusinger (2009) claim that they identified just such a case of a phi-feature restricting focus alternatives. Specifically, their research says that grammatical gender restricts the set of alternatives in certain constructions involving clitic doubling in Romanian.

First, they note the case of selectional restrictions as further evidence for grammatical phenomena interacting with alternatives and present the following example:

(8) John married MARY.

According to the Roothian story, the final set of alternatives to *Mary* only includes the set of contextually plausible candidates for John's marriage. However, the initial set that does not take contextual pruning into account includes a number of alternatives that do not match the selectional restrictions of the verb. This set includes such entities as cars or houses, since all of these are of the same semantic type as Mary. As Onea and von Heusinger (2009) point out, it is not a problem that the mechanism of focus interpretation over-generates, since contextual restrictions ultimately take care of the alternatives that do not obey the selectional restrictions of the verb.

However, it is generally assumed that selectional restrictions play a role in ordinary composition. If there are grammatical mechanisms that take care of sorting out compositional anomalies, we should expect the same mechanisms to be active in the generation of alternatives as well. Consider the following example:

(9) #John married Fido.

If Fido is a dog, sentence (9) is semantically anomalous in its ordinary composition. Onea and Heusinger (2009) then ask why it should not be equally anomalous as a proposition generated by focus. Selectional restrictions might apply at the level of syntax rather than semantics. Thus, sentence (9) would be considered *ungrammatical* rather than semantically anomalous. It would then seem that under this view of selectional restrictions, grammar plays a role in restricting focus alternatives. However, these restrictions are in most cases *weaker* than contextual ones; dogs would be eliminated as marriage partners

by context in any case. Thus, such restrictions are not apparent even though they may apply.

Should these selectional restrictions exist, how do Onea and von Heusinger (2009) attempt to account for them? In this sentence (8), *Mary* is focused and thus, there is a set of propositions that is created by replacing the focused elements with its alternatives. Suppose that we are only dealing with four individual entities in our model, namely John, Mary, Sally, all human, and Fido, a dog. All of these are initially alternatives to Mary. However, Onea and von Heusinger claim (2009), when the composition of the set of alternative propositions involves the verb, it rules out Fido, since it requires the property of being human for its object. Thus, we end up with a set of propositions where only the alternatives that abide by the selectional restrictions of the verb are present.

Now, a question arises whether we should actually modify our model of alternative generation to account for selectional restrictions. This task might seem unnecessary given that context solves the problem of overgeneration eventually. However, this is only the case where contextual restrictions are *stronger* than grammatical restrictions. Should there be any cases where grammatical restrictions are stronger, a model that allows grammar to restrict alternatives would have different predictions from the standard Roothian model (Onea – von Heusinger 2009).

Onea and von Heusinger (2009) claim that they found such a case. They argue that under certain conditions present in Romanian, gender-marked clitic pronouns on verbs restrict the alternatives to focused objects by means of their gender feature. These grammatical restrictions, they claim, can actually be “stronger” than contextual ones and so, in those cases, the hypothesis that grammatical restrictions apply has different predictions from the hypothesis that only contextual restrictions apply to focus alternatives.

These conditions, they argue, are met in Romanian in constructions where there is an optional gender-marked clitic pronoun on the verb that agrees with the object. The presence of these clitic pronouns depends on a variety of factors, including the presence of a differential object marker and the referential properties of the object. They report that in cases where a definite non-human denoting object is focused preverbally, a clitic pronoun is preferred but nevertheless optional. Take the following example:

- (10) BILA ROSIE am vazut (-o).
 ball.DEF.F red have.1SG seen CL-3SG.F
 ‘I have seen the RED BALL.’

(Romanian)

What they found based on their own intuitive judgments and by consulting native speakers of Romanian is that the presence of the clitic pronoun is more likely when the subject is animate, the object is highly affected, the subject and object differ in gender and, crucially, when the contextually available focus alternatives have the same grammatical gender. On the other hand, the absence of the clitic is more preferred when the alternatives are of a different gender.

This last factor, Onea and von Heusinger (2009) claim, could be attributed to grammatical gender restricting the focus alternatives of the direct object. The question is how gender could achieve this. The authors argue that clitic pronouns are used for anaphoric cross-sentential reference where they do in fact restrict the possible referents by means of their gender feature. They distinguish this from cases where these clitics play a purely grammatical role and are not optional and are presumably not semantically interpretable from those described above where the optionality suggests that the gender feature is interpretable.

The authors also propose a mechanism by which this gender feature restricts focus alternatives that is similar to what they propose for selectional restrictions. The Romanian optional gender-marked clitic pronoun on the verb is said to restrict the initial alternatives to the noun to only those with the same gender. Later however, context can add these gender incongruent alternatives back in through an accommodation process.

In addition to intuitive judgments and informal consultations with native speakers, Onea and von Heusinger (2009) conducted an acceptability judgement experiment to test their hypothesis. Their participants were asked to rate items based on their acceptability. These items were of the question-answer type as exemplified below:

- (11) Ce a murdărit supa vărsată, bluza sau pantalonul bucătăresei?
 ‘What did the spilled soup dirty, the blouse or the trousers of the cook?’
 Supa vărsată bluza bucătăresei a murdărit (-o), și nu pantalonul.
 soup.DEF.F spilled blouse.DEF.F cook.GEN has dirtied CL-3SG.F and not trousers.DEF.M
 ‘The spilled soup dirtied the blouse of the cook and not the trousers.’



(12) Ce a murdădit supa vărsată, bluza sau fusta bucătăresei?

‘What did the spilled soup dirty, the blouse or the skirt of the cook?’

Supa vărsată bluza bucătăresei a murdădit (-o), și nu fusta.

soup.DEF.F spilled blouse.DEF.F cook.GEN has dirtied CL-3SG.F and not skirt.DEF.F

‘The spilled soup dirtied the blouse of the cook and not the skirt.’

The experiment was of the 2×2 factorial design type and used magnitude estimation for participants’ ratings of acceptability. The first condition was whether a clitic pronoun was present or not. The second manipulation was whether there was a gender match or gender mismatch between the mentioned alternatives. Overall, their results show that items with the clitic pronoun present are always preferred, but importantly, the unacceptability of the lack of the clitic pronoun was lowered in the gender mismatch condition. Their results are summarised in Table 1.

Tab. 1. Rating results from the study of Onea and von Heusinger (2009)

	Gender match	Gender mismatch
Clitic pronoun present	16.2	6.2
Clitic pronoun absent	-30.2	-7.1

This result was in line with the predictions of a grammatically restricted theory of focus alternatives as opposed to the claim that alternatives are restricted only by context. The data showed that gender mismatch caused a deterioration of the acceptability of clitic pronouns. However, it is important to note here that there was high variance in their data and as a consequence, the results of Onea and von Heusinger (2009) did not prove to be statistically significant ($p > 0.1$).

What we might conclude from the study is that they provided a plausible theoretical reason for there being a gender-based grammatical restriction on focus alternatives. The direction of the empirical results of their experiment are in line with their predictions, however they should be treated with caution given the high variability of individual judgments. As Onea and von Heusinger (2009) admit, their study provides shaky evidence at best in support of their theoretical claim and thus conclude that more research is needed both on Romanian and on other languages to properly test their hypothesis.

1.5 Gender restrictions on focus alternatives in Czech

Having reviewed the evidence concerning the possible factors in the field of alternative restrictions, it seems plausible that grammatical phenomena could influence the formation of the set of focus alternatives. To investigate this further, we turn to Czech. The current study aims at testing whether there are phi-feature based restrictions on focus alternatives in Czech similar to those found by Onea and von Heusinger (2009) in Romanian.

Czech is a language with extensive inflectional morphology that includes grammatical gender which is marked on all nouns, adjectives and pronouns as well as inflection for number and in the case of masculine gender, for animacy. The grammar of Czech also requires gender and number agreement (Short 2006). Since Czech does not have the same system of clitic pronouns as Romanian where these could be optional in the same way, it is necessary to find another phenomenon which could likely result in similar effects to those found in Romanian. We chose to examine the case of noun phrases where the noun is modified by a cardinal numeral. In Czech, only the numerals *one* and *two* are inflected for gender in which they have to agree with the noun they modify. *Three* in Czech on the other hand, has a single inflectional pattern that is the same for all the three genders of Czech as illustrated on the following example (contrasting masculine and feminine genders):

- (13) Jeden muž a jedna žena.
 one.M man.M and one.F woman.F
 ‘One man and one woman’

- (14) Tři muži a tři ženy.
 three men.M and three women.F
 ‘Three men and three women’

Suppose now that the noun in these phrases is focused in the context of a whole sentence. We hypothesise that in the process of the composition of the set of alternative propositions, the gender marking on the numeral initially restricts the alternatives to the noun to only those that are of the same gender. Later, other contextually salient alternatives would be added by accommodation. This would be in line with Onea and von Heusinger’s

(2009) proposal for clitic pronouns in Romanian and for selectional restrictions. Crucially, this should only appear in the case of *one* and not for *three*, since the latter does not agree in gender with the noun. The reason we could expect this gender feature to be interpretable is because the numerals *one* and *two* in Czech are the only two words in the category of cardinal numerals that have to agree in gender with the noun they modify.

The intuitive judgments of the first author of this study, who is a native speaker of Czech, suggested that sentences where there was the gender-marked numeral *one* together with a focused noun and a negated alternative differed in intuitive acceptability depending on the presence or absence of gender match between the focused noun and the alternative. Those where there was a gender mismatch were thought to be slightly less acceptable. In sentences with *three* on the other hand, there was no perceived difference. Informal judgment gathering with several informants also confirmed the first author's intuitions. However, there were also speakers who did not perceive any differences. Therefore, we decided to run a formal acceptability judgment experiment with multiple lexicalizations and on native speakers who were blind to the experimental hypothesis.

2. Acceptability judgement experiment

In this experiment, we aimed at establishing whether grammatical gender plays a role in the construction of the set of focus alternatives in Czech. We predict that in cases of gender mismatch between the focused element and a negated alternative where the focused noun is modified by a numeral which requires gender agreement will lead to lower acceptability judgments when compared to the cases where there is gender match or where the numeral inflects in the same way for all genders. If grammatical gender does in fact initially restrict focus alternatives then those with a different gender feature are added later through an accommodation with this being reflected in lower acceptability. We will call this the *Accommodation Hypothesis*.

The design of this experiment modelled the constructions used by Onea and von Heusinger (2009) as closely as possible. However, instead of gender-marked clitic pronouns, we had a varying numeral modifying the focused noun. This was either *one* or *three*. We were drawing on the idea that whilst the numeral *one* initially restricts focus alternatives to a specific gender, given its differential marking for feminine and masculine gender, whereas *three* does not.

One point of methodological departure from Onea and von Heusinger's (2009) study is that we chose not to use magnitude estimation to measure acceptability. This is because it has been shown that the underlying cognitive assumptions of magnitude estimation tasks do not hold for acceptability judgments (Sprouse 2011). Thus, we decided to use a more traditional 7-point Likert Scale, as it has recently been found that magnitude estimation is not more powerful than other acceptability judgment tasks (Bader – Häussler 2010).

2.1 Participants

24 native speakers of Czech living or studying in or around the city of Oxford, UK, were recruited to take part in the acceptability judgment experiment. The mean age of the participants was 24.5 years ($sd=4.08$) and the gender split was 37.5% female and 62.5% male. Two participants reported being natively bilingual. For one the language was Hungarian, for the other it was English.

2.2 Materials

We constructed 40 test items and 80 filler items. Each test item was a single declarative sentence of Czech with SVO word order. All sentences included transitive verbs and an object that was modified by a numeral and the focus particle *jen* (*only, just*). The focus particle was added in order to elicit focus status, since we did not have the option of presenting the stimuli auditorily and mark focus by stress. The sentences used also include an elided negation of another object. The overall construction was similar to the following English sentence:

(15) Peter only saw one DOG, not a cat.

The negated part of the sentence contains a noun that could be considered a focus alternative to the focused element.

We used a 2×2 experimental design. Each test item had four variants covering the four permutations of two conditions. The first condition was gender match. Either the noun indicating a negated alternative was of the same or different grammatical gender as the focused element. Half of the items had a masculine negated alternative, the other had a feminine negated alternative. The second condition was named numeral agreement. This

referred to the numeral that was used as a modifier of the focused noun. The numeral modifying the noun was either one or three. The design of the stimuli is exemplified below on one of the items used in the experiment:

Gender mismatch, numeral agreement

- (16) Ivana potkala jen jednu atletku, hokejistu ne.
 Ivana met only one.F athlete.F hockey.player.M no.
 ‘Ivana only met one (female) athlete, not a/the hockey player.’

Gender mismatch, no numeral agreement

- (17) Ivana potkala jen tři atletky, hokejistu ne.
 Ivana met only three athletes.F hockey.player.M no.
 ‘Ivana met only three (female) athletes, not a/the hockey player.’

Gender match, numeral agreement

- (18) Ivana potkala jen jednoho atleta, hokejistu ne.
 Ivana met only one.M athlete.M hockey.player.M no.
 ‘Ivana met only one (male) athlete, not a/the hockey player.’

Gender match, no numeral agreement

- (19) Ivana potkala jen tři atlety, hokejistu ne.
 Ivana met only three athletes.M hockey.player.M no.
 ‘Ivana met only three (male) athletes, not a/the hockey player.’

Filler items were constructed in such a way to illicit responses all across the Likert Scale provided. The acceptability of filler items ranged from highly unacceptable ungrammatical combinations of words to highly acceptable sentences. As for those intended to receive ratings in the middle of the scale, we included, among others, garden-path sentences or semantically odd sentences.

2.3 Procedure

Participants were invited to come for an experimental session at St Hugh’s College, Oxford. Upon expressing interest in participating, they received an information sheet about the study via email at least 24 hours prior to their



session. When they arrived, they were given instructions for the experiment and asked to sign a consent form.²

The experiment itself was conducted using a computer. We used the Ibex-Farm platform for hosting linguistic experiments (Drummond 2011). The participants first filled in basic demographic information and some information concerning their linguistic background. This was followed by examples of sentences with varying degrees of acceptability and by a practice session of 6 sentences. Afterwards, the participants had an opportunity to ask questions to the experimenter. After this, the experiment proper started.

Participants saw sentences presented in the centre of the screen together with a Likert Scale from 1 to 7 where the lower end was glossed as “very unnatural” and the other “very natural”. In the instructions, participants were asked to indicate how natural the sentences presented seemed to them. They were asked to only use the keyboard to give their answers. After each item, there was a delay of 1000ms before the next sentence appeared. Altogether, each participant read and rated 40 test items and 80 filler items. The test items were organised according to a Latin Square design.

2.4 Analysis

The analysis worked with acceptability scores and response times. A linear mixed effects model was fitted to each data set. We removed item 40 from the analysis for having a typo that made it highly ungrammatical. We used a filter for response times to make sure we would not include responses that were too short for participants to actually read the sentences presented on one hand and those that were too long on the other. We chose to exclude all answers with response times under 1,500ms and over 15,000ms (8.44% data loss). Two participants were excluded for extremely long response times (5.59% data loss). For the analysis, we used the package *lme4* in the R programming language.

2.5 Results

The only statistically significant effect that the analysis revealed for the acceptability measure was a main effect of the numeral agreement condi-

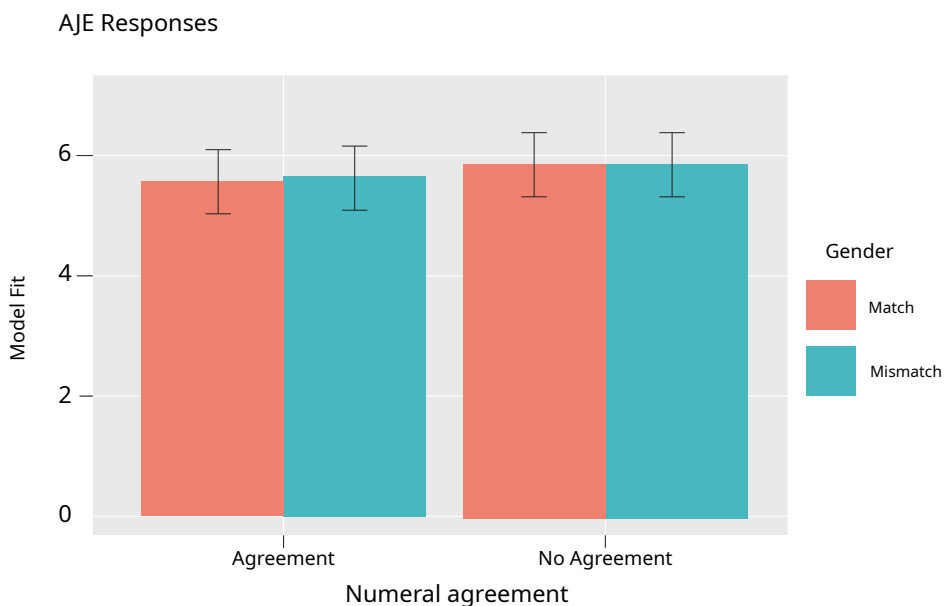
2 The experiment received ethical approval (R60210/RE001) from the Social Sciences and Humanities subcommittee of the Central University Research Ethics Committee at the University of Oxford.

tion ($\beta = -0.083$, $t = -2.797$, $p = 0.005$). Sentences that did not require agreement in gender between the numeral and the focused element were perceived as more acceptable than those which did. However, the size of the difference between the means was rather small (numeral agreement match $m = 5.714$, no numeral agreement $m = 5.876$). No statistically significant effect of the gender match condition was found, and neither was any interaction between the two conditions. The results of this experiment with regards to acceptability judgements are summarised in Table 2.

Tab. 2. Linear mixed-effects model results (fixed effects) of the Acceptability Judgment Experiment: Responses

	Estimate	SE	df	t-value	p-value
Intercept	5.789	0.189	25.29	30.63	<0.001***
Gender match	-0.017	0.034	99.36	-0.50	0.616
Numeral agreement	-0.083	0.030	725.62	-2.80	0.005**
Gender match : numeral agreement	-0.017	0.030	719.44	-0.58	0.564

Fig. 1. Mean ratings of acceptability in the Acceptability Judgment Experiment with associated standard errors by condition



2.6 Discussion

The acceptability judgment experiment failed to show any effects of gender match on acceptability judgments. Neither was there the predicted interaction between the gender match condition and the numeral agreement condition. Thus, the experiment failed to support the Accommodation Hypothesis.

However, the results might still be consistent with the effect of gender existing, since there is a possibility that it is simply too short-lived. According to Onea and von Heusinger (2009), gender restriction in the set of alternatives can be very easily overcome by a “cheap” accommodation process. Since there was no limit on how much time participants could take to give their answers, it is plausible that participants made their judgements long after having gone through this accommodation process of including the alternative with the wrong gender into the set. This could have levelled acceptability judgements. We shall call this the Early Effect Hypothesis. It still assumes that the effect of gender mismatch is that of sentences being perceived as less acceptable. However, it claims that this effect only affects early stages of comprehension. Given the unlimited time provided, the participants could have reanalysed the sentences with gender mismatch, which would again level perceived acceptability given how computationally cheap the accommodation process is proposed to be.

However, there is some weak evidence from the current experiment against this explanation already. We conducted a post-hoc analysis of response times and found no differences between the different conditions in this measure. If in fact participants had been conducting reanalyses in sentences with gender mismatch then we would have seen an effect of gender match on response times, yet we observed no such effect. On the other hand, response times at this level of granularity might not be sensitive enough to capture any differences between the conditions.

Let us now turn to how we might interpret the effect of the numeral agreement condition that was found. Firstly, it must be kept in mind that the difference observed is very small and that overall, both items with and without numeral agreement were perceived as highly acceptable. The explanation might lie in the fact that all of the negated alternatives were in the singular and that in the no numeral agreement condition, there was also an additional confounding mismatch in the actual number feature on the nouns. What is curious is that items that were mismatched in this way were actually more acceptable than those where both the focused noun and

the negated alternative had the same number feature. It therefore seems unlikely that the number of the focused noun restricted its alternatives in a similar way that we have put forward for gender. A more plausible explanation might be found in the use of the numeral rather than in the number feature on the nouns themselves. It could be that semantically the use of one in a neutral context is odder than the use of three.

The possibility of there being a reanalysis process that corresponds to Onea and von Heusinger's (2009) notion of "cheap accommodation" suggest that the key to finding the effects of gender on focus alternatives might lie in the application of more online research methods and generally in the domain of language processing. Thus, in the next section, we will review the current research on the comprehension of focus.

3. The processing of focus alternatives and grammatical gender

There is ample evidence that the Roothian semantic theory postulating focus alternatives is not only applicable on the abstract level of semantics, but that focus alternatives exist in real-time processing as well. Braun and Tagliapietra (2010) showed that when a syntactic element received focus status by means of contrastive pitch accent, there was an activation of focus alternatives. Their participants listened to Dutch sentences where a prime word (a noun) was produced either with or without contrastive accent. Following the stimulus, they had to perform a lexical decision task on words that could be alternatives. The researchers found that the words that could be alternatives were primed only when the prime was spoken with a contrastive pitch accent.

In Roothian alternative semantics, focus alternatives are restricted by context (Rooth 1992). We may ask whether this contextual restriction has an equivalent in processing. The study conducted by Husband and Ferreira (2016) provides evidence that contextual restriction does indeed take place in processing and that it is accomplished by means of a selection process. They conducted a cross-modally primed lexical decision task experiment on English speakers in order to find out how the representation of focus alternatives evolves over time. In their experiments, comprehenders heard sentences of the following construction:

(20) The museum thrilled the SCULPTOR when they called about his work.

The prime word (underlined in the example) was pronounced either with neutral prosody (H* or !H* pitch accents) or with focus prosody (L + H* pitch accent). Participants were exposed to a visually presented probe word and had to perform a lexical decision task. This word was either contrastively associated, meaning that it could replace the focused element (e.g. *painter*), non-contrastively related (*statue*) or unrelated (*register*). In their first experiment, they presented the target word at 0ms SOA with regards to the onset of the focused element. In the second experiment, the SOA was 750ms. What they found was that at 0ms both contrastively and non-contrastively associated alternatives were activated in the focus prosody condition. However, when the SOA was 750ms, only contrastively associated alternatives remained activated when there was focus prosody in the sentence. Husband and Ferreira (2016) claim that these experimental results show that first, a large number of focus alternatives that are semantically related to the focused element are activated. However, not all of these can replace the focused element. They propose that there is a selection process³ that comes later and that this mechanism reduces the initial set to only those that could replace the focused element.

Studies have also shown that other focus sensitive elements can trigger the activation of focus alternatives. In an experiment with German speakers, Gotzner and colleagues (2013) showed that focus particles such as *only* or *even* also activate focus alternatives. In their further study, Gotzner and colleagues (2016) investigated the evolving representation of alternatives. In their first experiment, they were interested in seeing whether focus particles like *only* and *even* had an effect on the representation of alternatives. They used a probe recognition design. First, the participants were auditorily presented with a discourse that included a list of three nouns (mentioned alternatives). In the final sentence of the discourse, only one of the three nouns appeared. In this critical sentence, the noun was preceded either by one of the focus particles *only* or *even* or it stood alone, in this condition the alternative carried bare intonational focus. Then, a probe word was presented. This was either one of the mentioned alternatives from the preceding discourse, an unmentioned semantically related word which could be a possible alternative

3 There are two possibilities as to the nature of the selection process. Either this process is passive, or it is active. The former would entail either decay in activation or competition of alternatives, whereas the latter their active suppression (Gotzner et al. 2016).



and an unrelated unmentioned word that served as the control. Consider this item (translated from the original German) from their study as an example:

(21) There are shirts, trousers and jackets in the catalogue.

I bet Matthias has bought shirts and trousers.

No, he _{/only/even} bought JACKETS.

In this item, the mentioned alternatives were the words *shirts* and *trousers*, the unmentioned alternative was *socks*, and the unrelated word *lychees*.

They found that the presence of focus particles caused an inhibition in comparison to the condition with no particle in mentioned alternatives and related unmentioned alternatives. There was no effect of particle for unrelated probes. Participants took longer to accept mentioned alternatives and to reject the unmentioned related ones when there was a particle present.

3. Focus alternatives and gender online

Here, we will be asking whether gender can play a role in the process of the comprehension of focus. We propose the *Selection Hypothesis*. It says that gender plays a role in the phase following the initial activation of alternatives. Following Husband and Ferreira (2016), we hypothesise that there is a process of selection that “culls” the activated alternatives that are not needed in the given context. How does the selection mechanism work? Whether it be passive or active, the question of what kind of information it uses to select the correct alternatives stays. Plausibly, the selection process makes use of feature overlap between the focused element and the activated alternatives. For example, if the noun *dog* is focused, the selection process could use semantic features such as animacy. The Selection Hypothesis says that grammatical gender is also one of these features. We hypothesise that alternatives that share the gender of the focused noun would have an advantage in this process and thus be better represented in the model of the discourse.

The current literature on the comprehension of focus often makes reference to the notion of “replaceability” when it comes to the set of alternatives for a focused element (Husband – Ferreira 2016; Gotzner et al. 2016; Braun – Tagliapietra, 2010). However, it is hardly clear what is meant by claiming that one of the criteria for something being an alternative is being

able to “replace” the focused element in the context of processing. In the semantic literature, this is clear, since its replaceability is tied to the notion of semantic types. In the psycholinguistic literature on the other hand, it seems that grammatical criteria are being applied as well. For example, in Husband and Ferreira’s (2016) study, many of their stimuli that were to be semantically related yet unable to replace the focused element were of a different word class from the focused element. For instance, in their item 3, the focused element was the noun *mammoths* and the target was the adjective *extinct*. Presumably, the reason why *extinct* was classed as non-contrastive is because it cannot replace *mammoths* in the sentence presented, since the result would be ungrammatical. Yet semantically, there would be no problem. The proposition containing the alternative *extinct*, meaning the set of extinct things, would be perfectly interpretable. It is clearly possible that the selection mechanism does in fact care about this type of grammatical information, but this would mean that the selection mechanism must in some way restrict the set of alternatives to, at least, just the alternatives of the same word class as the focused element. In fact, there seems to be no other good explanation for the results of Husband and Ferreira (2016), since these researchers created their stimuli in such a way that both contrastively and non-contrastively associated alternatives were equally semantically related to the focused noun (as measured by a latent semantic analysis).

If replaceability is tied to syntax through restrictions based on word class, we might ask whether other similar processing restrictions might exist based on phi-features such as grammatical gender or number in languages such as Czech. Take the following sentence taken from item 8 in our acceptability judgment experiment:

(22) Eva ubytovala jen jednu STUDENTKU.

Eva accommodated only one.F student.F

‘Eva only accommodated one (female) student.’

In sentence (24), *studentka* is focused and has feminine gender. The word *učitel* (teacher) is associated with it yet of masculine gender. If we attempt to replace *učitel* for *studentka*, the result is the following ungrammatical sentence:



- (23) *Eva ubytovala jen jednu UČITELE.
Eva accommodated only one.F teacher.M
'Eva only accommodated one (male) teacher.'

However, as the above reported acceptability judgment experiment shows, native speakers of Czech are not only willing to accept nouns with a different gender to the focused element as alternatives, the overall acceptability rankings for cases of gender mismatch were very high. This means that while some grammatical structure, namely word class, plays a crucial role in the selection of alternatives, phi-feature information is either ignored or has to be overridden. If there is gender mismatch, it might be that the selection process must do additional processing in order for the desired contextually appropriate alternatives to be able to replace the focus element. We call this the *Replaceability Hypothesis*. One way to test it would be to assume that this additional processing has an effect on acceptability judgments. This is in opposition to the hypothesis we derived from the proposal of Onea and Heusinger (2009), which claimed that first, only the alternatives of the same gender are included in the set and others are added.

To sum up, the results of the acceptability judgment experiment together with questions arising from the literature on the comprehension of focus give rise to several hypotheses. The Early Effect Hypothesis says that the effects of the accommodation process on acceptability are short lived. The Replaceability Hypothesis claims that in order for a word to be able to replace the focused element it must have grammatical features that allow it to take place of the focused element in the syntactic structure of the sentence and that gender and number are among these. Finally, the Selection Hypothesis says that during the selection process, the mechanism by which the final set of alternatives is established is sensitive to the gender feature. In the next section, we report on two further experiments we conducted to test these hypotheses.

4. Speeded acceptability judgment experiment

The second experiment we conducted was designed to test two hypotheses posed in the previous section, namely the Early Effect Hypothesis and the Replaceability Hypothesis. By employing the speeded acceptability judgment method, we might be able to tap into the time course of the comprehension process of focus alternatives prior to this accommodation process.

The predictions for the Early Effect Hypothesis remain the same as those for the response time unconstrained acceptability judgment experiment, namely that we should see a drop in acceptability in cases of gender mismatch and numeral agreement.

As for the predictions of the Replaceability Hypothesis, we expect the proportion of acceptability to mirror how good a fit an alternative is with regards to the match with both phi-features, that is gender and number. We can test the effect of the number feature, since there is a number mismatch already present in our no numeral agreement condition. If this hypothesis is true, the sentences where both gender and number match should be judged to be acceptable with the highest proportion. On the other hand, the sentences with both gender and number mismatch (no numeral agreement condition) should be the worst in this regard. The cases where there is a mismatch in one phi-feature should be intermediate between the two extremes.

4.1 Participants

For this experiment, 36 native speakers of Czech were recruited. Unlike the previous experiment, this part of the study was web-based. The study was advertised on social media and through posters placed at the Faculty of Social Sciences of Masaryk University in Brno, Czech Republic. If interested in the study, participants could go to a website where the experiment was conducted. Again IbexFarm (Drummond 2011) was used to host the experiment. Basic demographic data and some information about the participants' linguistic background were collected. There were 14 male (38.9%) and 22 female (61.1%) participants with the mean age of 22.3 (sd = 2.74). None of the participants reported being natively bilingual.

4.2 Materials

The materials used were the same as those used in the acceptability judgment experiment.

4.3 Procedure

Upon entering the website with the experiment, participants were first asked to read an information sheet about the experiment. They were asked



to indicate by ticking a checkbox that they were over 18 years of age and that they consented to participating.⁴

This experiment differed from the acceptability judgment experiment in the mode of presentation of the stimuli, in the range of potential answers to the stimuli and in the time participants had to provide their answer. As opposed to the previous experiment, all sentences were presented in the rapid serial visual presentation mode (RSVP). Words appeared singularly following one another in the centre of the screen. Each word was presented for 300ms and was followed by a 100ms pause. Immediately after the last word of a particular experimental item, the question “Does this sentence sound natural?” appeared with a forced choice for answering of either “Yes” or “No”. Participants were instructed to answer as soon as possible. There was a set timeout for this experiment of 3000ms. If the participant failed to answer within this time, an error message appeared.

At the start of the experiment, participants first saw 2 practice items without a required answer. These served to make the participants accustomed to rapid serial visual presentation. Next, participants saw 6 practice items where they were required to give a judgment. Following this, they saw 40 experimental items and 80 filler items.

4.4 Analysis

In this experiment, the measure of interest was the proportion of Yes/No responses. A generalised linear mixed effects model (logistic regression) was fitted to the response data. A standard linear mixed effects model was run on the response time data. One participant was excluded as an outlier for having mean response times higher than two standard deviations from the overall mean. We used the package *lme4* in the R programming language.

4.5 Results

In the answers measure, the analysis revealed a statistically significant effect of the gender match condition ($\beta = -0.334$, $t = -3.595$, $p = 0.0003$). The items where the focused element matched the alternative in gender were rejected as unacceptable more often than those where there was a mismatch in grammatical gender. We found no effect of the numeral agreement condition.

4 The ethical approval reference was R60210/RE002.

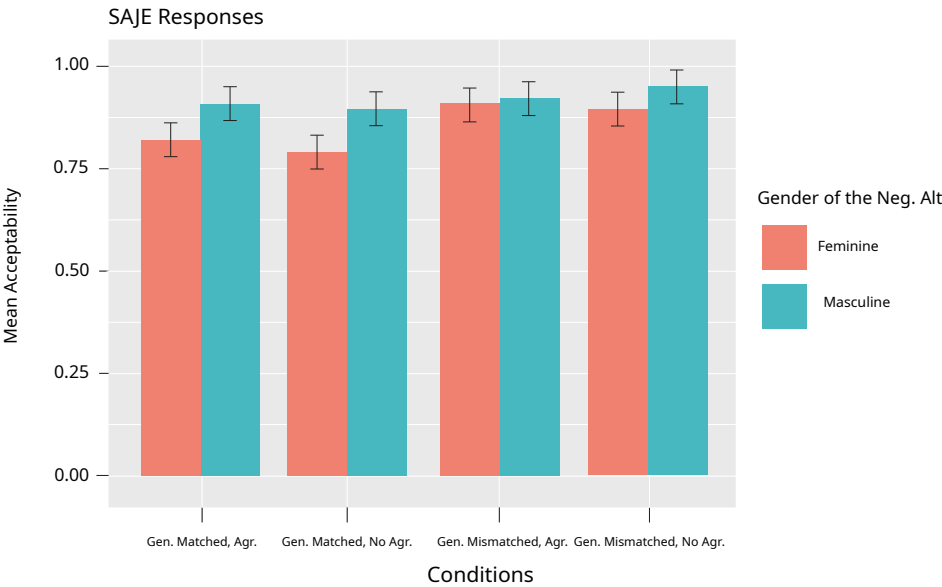


Likewise, there was no interaction between this condition and the gender match condition. The results for the answers measure are summarised in Table 4.

Tab. 4. Generalised logistic mixed-effects model results (fixed effects) of the Speeded Acceptability Judgment Experiment: Responses

	Estimate	SE	z-value	p-value
Intercept	2.534	0.220	11.52	<0.001***
Gender match	-0.334	0.093	-3.60	<0.001***
Numeral agreement	-0.002	0.092	0.02	0.982
Gender match : numeral agreement	0.036	0.093	0.389	0.698

Fig. 2. Mean judgments of acceptability in the Speeded Acceptability Judgment Experiment with associated standard errors by condition and the grammatical gender of the negated alternative



4.6 Discussion

The speeded acceptability judgment experiment failed to show any interaction between the gender match condition and the numeral agreement condition. This provides us with some evidence against the Early Effect Hypothesis which claimed that the reason why the previous experiment did not show any effects of grammatical gender on acceptability judgments was due to it being too short lived and being overcome in untimed conditions.

There was, however, a main effect of gender match. Curiously, the sentences where the gender of the focused element and of the negated alternative matched were perceived as unacceptable more often than in cases of gender mismatch. This is the opposite of what we predicted for the Replaceability Hypothesis, which was therefore not been supported by the data.

The effect seems to be driven by those items where both the focused element and the alternative were of feminine gender as can be seen in the graph above. How, then, could this be explained? One possibility is that feminine nouns, being marked morphologically, were simply longer than masculine ones. It may be that in a time-locked context, word length can lower acceptability judgments. We conducted a post hoc analysis comparing the letter length between the items where the negated alternative was feminine and where it was masculine (in the accusative singular). An independent measures t-test showed no statistically significant difference in length between the two ($m_F = 9.4$, $m_M = 8.9$, $t(39) = -0.94402$, $p = 0.175561$).

Having rejected the length explanation, another plausible story is that the feminine nouns used in the items have lower frequencies than those in the masculine condition. Word frequency could have had an impact on acceptability in our time-locked experiment, as such effects have been documented before (Bader – Häussler 2010). An analysis was therefore conducted where we extracted frequency counts from the Czech National Corpus SYN2015 (Křen et al. 2016) and looked at whether there was a significant difference between feminine and masculine items. First, we looked at the frequency differences between feminine and masculine nouns that were used as the negated alternative, that is the last word of the stimulus presented. An independent measures t-test showed that feminine nouns were significantly lower in frequency than masculine ones ($m_F = 642.8$, $m_M = 4155.7$, $t(39) = 2.74747$, $p = 0.00456$). The descriptive statistics of both length (in letters) and frequency (number of occurrences in SYN2015) are in Table 5.

Tab. 5. Descriptive statistics of the items used in the Speeded Acceptability Judgment Experiment

Gender	Frequency mean	Frequency st. dev.	Length mean	Length st. dev.
Feminine	643	836	9.4	1.43
Masculine	4156	5657	8.9	1.89

One shortcoming of this explanation is that it predicts that both gender-matched and gender-mismatched feminine items should be lower in acceptability. It is plausible that it was not only the frequency of the negated alternative, but also of the focused noun that caused lower acceptability for gender matched feminine items. This would be due to the focused nouns also being feminine in the gender match condition and therefore of lower frequency.

Another explanation we might put forward is that this is indeed evidence of grammatical gender playing a role in the construction of the set of alternatives. This hypothesised role would however be different from the one we predicted. It has been suggested in the literature on the processing of focus that there are inhibitory effects of focus in probe recognition experiments (Gotzner et al. 2016). It has been hypothesised that these effects are due to the competition between the focused element and the alternatives. It may be that this competition becomes more costly in processing terms if the focused element and the alternatives generated share more common features. These may be semantic features but also features such as grammatical gender. In essence, this is the Selection Hypothesis discussed above. What we are adding is the claim that processing cost then leads to lower acceptability for cases where there is a gender match, since it is more difficult to distinguish between the focused element and the alternative.

In order to test this hypothesis, which if true could help explain the results of our speeded acceptability judgment experiment, we must turn to the probe recognition method that has been used to investigate these inhibitory effects.

5. Probe recognition experiment

In this experiment, we investigated whether grammatical gender has a role in the evolving representation of focus alternatives using the probe recognition task. Unlike the methods employed in the previous two experiments, this task does not operate with acceptability judgements. Rather, the task is designed to look into the way discourse is represented in the mind of the comprehender.

As opposed to the lexical decision task, which simply reflects the degree of activation of elements in the mental lexicon, the method of probe recognition experiments taps into the representation of discourse referents (Gernsbacher – Jescheniak 1995). It has been argued that this task reflects not only the participants' knowledge of the text's surface syntactic structure but also the underlying structure of the events described by it (Gotzner et al. 2016). The probe recognition task requires participants to construct a model of the discourse given and then to compare a certain probe word with this representation.

For this experiment, we set up the Selection Hypothesis, which claims that the selection process makes use of the gender feature in establishing the set of contextually relevant alternatives. Those that match the focused noun in gender should be better represented.

As has been shown, even unmentioned semantically relevant alternatives are considered as a part of the discourse and possibly compete with mentioned alternatives and the focused element (Gotzner et al. 2016). It took comprehenders longer to reject these unmentioned alternatives as probes than unrelated probes presumably because there was a significant degree of semantic feature overlap between the probes and the focused element and the mentioned alternatives. Simplifying, the more something is considered as viable alternative, the longer it takes to indicate that it did not appear in the discourse.

We may thus predict that if the Selection Hypothesis is true, those semantically related probe words that share the same grammatical gender as the focused noun would be take longer to reject than gender mismatched ones, since gender match would make it even more difficult for comprehenders to distinguish them from the focused element and the mentioned alternatives.

5.1 Participants

In this experiment, 39 native speakers of Czech were recruited to participate online. Basic demographic data were collected together with some information about the participants' linguistic background. There were 16 male (41%)

and 23 female (59%) participants with the mean age of 29.2 (sd=10.5). None reported being a native speaker of a language other than Czech.

5.2 Materials

The Probe Recognition Experiment, aiming to replicate the results of Gotzner and colleagues (2016), used stimuli closely resembling those of their experiment. Each item consisted of three related sentences representing a dialogue and a probe word. The sentences were internally named the Context Sentence, the Continuation Sentence and the Critical Sentence and were presented in that order followed by the probe word, which appeared in capital letters. The Context Sentence enumerates all the mentioned alternatives for the particular item. To simplify the experimental design of Gotzner and colleagues (2016), only two alternatives were altogether included instead of three. The Continuation Sentence is a statement that highlights one of the two alternatives. The Critical Sentence then negates the assertion of the Continuation Sentence. It contains the contrastive assertion about the other alternative that was mentioned in the Context Sentence. Crucially, this alternative is preceded by the focus particle *jenom (only)*. It also appears at the right-most end of the sentence, which would give it the main sentence stress in spoken Czech, which is associated with focus status (Daneš, 1957; Groeben et al. 2017; Šimík – Wierzba 2015; 2017). Therefore, we are justified in asserting that the noun in the Critical Sentence was contrastively focused. The following is an example of a test item used in the study:

Context sentence

- (24) V katalogu je sukně a vesta.
 in catalogue is skirt.F and waistcoat.F
 ‘There is a skirt and a waistcoat in the catalogue.’

Continuation sentence

- (25) Jana určitě koupila sukni.
 Jana surely bought skirt.F
 ‘Jana surely bought the skirt.’



Critical sentence

- (26) Ne, koupila jenom vestu.
no bought only waistcoat.F
'No, she only bought the waistcoat.'

Unlike in Gotzner et al. (2016), where the Critical Sentence was manipulated, conditions differed only in the probe word. The design employed was that of 2 x 2. The first condition was semantic relatedness. The probe word was either semantically related to the focused word of the Critical Sentence (*waistcoat – jumper*) or unrelated (*waistcoat – bath*). The second condition was gender match. The probe word either matched the focused word in grammatical gender (*waistcoat.F – jacket.F*) or it did not (*waistcoat.F – jumper.M*). Thus, all probes a value with regards to both semantic relatedness and gender match. Half the test items were constructed in such a way that the enumerated alternatives were of feminine gender whilst the other half included only those of masculine gender. Accordingly, the gender matching probes were feminine in the former case and masculine in the latter.

In the present study, none of the probe words were mentioned in the three preceding sentences. Thus, the correct response for the participants to all test items was to indicate that the probe did not appear in the preceding discourse. This contrasts with the design of Gotzner and colleagues (2016), who included mentioned alternatives as probes. However, some filler items were constructed with the probe word appearing in the discourse. Overall, the correct response was “Yes” for a half of all items combined and “No” for the other half. This was done in order to ensure that participants would not be biased to respond in the negative to all items.

In order to control for word length effects, we calculated the mean letter length of probe words in each of the four conditions. We then conducted an analysis of these means using a one-way ANOVA. We found that there was no statistically significant difference in letter length between the conditions ($F = 0.21112$, $p = 0.888527$). Similarly, we tried to control for the effects of frequency, since it affects word recognition (Whaley, 1978). Each probe word was assigned a lemma frequency taken from the Czech National Corpus (Křen et al. 2016). Again, the means for each condition were calculated and an ANOVA was conducted. No statistically significant differences in frequency were found between the conditions ($F = 0.0252$, $p = 0.994564$). The descriptive statistics for the length and frequency (reported as the absolute number of occurrences in SYN2015) of probe words are reported in Table 6.

Tab. 6. Descriptive statistics of the probes used in the items for the Probe Recognition Experiment

	Frequency mean	Frequency st. dev.	Length mean	Length st. dev.
Gender matched, semantically related	1583	1544	5.60	1.30
Gender matches, semantically unrelated	1670	1448	5.37	0.85
Gender mismatched, semantically related	1590	1659	5.47	1.20
Gender mismatched, semantically unrelated	1660	1557	5.47	1.17

5.3 Procedure

The participants were first asked to read the information sheet about the study, indicate that they were over 18 years of age and to consent to participating.⁵

As opposed to the study of Gotzner and colleagues (2016), which employed a cross-modal paradigm, all stimuli were presented visually. In each trial, participants saw the three sentences following one another in the rapid serial visual presentation mode (RSVP). Individual words appeared in the centre of the screen for 300ms and a pause of 100ms following each word. Following the last word of the third sentence, a probe word appeared after 2050ms. Participants were simultaneously presented with a forced choice of ‘YES’ or ‘NO’. They were instructed to answer whether the probe word appeared anywhere in the preceding three sentences in any of its inflected forms. Noun probes were always presented in the nominative singular form and if a different inflected form of the probe appeared participants were told to count it as an instance of that word. They were also asked to answer as quickly as possible and to only use their keyboard. There was no time-out for their answer in this experiment. Before the start of the experiment proper, the participants saw 10 practice items. The first 2 sentences were not of the general experimental pattern and were intended to give the participants

⁵ The ethical approval reference was R60210/RE002.



time to adjust to the RSVP mode of reading. The remaining 8 items already contained three sentences and a probe word each. In the actual experiment, there were 30 test items and 90 filler items altogether. Thus, there were 3 filler items for each test item and each participant saw 120 items.

5.4 Analysis

In this experiment, we measured response times. Only correct responses (99.8%) were entered into the analysis. Item 28 was removed, since the probe was erroneously the same as one of the mentioned alternatives. We removed two subjects as outliers for having mean response times longer than two standard deviations above the mean. These data were then entered into a linear mixed effects model. Again, the package *lme4* in the R programming language was used.

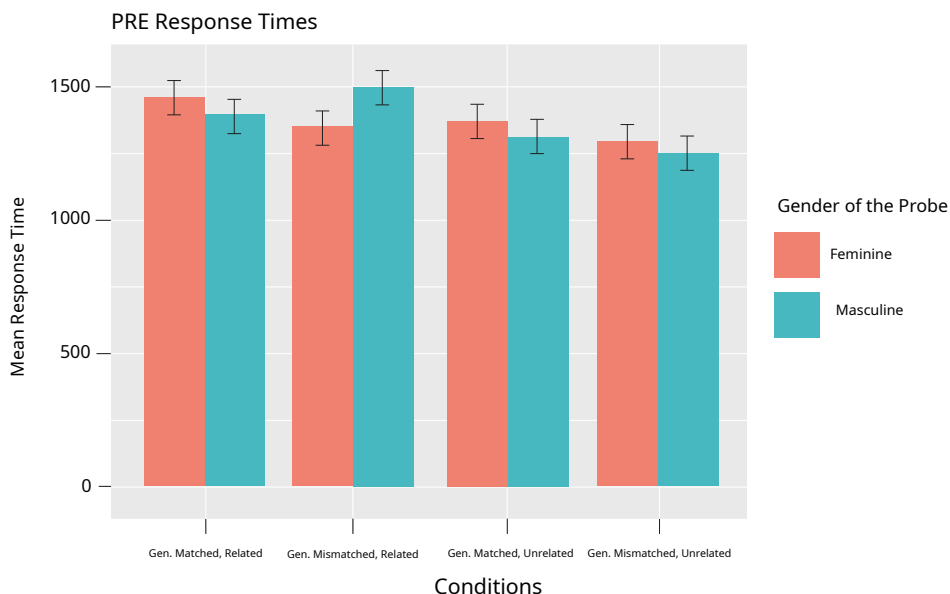
5.5 Results

The analysis revealed a statistically significant main effect of the probe's semantic relatedness ($\beta = 0.035$, $t = 3.326$, $p = 0.002$). Semantically related alternatives, which were contrastive and thus could replace the focused element, were recognised slower than semantically unrelated words. The difference between the means of the two conditions was 126ms. There was no statistically significant effect of the gender match condition. Likewise, no interactions were found. The results of the experiment are summarised in Table 7.

Tab. 7. Linear mixed-effects model results (fixed effects) of the Probe Recognition Experiment: Log-transformed response times

	Estimate	SE	df	t-value	p-value
Intercept	7.1204	0.0533	37.11	133.68	<0.001***
Gender match	0.0077	0.0125	30.22	0.617	0.542
Semantic relatedness	0.0347	0.0104	35.18	3.326	0.002**
Gender match : semantic relatedness	-0.0074	0.0113	34.62	-0.651	0.519

Fig. 3. Mean correct response times in ms in the Probe Recognition Experiment with associated standard errors by condition and the grammatical gender of the probe.



5.6 Discussion

Firstly, the results of the probe recognition experiment corroborate the findings of Gotzner and colleagues (2016) in finding an inhibitory effect of unmentioned alternatives in the presence of an exclusive focus particle. This suggests that even unmentioned semantically related nouns were considered as a part of the set of alternatives possibly competing with the mentioned alternatives and the focused element.

The importance of this lies in two areas. Firstly, our experiment was conducted on another language, namely Czech. Psycholinguistic studies on focus had mostly been done on English (Husband – Ferreira 2016; Kim et al. 2015; Calhoun et al. 2025), Dutch (Braun – Tagliapietra 2010), and German (Gotzner et al. 2016; Spalek et al. 2014). Our research brings in evidence for the presence of focus alternatives in the processing of a language with a significantly different grammar than those three. This corroborates recent results from Czech obtained by Lacina, Šimík, and Gotzner (2023). Secondly, the study of Gotzner and colleagues (2016) as well as others in the literature

employed a cross-modal paradigm. This means that participants were asked to listen to the stimuli. In our study, on the other hand, we employed the RSVP method where comprehenders are asked to read the sentences presented. That we found the same effects suggests that the findings of Gotzner et al. (2016) were not specific to the mode of presentation of the stimuli or to the German language.

Let us now turn to the hypothesis that we put forward for this experiment, the Selection Hypothesis. The lack of any gender effects means that the data fail to support it. The hypothesis predicted an interaction between the gender match condition and the semantic relatedness condition. It therefore appears that the selection mechanism does not make use of the gender phi-feature information when it is trying to establish the restricted set.

6. General discussion

Overall, the results of all three experiments failed to find evidence that phi-features such as grammatical gender play a role in the process of establishing the set of contextually relevant focus alternatives in Czech. Only one of the experiments showed any effect of a condition where gender was manipulated, namely the speeded acceptability judgment experiment. Here, however, it is more likely that differences in word frequencies between the feminine and masculine conditions were the factor causing lower acceptability judgments.

Our first experiment failed to support the Accommodation Hypothesis and the results of the speeded acceptability judgment experiment provide no evidence for the Early Effect Hypothesis. By time-locking, we attempted to rule out the possibility raised by the first experiment that participants were able to overcome any initial worries about gender mismatched sentences possibly through re-analysis or other means. The fact that we essentially found the same pattern of results as in the acceptability judgment experiment may give us confidence that it was not hiding any effects in virtue of the method employed, though the absence of evidence here does not conclusively rule out this possibility.

Thus, the findings of One and von Heusinger (2009) have not been corroborated and expanded by our study. Given the issues with their original study such as high variability in their data and the use of magnitude

estimation, the results reported here shed doubt on the existence of the effect they claimed to have found in Romanian.

The Replaceability Hypothesis was also not supported by the results of our second experiment. In the speeded acceptability judgment experiment, not only did we not find results in line with our prediction, we found the exact opposite pattern, namely that of gender matching leading to *lower* acceptability rankings. This finding has implications for the study of the processing of focus alternatives in that it points to the yet unsettled nature of the concept of replaceability as it has been shown that even in cases where there is a required gender agreement between a focused noun and its modifier, a gender mismatched noun can be a focus alternative without any effect on perceived acceptability.

In light of this, more research needs to be conducted to determine what exactly are the criteria of “replaceability” for focus alternatives in a processing context. It seems plausible that a potential alternative’s word class might matter. As has been shown, the phi-features of gender and number do not seem to matter in this way. The study of Husband and Ferreira (2016) provides evidence that even words that do not share the word class of the focused element are initially activated. This suggests that it must be during the selection process when grammatical restrictions apply. The precise nature of what these restrictions are remains unknown.

Turning to the Selection Hypothesis, the lack of effects found suggests that gender information is not involved in the selection process that establishes the contextually relevant set. From this, it seems that the selection process is itself selective when it comes to the features that it pays attention to. These are presumably those that are relevant to the semantic and pragmatic interpretation of utterances, these would be features such as animacy. On the other hand, as we have seen from the discussion of the notion of “replaceability”, it seems likely that the information about the word class of the focused element matter.

This hypothesis was also put forward as an explanation for the adverse effect of gender matching on acceptability in the speeded acceptability judgment experiment. Since we have failed to support it, this explanation becomes less probable.

The lack of evidence in support of the Selection Hypothesis should also lower our credence in the assumed nature of the selection process in that it uses feature overlap to establish the set of contextually relevant alternatives. The results are consistent with a mechanism that not only does not



take into account gender, but also no other features such as animacy. It does not however provide strong evidence for this picture of the mechanism. More research is needed to determine how the process goes about selecting the correct alternatives from the pool of activated elements.

The case of the other phi-feature that was present in our study, namely number, is arguably even more interesting. We did not observe any effects of number in the speeded acceptability judgment experiment. Unlike gender which does not serve any obvious communicative function for most nouns and is an inherent property of nouns (Bates et al. 1996), number has a semantics (Sauerland 2003) and most nouns can take all of its values. In many languages, including English and Czech, the number feature on nouns requires agreement markers on adjectives or verbs. It therefore seems plausible that number should not only matter for replaceability from a grammatical point of view in a similar way to gender, but also from a semantic point of view.

We shall now discuss what further research questions this paper raises. Firstly, it may be the case that gender plays a role in processing, however not in the selection process, but in the initial activation stage. Gender matched alternatives might have an initial advantage compared to gender mismatched ones. Gender-based priming has been studied before (Bates et al. 1996; Akhutina et al. 1999). To test this, an experiment which more directly measures initial activation of units in the lexical-semantic network would need to be conducted. The lexical decision task has been argued to tap into such activation (Gotzner et al. 2016). The ideal way for testing initial activation would be to conduct an experiment with the SOA of 0ms.

Finally, drawing back on the semantic work by Fox and Katzir (2011), we might ask a question about the processing of focus where the focused constituent is more complex than a single word. Focus can apply to phrases and even whole sentences in the form of all-sentence focus (Erteschik-Shir 2007). How are alternatives created in these cases? Should we follow Rooth (1992), the set of alternatives would include all the elements of the same type. We might ask what this would mean in processing. In Gotzner and Spalek's (2019) review of the psycholinguistic literature on the comprehension of focus, in all the studies reviewed, the scope of focus investigated was never larger than that of a single word. Lacina, Sturt, and Gotzner (2024) have recently attempted to test alternatives in broad focus experimentally yet came to inconclusive results.

Further research should investigate questions regarding the roles of different types of restrictions on alternatives, given that the presence of grammatical phenomena of some kind would seem plausible and even likely. It seems implausible that context alone would be able to guide this process of composition through spreading activation alone. What is very plausible is that certain processes that are involved in the processing of syntax are put to work.

7. Conclusion

This paper aimed at investigating whether the phi-feature of grammatical gender plays a role in the generation and processing of focus alternatives. The study of Onea and von Heusinger (2009) provided first evidence that gender-based restrictions on focus alternatives could be possible on the example of clitic pronoun doubling in Romanian. This opened up the possibility that such grammatical restrictions could exist in other languages. Our study first tried to extend the findings of Onea and von Heusinger (2009) by examining Czech. Following their study, we hypothesised that only alternatives that have the same gender are created first with others being accommodated later. The acceptability judgment experiment conducted failed to support this hypothesis and thus cast doubt on our initial intuitions that gender mismatch between the focused element and an alternative was less acceptable than gender matching. Further, we investigated whether gender could only be involved in the processing of focus alternatives. The Selection Hypothesis said that gender figures during the selection process. It predicted an interaction between the gender match and semantic relatedness conditions, saying that gender matched probes would be recognised slower than gender mismatched ones only if they were at the same time semantically related. This prediction did not come true as no effect of gender was observed in the probe recognition experiment.

In conclusion, this paper failed to provide evidence that phi-features such as gender or number play a role in establishing the set of alternatives to focused nouns in Czech. It also did not find any purely processing effects of gender. The lack of these effects suggests that gender does not interact with focus. The paper also highlighted some unresolved issues in the study of the processing of focus alternatives, namely those surrounding the notion



of “replaceability” with regards to the relationship between the focused element and its alternatives and made suggestions for future research.

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