Quantifier focus in Serbian

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Abstract: This paper presents a study on the interpretation of anaphoric reference to preceding quantified expressions in Serbian. Quantifiers not only differ in the proportions they denote but also, depending on their polarity, in their properties of assigning referential focus. In an off-line judgement task, we investigated the focus properties of four Serbian quantifiers. The results show that positive and negative quantifiers behave differently and focus different discourse referents. This is in line with what we know from other languages. However, Serbian differs from English in that negative quantifiers are more open to different set focuses. Our conclusion from the study is that negative and positive quantified expressions in Serbian show, in principle, the same categorical differences that we find in other languages. The effect of polarity on referential focus seems to be an effect not particular to English. However, there are subtle differences between negative quantifiers in Serbian and English.

Key words: referential focus, judgement task, semantics, syntax.

1. Introduction[3]

Natural language quantifiers include expressions such as *all, some* and *few*. They have played a central role in the development of linguistic theories, syntactic, as well as semantic. The most obvious function these expressions have is to denote amounts or proportions, but besides this, quantified expressions have important perspective modulating functions in discourse. This paper is an investigation of the subtle interpretations that quantified expressions give rise to when it comes to focussing discourse entities. The language of investigation is Serbian, thereby extending the empirical coverage of the focus properties of quantified expressions outside English.

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Moxey and Sanford (1987) noted that anaphoric reference to quantified expressions (QEs) differing in polarity (positive *vs* negative, see section 2.1) is not interpreted in the same way. The preferred antecedent for anaphoric reference changes depending on the polarity of the QE. This change of perspective, or focus (in the sense of Gundel, Hedberg & Zacharski 1993) is illustrated in the sentences in (1) and (2) (from Moxey & Sanford 1987):

(1) a. Many of the fans went to the match.
     b. They cheered happily when the team scored.

(2) a. Few of the fans went to the match.
     b. They watched it on television instead.

Moxey and Sanford's (1987) study revealed that in a sentence with a positive QE, such as *many of the fans* in (1a), speakers, when asked to provide a continuation, almost invariably provide continuations that describe the fans who went to the match, as in (1b). When the sentence instead contains a negative QE, such as *few of the fans* in (2a), the continuations are commonly, but not exclusively, made to the set of fans who did not go to the match, as in (2b). This possibility of QEs to change the perspective and focus different sets in anaphoric reference depending on polarity has been found in both production and reading studies in English (Filik, Leuthold, Moxey & Sanford 2011; Moxey & Sanford 1987; Sanford, Moxey & Paterson 1996).

The possibilities of QEs to direct focus for pronominal anaphoric reference on different sets play an important role in the processes of discourse comprehension like reference resolution. Still, studies on focusing properties of QEs have mostly been limited to English speakers. Notable exceptions are two studies on Swedish (Heinat & Klingvall 2019, 2020). Interestingly, the behavior of negative QEs in Swedish seems to be slightly different from English in that positive and negative QEs have more distinct patterns. This begs the question if the focusing properties of quantifiers are language specific or a cross-linguistic phenomenon. In order to expand our knowledge about the focusing properties of QEs in other languages, and another language family than Germanic, this paper presents the results from an offline experiment investigating QEs in Serbian, a Slavic language.

Psycholinguistic studies on quantifiers have been few in Serbian, and to our knowledge, there has been no study investigating the patterns of focus induced by different quantifiers. Thus, the present study aims to answer the general question whether QEs of different polarity induce the same kind of focus effects seen in English and Swedish. We address this question by means of an offline acceptability judgment experiment (Heinat & Klingvall 2019; Schütze & Sprouse 2013).

Before describing the experiment, we will go through some basic properties of quantifiers and sets and how they relate to anaphoric reference. Next, we will briefly discuss some previous studies and the properties of QEs in English and Swedish. After that, we provide a short description of the relevant aspects of Serbian. Then we present the experiment on Serbian, and its results, followed by a discussion of the results and, finally, a conclusion.

2. Quantifiers

The large number of quantifiers in natural languages make it clear that it is unlikely that quantifiers are simply linguistic expressions only denoting amounts, quantities and proportions (Nouwen 2010). One characteristic of quantifiers is that they form a very large and varied group of linguistic expressions. As a consequence, there exist many different ways in which quantity information may be worded, and while some quantifiers denote exact quantities (e.g., number words)[4], others are vague and imprecise (e.g., *few*, *many*, *some*). This necessitates a variety of approaches to their analysis, and Nouwen (2010) argues that creating a unified model of quantifier meaning may not even be possible and that quantifiers need to be studied on a case-to-case basis. However, Barwise and Cooper (1981), Peters and Westerståhl (2006) and Keenan (2011) among others have shown that there are certain formal properties of quantifiers that seem universal to natural languages and are of importance to the natural system of quantification[5]. In this section we present the properties of quantifiers that are known to play a role in set focus: polarity and monotonicity. We also go through set focus as outlined by Moxey and Sanford (see Sanford *et al.* 1996, for example). The remaining part of the section summarizes the experimental studies on which the experiment we present in this paper is based on.

2.1. Monotonicity, polarity and polarity items

Commonly, quantifiers are classified into monotone increasing, monotone decreasing and non-monotonic[6] (see for example Keenan 2011). The concept of monotonicity is illustrated in the following examples:

(3)   Many children dream of monsters.
(4)   Many children dream.

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[4] It should be noted that number words may still be vague (see e.g., Barwise & Cooper 1981; Horn 1972, for early discussions).

[5] Even Pirahã, a language which seems to lack number words, has quantifiers (Frank, Everett, Fedorenko & Gibson 2008).

[6] Non-monotonic QEs, such as *exactly three*, will not to be discussed in this paper.

The set of children who dream of monsters is a subset of the children who dream (the superset), therefore the sentence in (3) entails the sentence in (4). We have an entailment relation going from the subset to the superset and the quantifier *many* is said to be upward entailing or monotone increasing.

In the sentences in (5) and (6) we see the opposite entailment pattern, from the superset to the subset. If it is true that few children dream then that entails that few children dream of monsters. The quantifier few is thus downward entailing or monotone decreasing

(5)   Few children dream.
(6)   Few children dream of monsters.

Monotonocity is a property involved in the phenomenon of semantic polarity and it has been shown to be crucial for explaining the distribution of so called polarity items (NPIs) (see for example Klima 1964; Moxey, Sanford & Dawydiak 2001; van der Wouden 1997). NPIs are words or phrases that can appear only in negated contexts and are licensed by one or more negated elements in the clause[7]. The licensing of NPIs will be important in section 3, where we look at the Serbian QEs used in the study. In English, negative polarity items are words like *any, ever* and *anymore*. Monotone decreasing quantifiers are also called negative quantifiers, because they license NPIs. Monotone increasing quantifiers, on the other hand, cannot license NPIs, and are called positive quantifiers. The sentences in (7) and (8) illustrate this.

(7)   Not many/no dogs have ever bitten a cat.
(8)   *Almost all/some dogs have ever bitten a cat.

In (7), the NPI *ever* is allowed only in the sentence with negative or monotone decreasing quantifiers (*not many* and *no*), and unacceptable with positive or monotone increasing quantifiers (*almost all* and *some*), as in (8).

The monotonic properties of QEs are important since they serve as a basis for Moxey, Sanford and colleagues' experimental studies on set focus and quantification (Moxey & Sanford 1987, 1993; Sanford *et al.* 1996). We now turn to their observation that negative and positive QEs have different focus properties. In line with these studies, we will use the terms negative and positive quantified expressions or QEs, for monotone decreasing and monotone increasing QEs, respectively.

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[7] This is a very simplified view of the licensing of NPIs. In addition to being negative, the licenser needs to be in a specific syntactic configuration in relation to the NPI.

2.2. Set focus and anaphoric reference

For a successful understanding of a discourse, language users must determine if the expressions that appear in various parts of the context refer to the same entity, or discourse referent. Noun phrases like *my old dog*, or *those boring old thoughts* have the property to refer, that is, to stand for a particular discourse entity, its referent. Determining the intended referent of an expression requires the availability of a particular discourse context. This context-dependence is especially marked for pronouns, which, in contrast to ordinary noun phrases, are referentially dependent on a certain antecedent in the discourse[8]. A simple use of an anaphoric pronoun is shown in (9), where the personal pronoun *he* refers back to its antecedent, *my cousin.*

(9) Do you remember my cousin? Yes, he used to be my friend in school.

In such relatively simple situations, the anaphoric pronoun refers to a certain referent that has already been introduced into the discourse (see for example Kamp & Reyle 1993, for a discussion). While definite noun phrases and pronouns are referential, QEs do not refer (Portner 2005). They do not identify a specific referent but denote the quantity (number or proportion) of entities for which a certain property is valid. The complex phenomenon of anaphoric reference following QEs has attracted the attention of many studies (Heinat & Klingvall 2019, 2020; Kibble 1997; Nouwen 2001, 2003, 2010; Zulaica-Hernández 2018, to name a few). However, the most systematic investigation of anaphoric reference and quantified expressions has been a series of psycholinguistic experiments conducted by Moxey, Sanford and colleagues.

Moxey and Sanford argue that quantifiers require the cognitive activation of a number of sets and subsets, and that these sets must be considered in resolving the anaphoric reference when referring back to a QE. According to Sanford *et al.* (1996), sentences quantified with a quantifier Q, such as in (10), requires activation of at least three sets.

(10) Q of the fans went to the game.

The different sets and subsets activated by (10) are illustrated in Figure 1 (cf. Sanford *et al.* 1996).

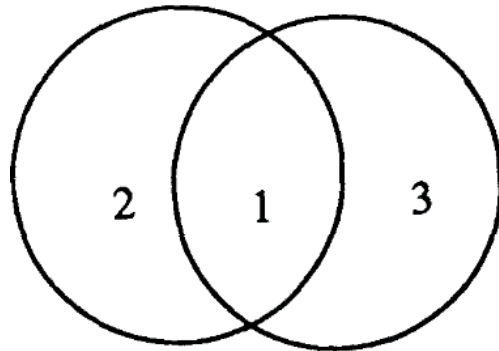[8] We exclude deictic uses of pronouns.

Figure 1: Set diagram representing a quantified sentence: Q As are Bs

The sets in Figure 1 are the following:

> Set 1: A necessary set of the fans who went to the game: the Reference set.
> Set 2: A possible set of fans who did not go to the game: the Complement set.
> Set 3: A possible set of people who went to the game but were not fans.

Moxey and Sanford claim that these sets are not equally accessible, or focussed, for anaphoric reference. In the case of a positive quantifier (e.g., *some*), the most accessible set, the set with most attentional focus (see Gundel *et al.* 1993) is Set 1 (the fans who went to the game). This set is called the Reference set. This is illustrated in the sentences in (11).

> (11) Some of the fans went to the game.
> a. They watched it with enthusiasm.
> b. #They watched it on television instead.

In (11a), the pronoun *they* refers back to the reference set, i.e., the fans who went to the game. In case the pronoun referred to Set 2 in Figure 1. i.e. the fans who did not go to the game the reference would be less acceptable or completely ruled out (indicated by #). This set is called the Complement set.

Moxey and Sanford (1987) observed that with negative quantifiers, regardless of whether they have a semantically explicit negative component (as in *not many*) or an implicit negative component (as in *few*) anaphoric reference to the Complement set is possible, as illustrated in (12).

> (12) Not many/Few fans went to the game.
> a. They watched it with enthusiasm.
> b. They watched it on television instead.

As can be seen in (12), with the negative quantifiers *not many* and *few*, reference is possible to the Reference set (12a) but also to the Complement set (12b).[9]

2.3. Set reference in English, Spanish and Swedish

In their original study, Moxey and Sanford (1987) investigated anaphoric reference to quantified expressions in English using sentence continuations tasks. The participants were presented with sentences like (13) and (14) (containing only one quantifier and one sentence connector), and were asked to provide a continuation after the pronoun *they*.

(13) Few/a few/not many MPs went to the meeting. They...
(14) Few/a few/not many MPs went to the meeting and / but / because they...

They obtained data from a large number of participants (640), and, in order to avoid contrast effects, the participants completed only one sentence each. The results were that negative QEs led to anaphoric reference patterns, in which more than a half of the continuations were references to the Complement set. In contrast, the positive QEs did not allow such continuations, but instead led to focus on the Reference set almost invariably. The authors concluded that positive QEs allow anaphoric reference to the Reference set and block reference to the Complement set. In contrast, negative QEs allow but do not require anaphoric reference to the Complements set. Thus, there is an asymmetry between positive and negative QEs, such that the focus effects of negative QEs are ambiguous and they allow either the complement set the reference set to be in focus.

In another study (Sanford *et al.* 1996) a larger number of English QEs were investigated in both production and comprehension processes. The first two experiments were sentence continuation tasks similar to the study discussed above, involving a whole range of negative and positive quantifiers. The results showed that set focus is not restricted only to QEs denoting very small proportions (like the quantifiers examined in Moxey and Sanford 1987), but that Complement set focus is also allowed for negative QEs that denote high proportions.

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[9] According to Nouwen (2003), in the interpretation of anaphoric reference to preceding quantified expressions, there is a preference to the Reference set over the Complement set reference. Reference to the Complement set, however, is possible but since the antecedent of the anaphoric pronoun is not prominent in those cases, it has to be inferred. Such inference, Nouwen argues, is only possible with monotone decreasing/ negative quantifiers. However, the results from numerous studies of Moxey, Sanford and colleagues show that with negative quantifiers the Complement set is indeed the prominent set, as we will see in section 2.3.

With the negative QEs in the study, the anaphoric reference pointed to the Complement set in 62% of continuations *vs* 21% to the Reference set. The positive QEs produced almost all Reference set continuations (90%) and almost no Complement set continuations (0.5%). The third experiment was a self-paced reading study, and the authors found that sentences with both positive and negative quantifiers were read with the same ease when they contained reference back to the Reference and Complement set, respectively. Moreover, they also observed that readers spent more time on reading when a sentence with a positive QE was followed by anaphoric reference to the Complement set. Longer reading times were also reported when a sentence with a negative QE was followed by anaphoric reference to the Reference set. According to the authors, the results showed that readers found it difficult to understand the passages where the pronoun referred to the unfocussed set. In conclusion, the results from these, and other studies (for example Filik *et al.* 2011; Moxey 2006; Moxey *et al.* 2001; Sanford, Dawydiak & Moxey 2007) show that in English positive QEs allow anaphoric reference to the Reference set only, and negative QEs put more focus on the Complement set, which then is the preferred set for anaphoric reference, but they still allow anaphoric reference to the Reference set. We now turn to two other languages where anaphoric reference to QEs has been discussed, Spanish and Swedish. Zulaica-Hernández (2018) claims that, for Spanish, the quantified expressions' anaphoric reference to the Reference set is the default, regardless of the monotonocity of the QE. However, anaphoric reference to the Complement set is still possible with negative quantifiers. Additionally, Zulaica-Hernández claims that, for Spanish, the crucial factor in determining the focussed set of the quantifiers is the relative size, in respect to the number of members, of the Reference and Complement sets. As pointed out above, Sanford *et al.* (1996) showed that set size is not relevant in English. It should be noted that Zulaica-Hernández bases his discussion on introspection and points out that experimental evidence is needed to confirm the patterns he finds in his intuitive data.

Finally, two semantic plausibility studies on Swedish quantifiers reported results that align with the observations of Moxey and Sanford, in that positive QEs invariably induce reference to the Reference set, whereas negative QEs give preference to the Complement set (Heinat & Klingvall 2019; Klingvall & Heinat 2022a, b). The negative QEs, however, showed unexpectedly low acceptability in focus on the Reference set and to such a degree that the authors concluded that the Reference set with negative QEs was not even an option, in contrast to English. Additionally, the role of set focus and relative set size was investigated (Klingvall & Heinat 2022a). The results showed that for Swedish QEs, the relative set size does not determine set reference, just as in English.

To sum up this section, we can say that in the three languages investigated in the literature, positive QEs invariably allow anaphoric reference only to the Reference set in the three languages. When it comes to negative QEs, the languages diverge. In Spanish, the Reference set is the default set for anaphoric reference, even though Complement set reference is allowed[10]. English shows the reversed situation, the Complement set is the default set, but Reference set reference is possible. In Swedish, the Complement set is the default set too, and the Reference set is claimed to be more or less excluded as possible for anaphoric reference.

3. Experiment: Set focus in Serbian

This experiment addresses a question of a very general nature, namely whether the claim for preferred patterns of anaphoric reference to positive and negative QEs holds for Serbian, as it does for English and Swedish (and Spanish, it seems). In the experiment in this study we make use of an acceptability judgment tasks (see Häussler & Juzek 2017; Juzek 2015; Schütze 1996; Schütze & Sprouse 2013, for extensive discussion and comparison of measurements and analyses). There are no previous studies on the focus properties of Serbian QEs, to our knowledge, but based on the previous studies on English and Swedish we expect the results will show a difference between positive and negative QEs with respect to the different sets they focus. Our predictions are, consequently, that for positive QEs:

- Sentences with continuations that focus the Reference set will be judged as better than sentences focusing the Complement set,

and for negative QEs, we predict the opposite:

- Sentences with continuations that focus the Reference set will be judged as worse than sentences focusing the Complement set.

3.1. Methods, participants and materials

The experiments make use of a 5-point numerical Likert scale (1 to 5), with the endpoints of the scale defined as *completely unacceptable* (1) or *completely acceptable* (5). The participants were asked to rate each sentence along the scale. The Serbian quantifiers included in the study are the two negative quantifiers *malo* 'few' and *veoma malo* 'very

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[10] As pointed out above, these claims are based on one speaker's intuition and are not verified by proper studies as on English and Swedish.

few' and two positive quantifiers, *mnogo* 'many' and *neki* 'some' (see the section below for details). The sentence connector in all the items is a full-stop, since it is considered to be a 'neutral' connective (Moxey & Sanford 1987).

Thirty-two adult native speakers of Serbian (13 female and 19 male, age 35 to 50) took part in the judgement task. All of them were naive with respect to the aim of the experiment. They participated in the study on a voluntary basis and were not compensated for their participation. In line with ethical principles of research, informed consent (oral) was obtained from all participants prior to their participation in the study. No personally identifiable information has been connected to the results.

Before detailing the sentences used in the study, we will show that the quantifiers used are indeed negative and positive.

3.1.1. QEs in the study

In the following, we present the main features of Serbian that are relevant for our investigation of set focus, with a focus on the licensing of NPIs, since these will be used as a diagnostics for the quantifiers used in the acceptability judgement task.

Serbian shows negative concord and allows more than one negative element to convey a single negative concept, as in (15)[11]:

(15) Stefan *nikada ne* smatra   *nikoga*   inteligentnim.
Stephen never not regard-PRS.3SG.MASC. no-one-ACC intelligent-
INSTR.
'Stephen does not ever regard anyone as intelligent.'

There are two types of Negative Polarity Items (NPIs) in Serbian (Progovac 1994):

(16) a. *ni*-NPIs: *niko* 'no-one', *ništa* 'no', *nikad* 'never', *nigde* 'no place'
     b. *i*-NPIs: *iko* 'anyone', *išta* 'any', *ikad* 'ever', *igde* 'any place'

The NPIs in (16a), the *ni*-NPIs, occur only in the same clause as the licenser, the negation *ne*, as in (15) above, and the NPIs in (16b), the *i*-NPIs, occur in negated contexts, such as in a clause embedded under the scope of *ne*, as in example (17) (from Progovac 1994: 42). Both types of NPIs are equally unacceptable if there is no licenser in the sentence.[12]

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[11] Abbreviations ACC = accusative, F = feminine, GEN = genitive, INF = infinitive, INST = instrumental, LOC = locative, M = masculine, N = neuter, NOM = nominative, PL = plural, PROG = progressive, PRS = present, PST = past, SG = singular.
[12] The syntax of Serbo-Croatian NPIs is intricate and the reader is referred to Progovac (1994) for details. The summary above focuses on the details relevant for establishing the polarity of the quantifiers used in the study on Serbian.

(17) Milan ne   tvrdi   [da Marija poznaje itkoga.]
Milan not claim-PRS-3SG-M   that Mary know-PRS-3SG-F anyone-ACC
'Milan does not claim that Mary knows anyone.'

With respect to quantifiers and their licensing of negative polarity items in Serbian, the following examples test the polarity of the Serbian quantifiers used in the study, *malo* 'few', *veoma malo* 'very few', *mnogo* 'many' and *neki* 'some':

(18) *Veoma malo/Malo* dece   je *ikada* videlo   vulkan.
very few/few child-GEN.PL.N. is ever see-PST.3SG.N. volcano-ACC.SG.MASC.
'*Very few/Few* children have *ever* seen a volcano.'

(19) *Mnogo dece   je *ikada* videlo   vulkan.
many child-GEN.PL.N. is ever see-PST.3SG.N. volcano-ACC.SG.MASC.
'*Many* children have *ever* seen a volcano.'

(20) *Neka deca   su *ikada* videla   vulkan.
some child-GEN.PL.N. are ever see-PST.3SG.N. volcano-ACC.SG.MASC.
'*Some* children have *ever* seen a volcano.'

As shown in (18), the negative polarity item *ikad* 'ever' is allowed only in sentences with the negative quantifiers *malo* 'few' and *veoma malo* 'very few', and unacceptable with the positive quantifiers *mnogo* 'many' and *neki* 'some', in (19) and (20).

In order to establish the available interpretations of quantified sentences, stimuli sentences were created in the following way. The first sentence of each stimulus contained a quantified noun phrase in the role of the subject, and the following sentence contained an anaphoric pronoun. The second sentence in the stimuli set up a context that either favoured a complement set or a reference set interpretation of the anaphoric pronoun (see Moxey & Sanford 1987, for details). The way anaphoric reference was made to the preceding QE was achieved in three different ways, by means of: a plural anaphoric pronoun *oni* 'they', as in (21) and (22), a null subject pronoun (indicated by --, which was not present in the material the participants saw), as in (23) and (24), or a plural possessive pronoun *njihov* 'their' as in (25) and (26).[13]

(21) NEG.QE-COMP
Veoma malo dežaka je gledalo film. Oni su umesto toga zadirkivali devojčice.
'Very few of the boys watched the film. They teased the girls instead.'

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[13] The examples are not glossed since the morphology is not relevant for understanding the manipulations of the sentences.

(22) POS.QE-COMP
Neki dečaci su gledali film. Oni su, umesto toga zadirkivali devojčice.
'Some of the boys watched the film. They teased the girls instead.'

(23) POS.QE-REF
Mnogo gostiju hotela je koristilo bazen. -- Uživali su mnogo u plivanju.
'Many of the hotel guests used the swimming pool. They enjoyed swimming a lot.'

(24) NEG.QE-REF
Malo gostiju hotela je koristilo bazen. -- Uživali su mnogo u plivanju.
'Few of the hotel guests used the swimming pool. They enjoyed swimming a lot.'

(25) POS.QE-REF
Mnogo studenata je položilo ispit. Njihov uspeh je potvrdio očekivanja profesora.
'Many of the students passed the exam. Their success confirmed the professor's expectations.'

(26) NEG.QE-REF
Malo studenata je položilo ispit. Njihov neuspeh je potvrdio očekivanja profesora.
'Few of the students passed the exam. Their failure confirmed the professor's expectations.'

The experimental data included a total of 80 test items, with each item containing four sentences manipulated along two dimensions: the quantifiers' Polarity (negative *vs* positive) and Set Reference (complement vs. reference set), as shown in (27). Since there are no structural anomalies in the sentences that may interfere with the judgements, we are confident that the participants' judgements tap into semantic, or contextual congruency rather than grammatical well-formedness.

(27) a. POS.QE-REFSET
Mnogo gostiju hotela je koristilo bazen Uživali su mnogo u plivanju.
'Many of the hotel guests used the swimming pool. They enjoyed swimming a lot.'

b. POS.QE-COMPSET
Mnogo gostiju hotela je koristilo bazen Oni su, umesto toga, pili u baru.
'Many of the hotel guests used the swimming pool. They drank in the bar instead.'

c. NEG.QE-REFSET
Malo gostiju hotela je koristilo bazen Uživali su mnogo u plivanju.
'Few of the hotel guests used the swimming pool. They enjoyed swimming a lot.'

     d. NEG.QE-COMPSET
       Malo gostiju hotela je koristilo bazen. Oni su, umesto toga, pili u baru.
       'Few of the hotel guests used the swimming pool. They drank in the
       bar instead.'

The 80 experimental items were then distributed across four lists using a Latin Square design, so that each participant read all types of manipulations but only one sentence from each item. Each list contained the same number of unrelated filler sentences as the number of target sentences, making the total number of sentences on each list 160. Each list was randomly assigned to eight participants. Due to the fact that not all participants had access to a computer or the Internet, the materials were printed, such that there was only one sentence on a sheet. Thus, a sort of booklet was created.

3.2. Procedure

Each participant was assigned one booklet. Before starting the experiment, the participants read the instructions. These were written in Serbian in the booklet. They were instructed to read each sentence at their own pace, allowing for the time needed for full comprehension, and rate each sentence in line with their first impression, using the 5-point Likert scale. The instructions also guided the participants not to return to the sentences they had rated. The test took approximately 25 minutes to complete, and an experimenter was present during the whole procedure.

3.3. Results

Even though a Likert scale does not give continuous data, it is standard to treat the grading as such (see e.g., Häussler & Juzek 2017; Juzek 2015; Schütze & Sprouse 2013; Sprouse 2007). The statistical analysis was done using R (R Core Team, 2016) and the package LmerTest (Kuznetsova, Bruun Brockhoff & Haubo Bojesen Christensen 2016) was used to fit the data to a linear mixed effect model of the relationship between the QEs' polarity and set reference. The fixed effects in the models were Polarity of QE (positive and negative) and Focussed set (reference set and complement set) and their interaction. Random intercepts and random slopes for participants and items were included as maximally as permitted by the data (Barr, Levy, Scheepers & Tily 2013).
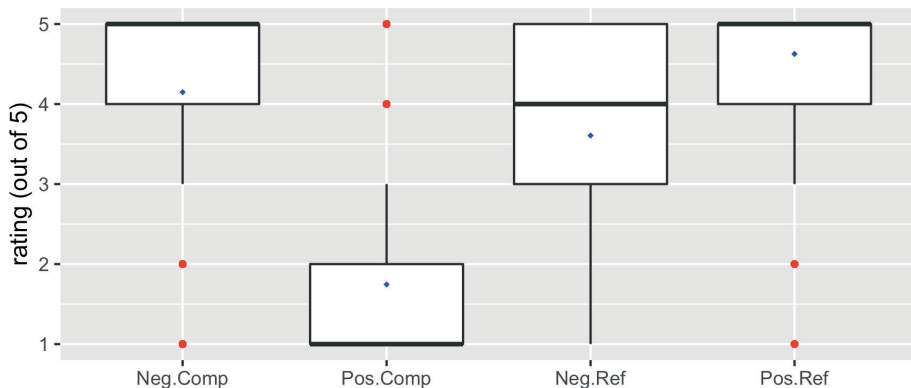
Figure 2: Ratings of positive and negative QEs in Serbian

QE Set	Rating
Positive refset	4.63
Positive compset	1.75
Negative refset	3.61
Negative compset	4.15

Table 1: Mean ratings of Positive and Negative quantifiers in Serbian

Table 1 shows the means for each of the four conditions and Figure 2 shows the sentence ratings by conditions polarity and reference set. The blue dots within the boxes represent the average value of each condition, while the red dots are outlying ratings for each condition. These outlying ratings occurred with all quantifiers. These few outliers are most likely due to performance error, which is not uncommon when human subjects are involved and since the outlying ratings are not representative of any general behaviour, we see no reason to exclude any of these datapoints (see discussion in Winter 2019).

The results show that positive quantifiers with anaphoric reference to the Reference set received much higher ratings than they did with anaphoric reference to the Complement set. As for negative quantifiers, it can be seen that interpretations of anaphoric reference to the Complement set received higher ratings than those to the Reference set, though with a smaller difference between ratings.

As seen in Table 1, the average rating of sentences with positive QEs focusing on the Reference set is 4.63 and Complement set 1.75. This shows that the Reference set is the preferred set for positive QEs. Sentences with negative QEs focusing on the Complement set received the average rating of 4.15, and Reference set 3.61. This makes the Complement set the preferred focus of anaphoric reference for negative QEs.

Condition	Estimate	Std. Error	Df	t value	Pr(> |t |)	
Pos QEs - comp (Int)	1.75	0.082	192.32	21.38	<2e-16	***
Neg QEs - comp	2.40	0.099	314.72	24.27	<2e-16	***
Pos QEs - ref	2.88	0.099	314.72	29.10	<2e-16	***
Neg QEs - ref	-3.42	0.140	314.72	-24.45	<2e-16	***
Neg QEs - comp (Int.)	4.15	0.082	192.32	50.81	<2e-16	***
Neg QEs - ref	-0.54	0.099	314.72	-5.47	<8.9e-08	***
Pos QEs - comp	-2.40	0.099	314.72	-24.27	<2e-16	***

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Model = lmer(Rating ~ Polarity * Set + (1 + Set | Participant) + (1 | Item))

Table 2: Positive and Negative quantifiers in Serbian (Pos-comp and Neg-comp as Intercepts)
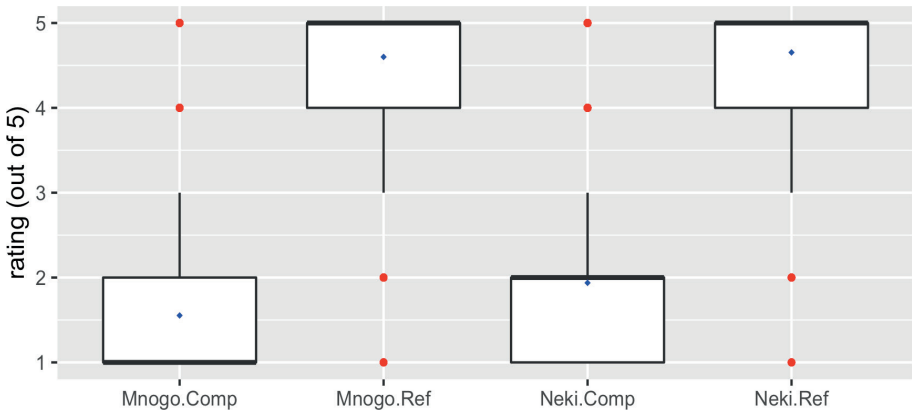

Figure 3: Ratings for positive quantifiers Serbian anaphoric reference for negative QEs

The results from the Linear mixed models analysis in Table 2 show that all the differences between the conditions are significant. In order to get an overview of all significant differences between the conditions, a relevelling of the results was done. The upper part of Table 2 shows positive QEs with Complement set focus as the intercept (Int.), and the lower part shows negative QEs with Complement set focus continuations as the intercept.

In order to make sure that the results are not driven by any one particular QE, we see in Figure 3 that the acceptability ratings for positive QEs *mnogo* 'many' and *neki* 'some' with reference to the Reference set have similar values. In the Complement set condition, the two QEs differ slightly in that the quantifier *mnogo* received average ratings closer to the floor-rating than *neki*. However, the tendencies are the same and we can be quite certain that both these positive QEs behave the same.

Figure 4 displays the average ratings for individual quantifiers within the group of negative QEs and we see that the quantifiers *malo* 'few' and *veoma malo* 'very few' do not differ much in their ratings for the Reference set. In the results for the Complement set, the quantifier *veoma malo* received less uniform ratings than *malo*, but again, the behaviour of the two QEs is similar and we are confident that they behave the same.[14]

Figure 4: Ratings for negative quantifiers Serbian

The results of Experiment 1 can be summarised as follows:

- Sentences with Positive QEs received significantly higher ratings with Referent set focus than sentences with Complement set focus.
- Sentences with Negative QEs received significantly higher ratings with Complement set focus than sentences with Reference set focus.
- Sentences with Reference set focus with Positive QEs received significantly higher ratings than sentences with Complement set focus with Negative QEs.
- Sentences with Reference set focus with Negative QEs received significantly higher ratings than sentences with Complement set focus with Positive QEs.

4. Discussion

In this study, an off-line judgment task was used to investigate the patterns of anaphoric reference to positive and negative QEs in Serbian. We attempted to answer the question whether positive and

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[14] We have not tested these differences for significance, since the experiment is not set up for comparing individual QEs.

negative quantifiers in Serbian give rise to different interpretations of anaphoric reference to preceding quantified expressions. The results showed that there is a distinction between interpretations of anaphoric reference related to the polarity of quantifiers in Serbian; positive QEs focus the Reference set and negative QEs focus the Complement set. The results of the experiment align with the results reported on English (e.g., Moxey & Sanford 1987; Sanford *et al.* 1996) and Swedish QEs (e.g., Heinat & Klingvall 2019). Moreover, the asymmetry of the focus patterns of positive and negative QEs observed for English is also seen in Serbian. Thus, positive QEs almost invariably focus the Reference set and block Complement set focus. On the other hand, negative QEs focus the Complement set and also allow Reference set focus to a certain degree; this condition received the average ratings of 3.60 in the present study. Having in mind that Sanford *et al.* (1996) reported only 21% of reference set continuations for negative QEs in English (compared to 61% of complement set continuations, see section 2.2), the average rating for the Reference set with negative QEs (3.60) in Serbian is somewhat unexpected. It is even more unexpected in comparison to Swedish, a language that strongly rejects reference set focus with negative QEs (Heinat & Klingvall 2019). Admittedly, the present experiment is a very small experiment and we have only looked at two positive and two negative QEs. Had we included more QEs, the results might have been more in line with the English and Swedish data. However, the two negative QEs behave in a similar way, which we take as an indication that there is a difference between languages in their possibilities to focus the reference set with negative QEs.

In sum, for Serbian QEs it can be said that positive QEs require anaphoric reference to the reference set, whereas negative QEs allow reference to the Complement set but do not require it. In comparison to Swedish and English, negative QEs in Serbian seem to favour the Reference set focus to a much higher degree.

5. Conclusion

This study presented experimental data on quantified expressions in Serbian. The observations reported clearly fit into the general theoretical framework on quantifiers focus properties as outlined by Moxey, Sanford and colleagues (for example, in Moxey & Sanford 1987, 2000; Sanford *et al.* 1996). The conclusions of the study can be summarised in the following important observations: positive and negative quantifiers in Serbian differ in focus properties, i.e., they direct focus of anaphoric reference to different discourse entities. The polarity of the quantifier is a determining factor in the interpretation of the anaphoric reference to the quantified expression. Importantly, the Reference set focus with negative quantifiers is favoured to a higher

degree in Serbian than in English (as described in various studies by Moxey and colleagues). We find that there indeed are general crosslinguistic patterns in the set focus of quantifiers, but also that there are subtle differences between languages.

The major contribution of this paper is empirical in its nature and the results show that quantified expressions in Serbian behave as in the other languages studied, but there are subtle differences in interpretation. However, the reasons why we find these differences in focusing effects between QEs of different polarity are not clear. There have been suggestions in the literature that they have to do with expectations that certain elements, such as sentential negation and negative QEs give rise to, but whether this is the case in Serbian is a question for future research.

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