Linguistic Relativity and Grammatical Number: A Comparison between Native Slovenian and English Speakers

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Abstract. The theory of linguistic relativism suggests that language influences the way we think (Reinez & Prinz, 2009). The present study aims to extend the evidence into another domain, grammatical number. The methodology and idea stem from research by Phillips & Boroditsky (2003). My study investigated the differences in cognition between native speakers of a 2-way number system language (English) and native speakers of a 3-way number system language (Slovenian). The primary hypothesis was that Slovenians group pictures of two versus three by number, whereas the English group them by type. Dual and nondual dialects of Slovenian are also compared to exclude the possible cultural differences between the English and the Slovenian participants. The experiment was carried out online using Qualtrics survey software. A grouping task was used to explore whether there is a difference between Slovenian and English native speakers' mental categories. The design for ensuring balanced conditions was Latin square, and factorial ANOVA was used for the data analysis. There was no significant difference in grouping choice between the English and Slovenian group. There was a slight effect of dialect, which needs to be explored further. A big limitation was a significant effect of the device used for solving the survey on the groupings. There was no evidence found in favour of linguistic relativism in the domain of the grammatical number. The findings offer some compelling grounds for further research.

Keywords: language relativity; Slovenian dual; language cognition interaction; Slovenian dialects

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1 Introduction

This dissertation investigates whether having a grammatical category of the dual number in your native language affects the way you think, or more specifically, the way you choose to group objects. The theory behind this study is called linguistic relativism, which states that the language we speak influences the way we think. It has been a source of controversy ever since it had been proposed by Whorf in 1956. The strong Whorfian view, or linguistic determinism, which says that thought and action are entirely determined by language, has been abandoned in the field. A more moderate question of whether language shapes or influences thought is still being actively researched. It has proven to be difficult to definitively answer, as there is evidence for both sides of the debate. Much recent evidence in favour of linguistic relativism comes from the work of Lera Boroditsky. Phillips and Boroditsky (2003) were testing whether the grammatical gender of inanimate objects leads people to think of them as having a gender. They found the effects of grammatical gender on people's perceptions of objects in a variety of settings. Her other experiments have also found effects of linguistic relativity in representations of space, time, and substances. This study investigates whether grammatical number also shows effects of linguistic relativity by exploring the differences in cognition between native speakers of a language with a 2-way number system (English) and native speakers of a language with a 3-way number system (Slovenian).

2 Linguistic Relativism

Languages differ immensely in how they describe the world. However, does having a different way of describing the world also means that speakers of different languages think about the world in different ways? This question is addressed by the theory of linguistic relativity or Sapir-Whorf hypothesis (Casasanto, 2008). Reinez and Prinz (2009) summed up the evidence of linguistic relativity according to four domains: grammatical gender, frames of reference, spatial categories, and noun types. The present study aims to extend the evidence into another domain; the grammatical number.

Hunt and Agnoli (1991) state that linguistic relativism occurs because different languages pose different challenges and provide differential support to cognition. They discuss the arguments that oppose and support the Sapir-Whorf theory from a cognitive psychology point of view. According to them, one of the major counterarguments of the theory is the intertranslatability issue. This issue asks whether a statement in one language can be translated into a statement in another language. That usually is the case, which disproves the strong version of the theory, linguistic determinism. However, the statements in different languages might be of different length and therefore easier or harder to create. The issue is then whether the naturalness of the translation between the languages is the same. Naturalness can be quantified in terms of the computational burden, which would make longer statements more expensive than single-word ones. Hunt and Agnoli (1991) compare this complexity argument to Whorf's idea, which says that the distinctions made by the grammar of a language are far more important determinants of thought than the explicit categorisations of the lexicon (Whorf, 1956). This connection between grammar and language is one notion that the present experiment is going to test.

Linguistic determinism goes against the view held by Noam Chomsky (2006), among others, which states that human cognition is largely universal and independent of language and culture. He says that all languages share the same deep structure of thought and that thought has a universal quality separate from language. The cognitive linguistics as a discipline rejects the notion of linguistic relativity. They view language as just another cognitive function operating under the same rules as other cognitive processes. Boroditsky's critics say that her findings, for example, that differences in English and Mandarin speaker’s conceptions of time affect the temporal cognition (Boroditsky, 2001), are highly dependent on the context in which the experiments take place. They say that her findings neglect the reality that language is much less complex than our thoughts and as such, cannot determine them (January & Kako, 2007).

There is a lot of conflicting arguments and views in the field of linguistic relativism. In his influential book, ‘The Language Instinct’, Steven Pinker (1994) describes linguistic relativism as a ‘conventional absurdity’. He claims that language cannot equal thought as it ‘is hopelessly unsuited to serve as our internal medium of computation’ (Pinker, 1994, p. 76). He lists five properties of the English language, which show problems for the notion that language equals thought. ‘Ambiguity’, in his opinion, shows that if there can be two thoughts corresponding to one word, thoughts cannot be equal to words. ‘Lack of logical explicitness’ shows that we need something else other than language to think, namely common sense, which is not available in the sentences alone. ‘Co-reference’ shows that we know who we are talking about, even if we refer to them with different expressions. ‘Deixis’ shows that some information can only be extracted from the context of the utterance, not words themselves. ‘Synonymy’ shows that we understand many different arrangements of words to have the same message, and we cannot get that simply by processing the words. These five properties of language are why he thinks that people think in the language of thought, 'mentalese', rather than in any particular natural language. Knowing a language then means knowing how to translate mentalese into strings of words and vice versa. However, language relativism is not claiming

that language equals thought. Casasanto (2008) says that a lot of the controversy in the field is due to conflating two distinct questions — Do we think in language? and Does language shape thought?. What Pinker is arguing is not the same as what Whorf initially proposed, which is that differences among languages cause differences in the thoughts of their speakers. Language may shape the way people think even if they do not think in a language (Casasanto, 2008).

The type of linguistic relativity that is considered in this study is structural relativism. This concerns how speaking one or more particular languages may influence thinking as a result of differences in the morphosyntactic configurations (Lucy, 2000). One of the differences between the world's languages is how they mark the number on different word classes. The languages chosen for comparison in this study are Slovenian and English, as they differ in their grammatical number systems. English distinguishes between being one, singular, and being two or more, plural. Slovenian adds a category for being exactly two, dual. The dual is a form of the plural and is the most marked category (Jakop, 2012).

3 The Slovenian Dual

Slovenian (also called Slovene) is a South Slavic language spoken primarily in the Republic of Slovenia. It is the native language of about 2 million people living in Slovenia and its global diaspora. It is one of the few Indo-European languages that still have the grammatical number category of dual, next to Upper and Lower Sorbian, which are minority West Slavic languages in eastern Germany. Some sources also mention sub-national language variety Kashubian as having dual (Jakop, 2010), but others claim that it only had dual in its earlier historical development (Slobodchikoff, 2013). Dual is otherwise present in around 200 non-Indo-European languages, the biggest one being Arabic (Jakop, 2010).

Dual is present in all paradigms in Contemporary Standard Slovenian (CSS), which is the language used in the literature and official writings. In addition to CSS, the Slovenian language has 36 dialects and 12 subdialects, which are separated into seven dialect groups. There is also a colloquial standard which is used in less formal speech settings such as television, radio, and theatre. It has formed between CSS and local dialects and therefore differs across different regions of the country. Dual is one of the more interesting areas of difference between the distinct codes of Slovenian, as it is used to various extents across the different varieties (Jakop, 2012). Some Slovenian dialects are witnessing a gradual disappearance of the dual and its replacement by plural forms. Dual is the most stable in nominative and accusative masculine case. In feminine nouns, dual forms have been mixed with plural forms since the 16th century (Jakop, 2008). In the colloquial language of central Slovenia, dual is still used for masculine nouns. However, the dual forms for feminine nouns have been replaced by the plural: ‘dva fanta’ [two boys] (masc. dual), ‘dve punce’ [two girls] (fem. dual/pl.). The CSS equivalent for the later has two different forms: ‘dve punci’ [two girls] (fem. dual) and ‘dve punce’ [two girls] (fem.pl.). The situation in the central Slovenian dialects is the same, while the dialects in the north-west and north-east still preserve the feminine dual. Masculine and feminine verbal forms exist in most Slovenian dialects, and in some of them, the distinction between genders occurs only in dual, which is not the case in CSS (Jakop, 2012).

Slovenian is an ideal language for investigating differences in mental representations between native speakers of a language with a two-way grammatical number system and native speakers of a language with a three-way grammatical number system. Not only because it uses the grammatical number category of dual, but also because the usage of dual is not equally distributed in the different dialects. This distribution provides a unique opportunity to eliminate possible other influences on different mental representations between Slovenian and English native speakers, such as cultural differences. Speakers of different dialects

of Slovenian have (roughly) the same culture, but they differ in the extent to which they use the dual grammatical number (Marušič et al., 2016). The present study will compare whether there is a difference between Styrian and Littoral dialects, which use dual more, and Upper Carniolan and Ljubljana dialects, which use dual less. This grouping of dialects was selected based on the description of the differential use of the dual by Jakop (2008).

4 The Present Study

An important point when researching linguistic relativity is not to mistake language relativity with language diversity. Opponents of the theory do not deny the fact that languages differ immensely between each other, not only in their lexicon but also in the way they form their descriptions of the world and mark the distinctions on the different word classes. When testing for language relativism, it is important not to make a circular question and test a function that is dependent on language, but to test other non-linguistic cognitive implications. In order to have evidence for linguistic relativity, there must be an assessment of cognition that is independent of immediate verbal production (Lucy, 2000). In consideration of this argument, a grouping task was chosen as a test of linguistic relativity in the present study.

A suggestion of the theory of linguistic relativity is that language structure cues attention. For example, if a language has a grammatical distinction between words for groups of two versus groups of three, its speakers will pay more attention to those cues, and they will form a category in their mind. The notion that language cues attention is an assumption of the present study.

The main research question is: Does having the dual grammatical number category in a language influence the way the native speakers of that language choose to group pictures? The research question will be tested with the following hypotheses:

(H0) Slovenian and English native speakers will group the same pictures, or the grouping difference will not be statistically significant.

(H1) Slovenian speakers will group pictures with two items by the number of items significantly more often than English native speakers.

(a) Same Picture Same Number (SPSN) item will be grouped with Distinct Picture (DISP) in the Plural Dual (PD) and Dual Plural (DP) conditions significantly more in the Slovenian native speaker group.

b) English and Slovenian participants will be as likely to group SPSN with DISP and Distinct Number (DISN) in the Singular Dual (SD), Singular Plural (SP), Plural Singular (PS), and Dual Singular (DS) conditions.

c) Nondual dialect Slovenian native speakers will respond similarly to English native speaker group, therefore grouping by the entity in DP and PD conditions.

d) Because the use of dual in different dialects contracts in the feminine cases most strongly, a comparison between dual and nondual dialects of Slovenian with only items of feminine grammatical gender will be made. Participants from dual dialects will group DISN and SPSN significantly more often than participants from nondual dialects.

Some other exploratory research questions will be tested:

(A) Does the item type of the picture – human, animal, object – influence the grouping?
(B) Does the device the survey is completed on influence the grouping?
(C) Does the sex of the participants influence the grouping?

To summarise, this study will explore whether native speakers of languages with different systems for marking number – Slovenian and English – show any effects of linguistic relativism, therefore if their native language's way of marking number affects their mental representations. This will be tested through a grouping task, where differences in grouping choices of pictures with two entities versus pictures with three entities will be observed. Different dialects of Slovenian which contrast in their usage of dual will be compared as well, especially the difference between masculine and feminine items. Grouping of different types of items (human, animal, object) will be investigated exploratorily. The influence of participants' sex and the device used on the grouping will be tested as well.

5 Methods

5.1 Participants

Participants were recruited online with convenience sampling, using a Qualtrics (Qualtrics, Provo, UT) anonymised link and posts on Facebook. 160 Slovenian native speakers and 50 English native speakers completed more than 90% of the survey, which was the cut-off for inclusion in further analysis. All participants in respective groups regarded Slovenian or English as their only native language. The average age of all participants was 23.4 years (SD = 6.86). Slovenian participants ranged in age from 18 to 57 years (M = 22.9, SD = 6.18). English participants ranged in age from 19 to 67 years (M = 23.0, SD = 8.60). Data from participants above the age of 30 were excluded before the analysis to make the sample more balanced and comparable. The new number of Slovenian native speakers was 151 (mean age = 21.49, SD = 2.10), and the new number of English native speakers 46 (mean age = 22.95, SD = 2.24). Out of the participants that answered the question about their sex, there were 35 males and 110 females in the Slovenian group, and 23 males and 21 females in the English group (see Figure 1).

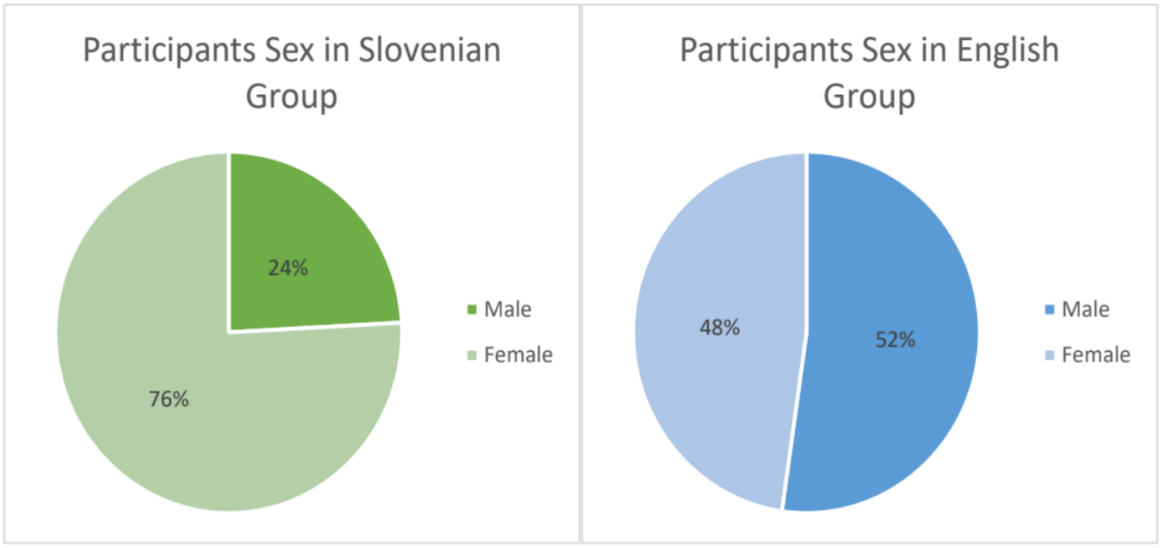

Figure 1: *Participant sex distribution in Slovenian and English groups.*

The Slovenian native speakers had, on average, 12.85 years of experience with English (*SD* = 3.02). The Slovenian group spoke on average 2.58 foreign languages (range 1 to 7, *SD* = 1.04), the most common being English (*n* = 143, 9 did not answer), German (*n* = 83), and Serbo-Croatian (*n* = 54). The English group spoke on average .89 foreign languages (range 0 to 5, *SD* = 1.30), the most common being French (*n* =15). The groups differed in education levels achieved by the participants (see Figure 2).

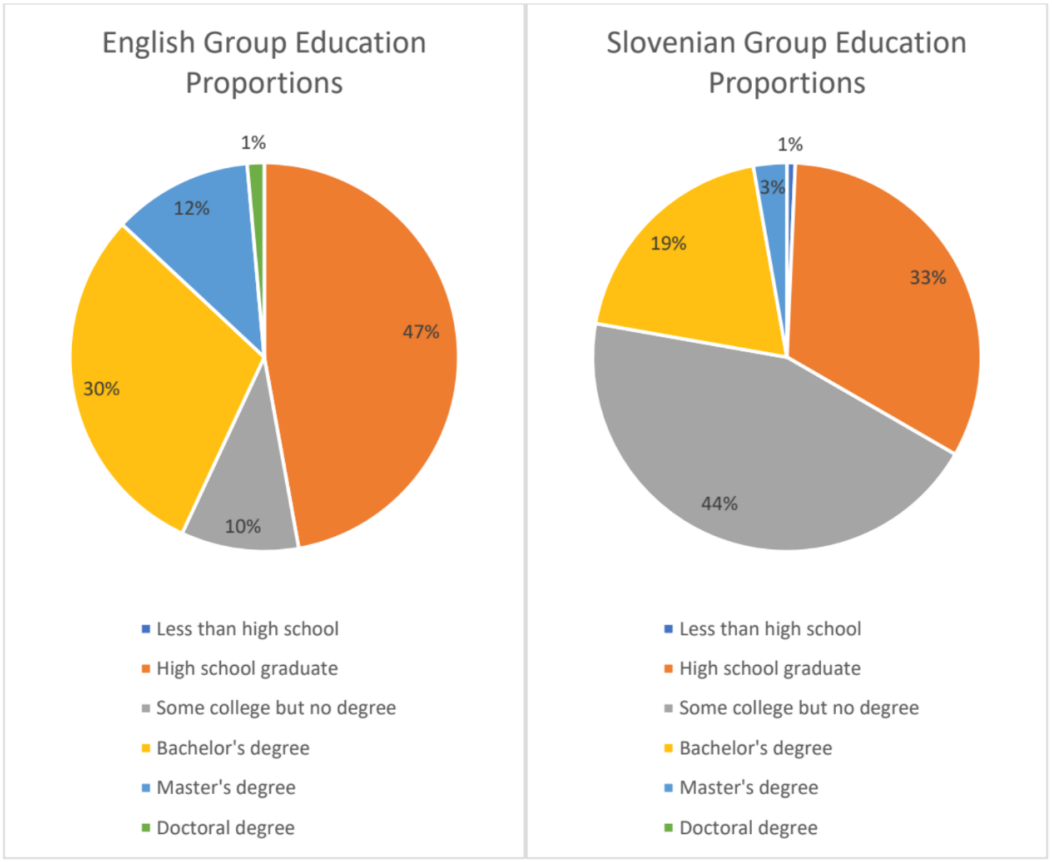

Figure 2: *Slovenian and English group participants' highest achieved education in proportions.*

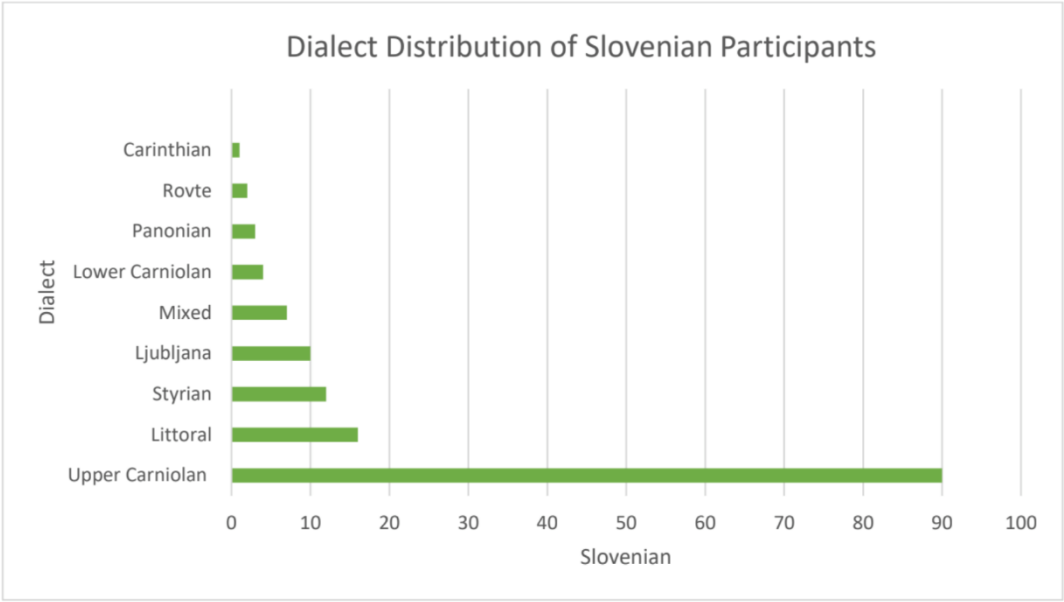

Figure 3: *The dialect distribution of the Slovenian participants.*

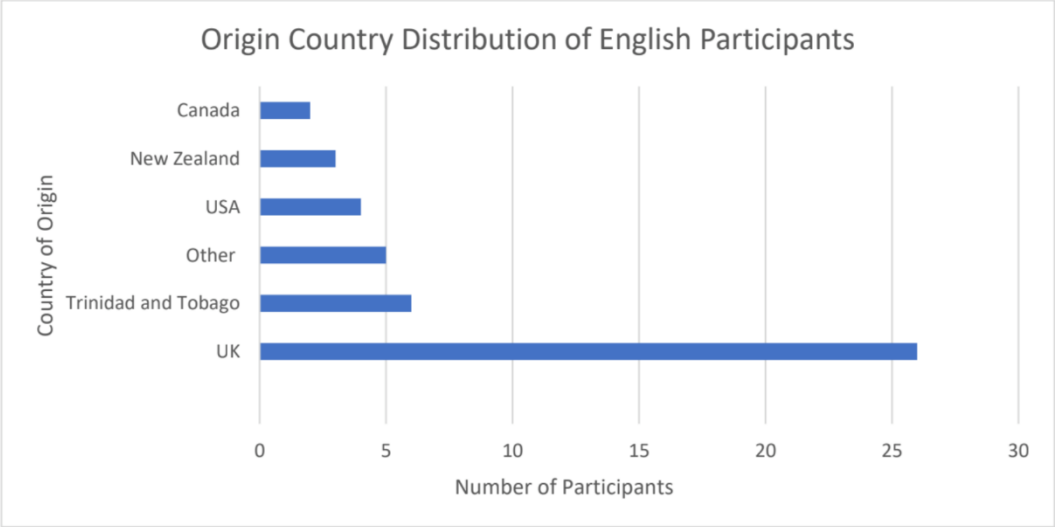

Figure 4: *Countries of origin for the English group.*

5.2 Materials

Materials comprised of 36 pictures. There were six categories of pictures, with six pictures in each category: 1 – 'human male', 2 – 'human female', 3 – 'animal male', 4 – 'animal female', 5 – 'object masculine' (the word for that object has masculine grammatical gender in Slovenian), 6 – 'object feminine' (the word for that object has feminine grammatical gender in Slovenian). The pictures were chosen by the researcher from Google clipart. For the full list of pictures, see Appendix Two.

The study had six conditions (SD, SP, DS, DP, PS, and PD). Every condition had a different combination of three pictures. For example, a question in SD (Singular Dual) condition had two pictures with a single item (singular), and one picture with two items (dual). One single picture was of the same type as the dual picture (e.g., the type of both was 'boy'). Different pictures of *boys* were used to avoid grouping due to the pictures being identical. The other singular item was a distinct picture (e.g., 'girl'). Therefore, the SD version of the first item (1a = 'boy') pictured 'one girl' (Distinct Picture – DISP), 'one boy' (Same Picture Same Number – SPSN), and 'two boys' (Distinct Number – DISN). For other conditions of this item, see Figure 5. A question in SP condition in the 'animal female' category had for example pictures of three cows, one cow, and one bull.

In three questions of each category (e.g., 'human male'), the DISP was of the opposite grammatical gender than DISN and SPSN (like in the example in Figure 5 – 'girl' is of the opposite gender to the 'boy'). In the other three questions of each category, the DISP was of the same gender (e.g., the PD condition in category 'animal male' had three bulls, two bulls, and three rams). This design served as a counterbalancing precaution to prevent grouping by gender of pictures.

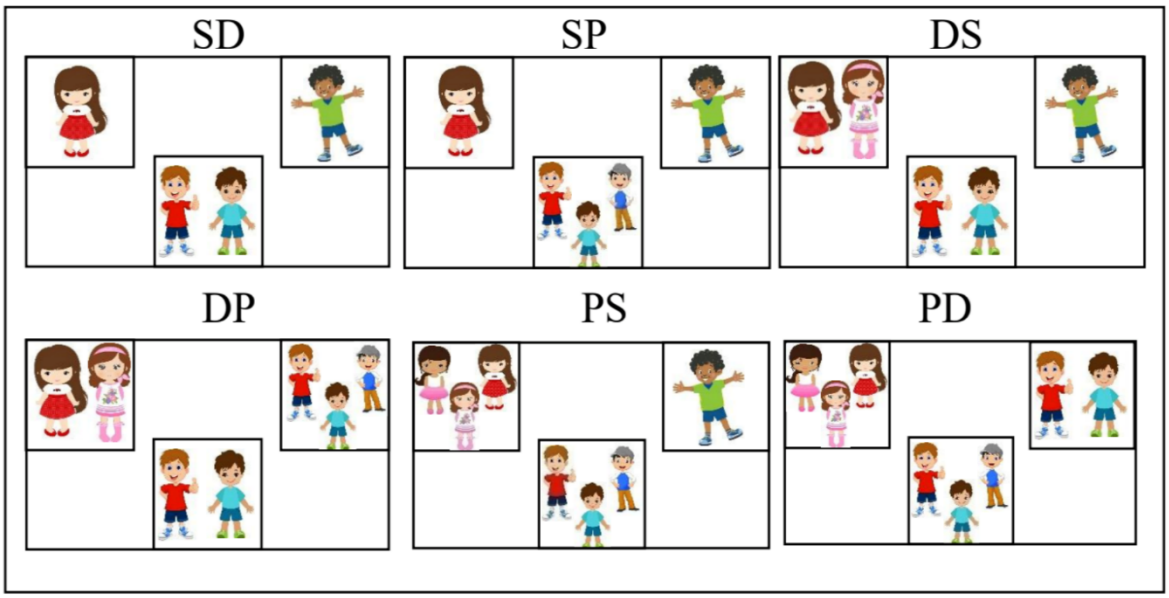

Figure 5: *Example of all conditions for the picture 1a – boy. There were 36 complete sets like this one in the experiment.*

5.3 Design

The design of the experiment was the Latin square, which means each participant saw only one version of each picture, and an equal number of pictures in each condition. For example, participants in group A saw the item *boy* in SD version, *man* in SP version, *ballet dancer* in DS version, *king* in DP version, *teacher* in PS version, *clown* in PD version. The order of answers in each question and the order of questions was randomised, to avoid any ordering effects. Participants were randomly presented with questions from one of six groups (A, B, C, D, E, F), with each group being presented to an equal number of people. Because not all participants finished all the questions, and some participant data was discarded in order to make the age groups more balanced, the end numbers of people in each group were not equal: A = 38, B = 34, C = 31, D = 34, E = 29, F = 31 (M = 32.83, SD = 2.91). To see the full list of questions for each group, see Appendix Three.

5.4 Procedure

The participants were first screened for their native language, and those who answered that their native language was only English or only Slovenian were able to proceed to the experiment. Bilinguals and people with other native languages were excluded. Participants were provided with the necessary information about their rights and asked for their consent. If they chose to proceed to the experiment, they were then provided with these instructions: 'Click on the two pictures you think are the most similar.' (Slovenian version: 'Izberi dve sliki, ki sta si najbolj podobni.'). First, they completed three practice questions to get used to the method. The practice questions included pictures that were not used in the main experiment. After the practice part, participants were notified that they are now going to start the main experiment. They had to respond to 36 questions (six for each condition, each one from a different category, in random order)

with the same instructions as above. When they finished, they were asked to provide some demographic data: age, sex, their level of education, rating of their proficiency in their native language, whether they speak another language and which language that is. Participants in the Slovenian group were also asked to specify which dialect they consider to be their primary dialect. They had to choose all that apply out of seven main dialect groups. The instructions for the demographic part of the survey told them that they could leave blank any question that they do not feel comfortable answering. They were asked the experimental questions first and demographic questions later so they would not be primed to think the experiment is about language, and so that more participants would answer the experimental questions. After they finished, participants were asked if they have any comments about the experiment. They were then debriefed about what the study was researching, the research hypotheses, and how to get in touch with the researchers if they have any questions or want to find out the results. In the end, they were asked for comments again and thanked for their participation. To see the survey flow from Qualtrics, see Appendix Five.

5.5 Plan of Data Analysis

The plan is to code the participant responses as '1' if they grouped pictures by number (e.g., 'two boys' and 'two girls' together), and as '0' if they grouped the pictures by type (e.g., 'two boys' and 'one boy' together). Responses that grouped by neither number or entity (e.g., 'three boys' with 'two girls') will be coded as '2' for the descriptive statistics and discarded before statistical analyses. There will be nine mixed factorial Analyses of Variance (ANOVA) tests conducted. Levene test will be used to check for the homogeneity of variance assumption (Navarro, 2015).

The Slovenian and English group responses will be compared using a two (grouping proportions) by two (native language) factorial mixed analysis of variance (ANOVA). The design will be mixed as within-subject variables (grouping proportions in different conditions), and between-subject variables (native language) will be compared. Three separate ANOVAs like the one above will be conducted: the first one with DP/PD as conditions, second with SD/DS as conditions, and the third one as PS/SP as conditions. There will be a general ANOVA testing the interaction between the means of the critical versus the means of control conditions and Slovenian versus English group.

Another 2x2 ANOVA will be conducted to test whether the dialect of the Slovenian participants influenced grouping in the critical conditions (dual dialect/nondual dialect vs DP/PD). A separate test will be conducted on only feminine items to test whether the grammatical gender has a significant effect on the grouping choice.

A 3x2 ANOVA will be conducted to test whether the item type of pictures influences grouping. The two factors will be the item type (human/animal/object) versus the native language (Slovenian/English).

Additional two 2x2 ANOVAs will investigate whether there was an effect of the device used for solving the survey (phone vs computer) on the groupings; and whether there was an effect of participant's sex on the groupings.

All data analysis will be done in R (Version 3.4.4., R Core Team, 2018). The coding and some participant statistics will be done in Excel.

5.6 Ethics

The study has been approved by the School of PPLS Ethics Committee, reference number 143–1920/2. For participant information sheet, consent form, and participant debriefing sheet, see Appendix Four.

6 Results

Data were collected anonymously from 210 people who finished the online experiment through Qualtrics. There were 151 Slovenian native speakers and 46 English native speakers who fit the criteria for the analysis.

Data were coded according to the grouping of pictures. Participants grouped pictures either by the entity (e.g., 'one cow' with 'two cows'), by number (e.g., 'one cow' and 'one sheep'), or by neither of those (e.g., 'one cow' with 'two bulls'). Grouping by the entity was coded as '0', grouping by number as '1' and grouping by neither was coded as '2'. Because the hypotheses concerned only grouping by number or by the entity, the responses that grouped by neither ('2') were discarded (1.1% of all responses). Therefore, all the means for the analyses were values between 0.0 and 1.0.

6.1 Interaction of the Native Language and the Grouping Choice

Firstly, the main hypothesis that there is a difference in the grouping of pictures between the Slovenian and the English groups was addressed. There were six questions in each condition in each of the six groups; therefore, 72 questions for each pair of conditions analysed. Response means of the conditions were calculated by averaging all responses in a condition from each participant.

The effect of the native language of grouping pictures in the critical conditions DP (two pictures in dual, and one picture in plural) and PD (two pictures in plural and one picture in dual) was analysed with a mixed factorial analysis of variance (ANOVA). The ANOVA was conducted with two factors, between-subject (language – English vs Slovenian) and within-subject (response proportions in DP and PD conditions). The Levene test of homogeneity of variance (Navarro, 2015) was not significant ($F(3,392) = .26$, $p = .85$), which shows that the homogeneity assumption of the ANOVA was not violated. There was no main effect of condition ($F(1, 390) = .02$, $p = .88$) or language ($F(1, 390) = .90$, $p = .34$). There was no interaction between condition or language ($F(1, 390) = .05$, $p = .83$). These results suggest that the native language of participants does not have a statistically significant effect on the grouping of pictures in the DP and PD conditions.

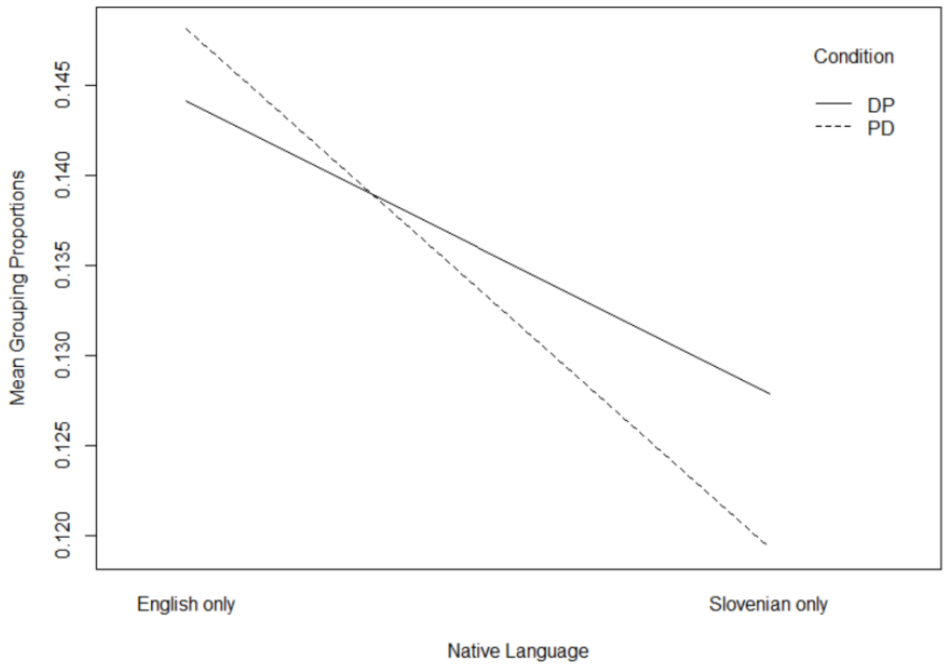

Figure 6: *An interaction plot showing how the mean grouping proportions of DP and PD conditions interact with the native language of participants.*

Next, the control conditions were analysed to see whether there is an effect of native language on grouping there. A mixed factorial ANOVA was conducted to investigate whether the native language of the participants (Slovenian vs English) interacted with the grouping of pictures in the SD and DS conditions. There was no main effect of condition ($F(1, 390) = 1.5$, $p = .22$). There was a main effect of language ($F(1, 390) = 4.49$, $p = .04$), with English participants grouping more by number than Slovenian participants (see Figure 7). There was no interaction between condition and language ($F(1, 390) = .59$, $p = .44$). The Levene test of homogeneity of variance was significant ($F(3,392) = 4.02$, $p < .001$), which shows that this assumption was violated. The main effect of language therefore needs to be interpreted with caution (Navarro, 2015).

Another factorial mixed ANOVA was conducted to investigate whether the second control conditions SP and PS interacted with the native language of participants. The Levene test of homogeneity of variance was significant ($F(3,392) = 2.95$, $p < .01$), which shows that this assumption was violated. There was a main effect of condition ($F(1, 390) = 5.64$, $p < .01$), with participants grouping more pictures by number is the PS condition (see Figure 7). There was no main effect of language ($F(1, 390) = .18$, $p = .67$). There was no interaction between condition and language ($F(1, 390) = .01$, $p = .95$). The main effect of the condition needs to be treated with caution because the Levene test was significant, which means the variances of the two groups are not homogenous.

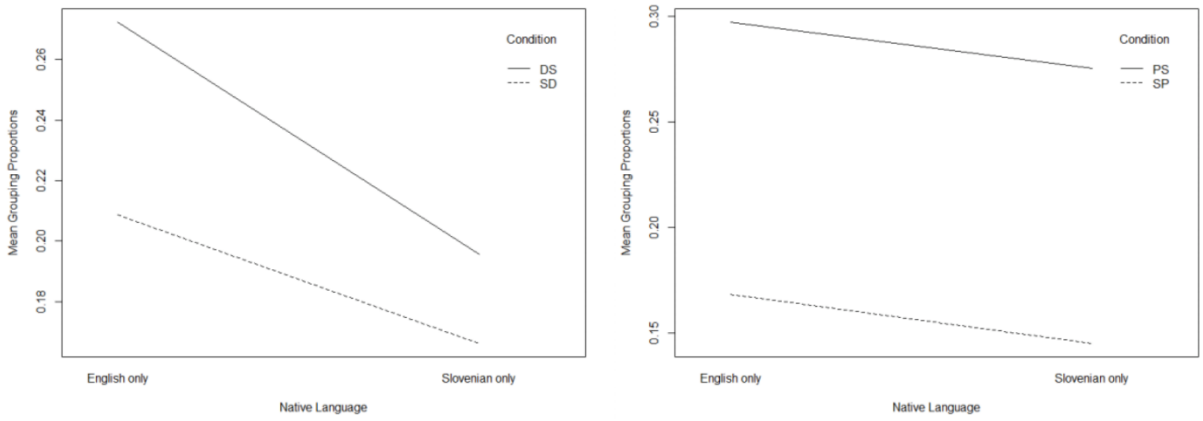

Figure 7: *Interaction plots showing how the mean grouping proportions of DP and PD (top), DS and SD (bottom left), SP and PS (bottom right) conditions interact with the native language of participants.*

A mixed factorial ANOVA was conducted between the mean proportions of the critical condition groupings (DP and PD) and control conditions groupings (SD, DS, SP, PS). The Levene test of homogeneity of variance was not significant $F(3,390) = .45$, $p = .72$). There was no main effect of condition ($F(1, 388) = 1.22$, $p = .27$) or language ($F(1, 388) = 1.32$, $p = .25$). There was no interaction between condition and language ($F(1, 388) = .02$, $p = .90$). These results suggest that the native language of participants does not statistically significantly affect the grouping of pictures in the critical and noncritical conditions.

These analyses uncovered that there might be a difference in the grouping proportions between conditions that have a 'lower' grammatical number (i.e., singular is 'lower' than dual, dual is 'lower' than plural) presented twice in a question (SD, DP, SP) and the conditions that have a 'higher' grammatical number (DS, PD, PS) presented twice in a question. The mean proportions in PD, DS, and PS were all higher than their 'lower' number twice counterparts (see Figure 8). A mixed two ('lower' number twice vs 'higher' number twice) by two (Slovenian vs English) factorial ANOVA was conducted to see if there is an interaction between the native language and mean proportions of critical and control conditions. The Levene test of homogeneity of variance was not significant ($F(3,390) = 1.67$, $p = .17$). There was no main effect of condition ($F(1, 388) = 1.82$, $p = .18$) or language ($F(1, 388) = 1.44$, $p = .23$). There was no interaction between condition or language ($F(1, 388) = .04$, $p = .84$). These results suggest that the native language of participants does not statistically significantly affect the grouping of pictures in the 'lower' number twice and 'higher' number twice conditions.

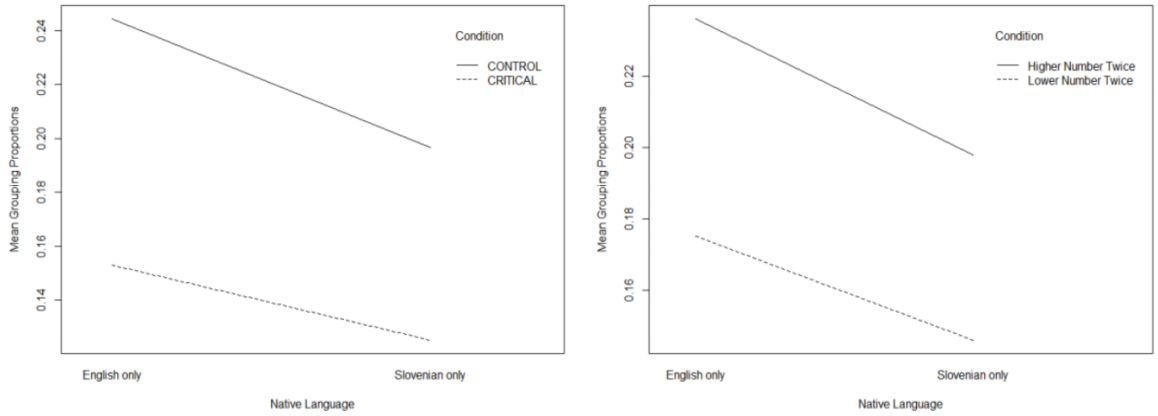

Figure 8: *Interaction plots of the critical and control conditions (left), and 'lower' number twice and 'higher' number twice conditions' (right) mean grouping proportions and their interaction with the native language of the participants.*

6.2 Interaction of the Slovenian Dialect and the Grouping Choice

The second part of the analysis looked at whether there is an interaction between dual vs nondual dialects of Slovenian participants and their grouping choices. Upper Carniolan and Ljubljana dialects were classified as the dual dialects, and Styrian and Littoral dialects as nondual dialects (Jakop, 2012). The rest of the Slovenian and all English data was not used for these analyses. First, a mixed factorial analysis of variance was conducted to investigate whether the dialect of the Slovenian participants (dual vs nondual) influenced their grouping in the critical conditions (DP and PD). There was no main effect of condition ($F(1, 256) = .00$, $p = .95$) or dialect ($F(1, 256) = 2.69$, $p = .10$). There was no interaction between condition or dialect ($F(1, 256) = .02$, $p = .90$). The Levene test of homogeneity of variance was not significant ($F(3,258) = .67$, $p = .57$). These results suggest that the dialect of participants did not affect the grouping of pictures in the critical conditions (DP and PD).

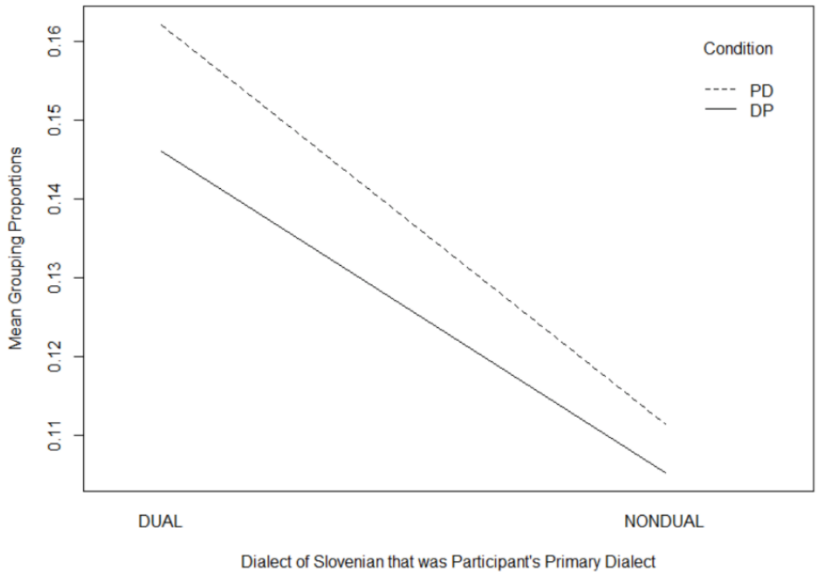

Figure 9: *An interaction plot showing how the mean grouping proportions and the dialect of Slovenian that was participant's primary dialect interact in critical conditions.*

Since the biggest difference in dual usage between dialects of Slovenian is the presence of the feminine dual, responses of dual vs nondual speakers were tested for interactions with responses on masculine vs feminine items. A two (dual vs nondual) by two (masculine vs feminine items) mixed factorial analysis of variance was conducted to investigate whether there is an interaction between the dialect of the Slovenian participants and their groupings of feminine and masculine items. The Levene test of homogeneity of variance was not significant ($F(3, 248) = .31$, $p = .82$), which suggests that this assumption was not violated. There was no main effect of grammatical gender ($F(1, 246) = .00$, $p = .99$) or dialect ($F(1, 246) = .94$, $p = .33$). There was no interaction between condition and dialect ($F(1, 246) = .01$, $p = .91$). These results suggest that the dialect of participants did not affect the grouping of masculine and feminine items. These findings were the same also when comparing groupings of feminine and masculine items between English and Slovenian native speakers. There was no effect of grammatical gender ($F(1, 388) = .03$, $p = .87$) or language ($F(1, 388) = 1.47$, $p = .23$). There was no interaction between condition and language ($F(1, 388) = .11$, $p = .75$). The Levene test of homogeneity of variance was not significant ($F(3, 390) = .49$, $p = .69$).

7 Exploratory Research Questions Analysis

7.1 Interaction of Item Type (Human, Animal, and Object) and Grouping Choice

Exploratory analysis of the influence of the item type on the grouping choice was carried out to see if pictures depicting humans, animals or objects were grouped differently. A three (human, animal, object) by two (English vs Slovenian groupings) mixed factorial ANOVA was conducted. The Levene test of homogeneity of variance was significant ($F(5, 585) = 5.28$, $p < .001$). There was a main effect of item type

($F(2, 582) = .53$, $p = < .001$), which indicated that the human items were grouped more by number than animal and object (see Figure 10), if unaffected by the results from the Levene test. The was no main effect of language ($F(1, 582) = 2.13$, $p = .15$) which indicates that there was no significant difference in grouping between the Slovenian and English group. There was no interaction between item type and language ($F(2, 582) = .10$, $p = .91$) which indicates that there was no difference in the grouping of different item types between the English and Slovenian group.

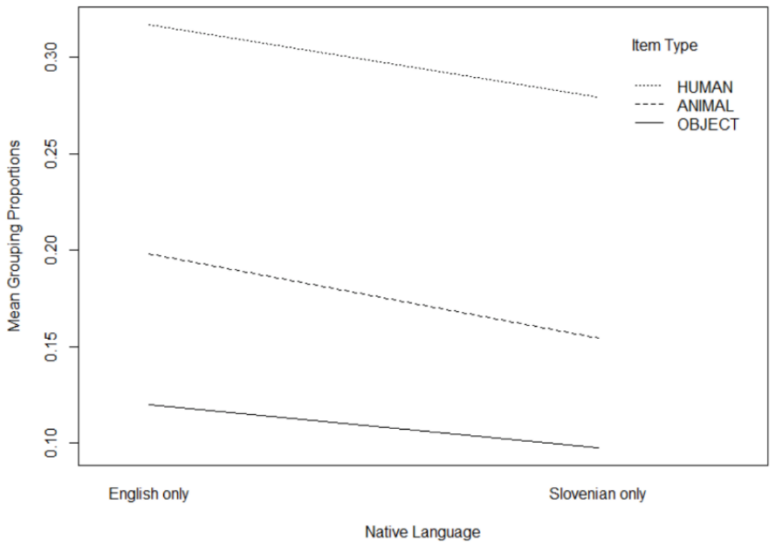

Figure 10: *An interaction plot of how the item type and native language groupings interact.*

7.2 Interaction of Device Used and Grouping Choice

A two (phone vs computer) by two (Slovenian vs English) mixed factorial analysis of variance was conducted to check for the interaction between the device used for solving the survey and the grouping proportions in the Slovenian and English groups. Data from all conditions were used for this analysis. Out of the participants who specified the device they used for the survey, there were 139 (74%) participants who used their phone and 48 (26%) participants who used their computer. The Levene test of homogeneity of variance was not significant ($F(3, 370) = 2.46$, $p = .06$). There was no main effect of condition ($F(1, 368) = .10$, $p = .18$). However, there was a main effect of the device ($F(1, 368) = 4.05$ $p < .05$), which suggests that the participants tended to group more by number when solving the experiment on the phone rather than on the computer (see Figure 11). There was no interaction between language and device ($F(1, 368) = .25$, $p = .62$), which suggests that there was no significant difference in groupings between Slovenian and English group.

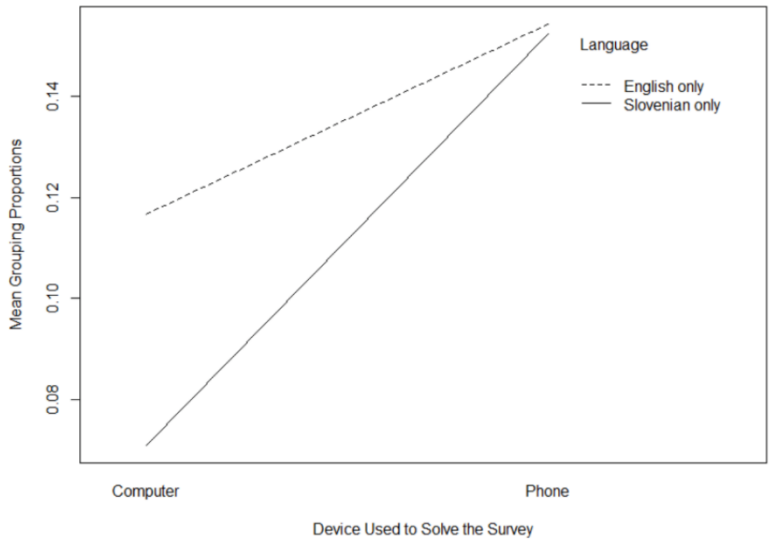

Figure 11: *An interaction plot showing how the device used to solve the survey, mean grouping proportions, and the native language of the participants interact.*

7.2.1 Interaction of Participant Sex and Grouping Choice

A two (female vs male) by two (critical condition proportion vs control condition proportion) mixed factorial analysis of variance has been conducted to check for the interaction between the sex of the participants and groupings in the critical and noncritical conditions. Data from all conditions were used for this analysis. Out of the participants who specified their sex, there were 131 (69%) females and 58 (31%) males in both groups. The Levene test of homogeneity of variance was not significant ($F(3, 374) = .29$, $p = .83$). There was no main effect of condition ($F(1, 372) = 1.14$, $p = .29$), or sex ($F(1, 372) = .93$, $p = .37$). There was no interaction between the sex of participants and grouping ($F(1, 372) = .00$, $p = .97$). These results suggest that the sex of the participants did not influence the grouping of pictures in a statistically significant way.

8 Discussion

8.1 Interaction of the Native Language and the Grouping Choice

A hypothesis test of the main hypothesis that grouping of pictures will differ between the Slovenian and English group showed a non-significant interaction between the grouping proportion and native language in the critical conditions. Therefore, we failed to reject the null hypothesis. An ANOVA comparing the control conditions SD vs DS showed a main effect of language, with English participants grouping more by number than Slovenian participants (see Figure 7). This effect is the opposite of the hypothesised effect and against the hypothesis H1 (b), which stated that English and Slovenian participants would be as likely to group SPSN with DISP and DISN in the control conditions. This main effect needs to be treated with

caution because the Levene test was significant. That shows that the homogeneity of variance assumption was violated, which means that the variances between groups were not homogenous. This outcome causes a problem when interpreting the results as robust. If we disregard the violation of the ANOVA assumption, this result shows that the English native speakers grouped the cases where there were either two single items and a dual item, or two dual items and a singular item, by number significantly more than the Slovenian group. Both groups still grouped more by the entity. The effect found could be a result of a considerable smaller number of participants in the English group.

There was a main effect of condition in the PS vs SP analysis, which suggests that participants grouped significantly more pictures by number is the PS condition than in the SP condition (see Figure 7). The Levene test of homogeneity of variance was significant, so this effect needs to be treated with caution. Nevertheless, this result could point to the fact that people tend to group pictures by number in conditions with 'higher' number twice (PD, DS, PS) more than in conditions with 'lower' number twice (DP, SD, SP). To test this, another mixed factorial ANOVA was conducted, this time to see if there is an interaction between the native language and mean proportions of the 'lower' number twice and 'higher' number twice conditions. There were no significant effects found, although there is a general trend that all 'higher' number twice cases have higher mean proportion. More data is needed to explore this effect.

A general ANOVA between the means of the critical (DP, PD) and control conditions (SD, DS, PS, SP) was done to investigate if there is an interaction with the native language. No significant interaction or main effect was found.

There are two possible conclusions from these results, either the theory of linguistic relativism does not apply to grammatical number (at least in the case of Slovenian versus English), or this experiment was flawed. Both possibilities will be discussed below.

8.2 Interaction of the Slovenian Dialect and the Grouping Choice

The hypothesis, which stated that Slovenian nondual dialect speakers would respond similarly to the English native speaker group (grouping by the entity in the critical conditions), was not significant. This result suggests that there was no difference between groupings of participants that regarded dual dialects of Slovenian as their primary dialects and participants that regarded nondual dialects of Slovenian as their primary dialect. However, the *p*-value for the main effect of dialect was 0.1, which was deemed significant by cognitive scientists in the past when discussing the variance for a variety of linguistic performance (Hunt & Agnoli, 1991). Therefore, the effects found could indicate some difference between dual and nondual dialect speakers. The mean of the dual dialect group was higher than the mean of the nondual dialect group (see Figure 9). That suggests that dual dialect participants group more by number than nondual dialect participants, which supports the hypothesis H1 c). This finding could indicate that mental representations depend on the spoken language (dialect) more than on the standard written language (CSS Slovenian).

A possible limitation is that the dialects cannot be separated into two clear-cut categories of whether they use dual or they do not. The ANOVA that tested responses on feminine vs masculine items between the dialects did not yield any significant interaction. That is a problem for the previous findings, as the dialects contrast the most in the use of feminine dual. Also, no speaker speaks in their dialect all the time because of the influence of education and media in CSS. The number of participants by the group was quite different; there were 29 dual, and 102 nondual dialect participants. However, the Levene test did not show a violation of the assumption of homogeneity of variance.

8.3 Exploratory Research Questions Analysis

8.3.1 Interaction of Item Type (Human, Animal, and Object) and Grouping Choice

The exploratory research question – Does the item type of the picture – human, animal, object – influence the grouping? – was analysed with three (item type) by two (grouping in the critical vs noncritical conditions) mixed factorial ANOVA. The analysis showed that participants grouped pictures of humans significantly more often by number than by the entity. There was no significant difference between the languages, so the results do not concern the main hypothesis. However, this indicates some interesting characteristics of the experimental setup that could be relevant for further research. Perhaps different humans seem more like each other than different objects (e.g., 'two men' and 'two kings' look more like each other, than 'two chairs' and 'two laptops'), and that is why participants grouped humans by number more. Another option is that the number of people bears more meaning than the number of, for example, erasers. A distinction between a single person, a pair of people, and a group of three people is more important to our everyday lives than a distinction between one, two, or three chairs. We even think about pairs of people (parents, couples, twins), and very rarely in pairs of objects.

Another possible influence is that, in some cases, an identical picture was used for the singular version and the dual or plural version for animals and objects, due to not finding many different appropriate pictures. The human items were consistently not identical between conditions. That could lead to grouping items that are identical in appearance, with no linguistic processing involved. The choice of pictures was a major flaw of the experiment, which needs to be improved in further research.

Another reason for differences in grouping between items of a different type was highlighted by participant feedback. It was reported that the colours of the animals were distracting (especially the eagles and rabbits) and that they chose to group the same colours, irrespective of item type or number.

8.3.2 Interaction of Device Used and Grouping Choice

The Qualtrics survey could be solved on the computer or the phone. Most participants used their phone (74%) rather than a computer (26%) to solve the experiment. A hypothesis test showed that people who solved the survey on their phone grouped pictures by number more. This result pointed out a major flaw of the experiment execution. Possible reasons for differences between solving on a phone and a computer are that participants had to scroll down to see all pictures in one question in the phone version of the survey, which could have prolonged the response time. Additionally, participant's comments pointed out that the phone version of the Qualtrics survey sometimes had delays in loading all pictures of one question on the screen. Since the participants were supposed to answer based on their first intuition, the different exposure times to certain pictures in a question might have influenced their answer. This finding could mean that when people have more time to think about the similarities, they choose the number more often. A suggestion for further research is to specify that the survey can only be solved on the computer.

8.3.3 Interaction of Participant Sex and Grouping Choice

The participant sample was quite heterogeneous, with a large difference in the number of participants between the two groups (77% of participants were Slovenian, 23% English). This proportion was justified by the English speaker group being the control, so there were fewer participants required. However, it

nevertheless could have influenced the difference between the groups not yielding a significant result. There was a big difference between the number of males and females between groups as well; there was 24% Slovenian males and 52% English males. Some studies (e.g., Payne & Lynn, 2011) have found that females have a stronger module for second language processing than males, which could affect the results of this experiment. English as their second language could have influenced females in the Slovenian group when responding to the grouping questions. However, there was no statistically significant interaction found between the participant's sex and their grouping choice.

8.4 Relation of the Results to the Theory of Linguistic Relativism

The results of this study failed to support the theory of linguistic relativism and are, therefore, not in line with the findings of Phillips and Boroditsky (2013). The only effect was found between the dual and nondual dialect of Slovenian. However, it is not robust as the *p* value is 0.1, there is a big difference between groups, and it is hard to make a sharp distinction between dialects. Nevertheless, comparing dialects of the same language is somehow better than comparing two separate languages, as there are no confounding cultural effects. Perhaps the lack of effect we found between languages is due to other factors, such as culture. Furthermore, the results can be explained by a finding of Athanasopoulos (2006) that the second language acquisition may alter cognitive dispositions established by the first language. Since all the Slovenian participants were fluent in English, the English number system could have affected their cognitive representations of numbers. That effect has been controlled for in the dialect comparison. These results might be possible evidence in favour of linguistic relativism.

Nonetheless, more research is needed to establish whether the grammatical number is one of the domains in which the effects of linguistic relativism can be observed. The experimental design of this study was not completely appropriate for testing this question. The task used would have to be more implicit, perhaps including some distractor questions, so participants do not figure out what the experiment is about, to test how people think about groups of two versus groups of three and one better. Only telling people to group the more similar pictures is too vague and too easy. People just chose one characteristic of the pictures to focus on, be it the colour, the type, the arrangement, or the number, and then grouped them quite consistently according to that.

8.5 Other Limitations and Outlook

The Qualtrics survey has been translated from English to Slovenian by the researcher, and English was the original language of the survey. A considerable amount (n = 27) of Slovenian participants completed it with English instructions, even though they were specifically asked by the researcher and by text in the survey itself to change the language. That could have led to a priming effect of English, and so the Slovenian participants who were all fluent in English could have subconsciously employed more of an English number system. This suggestion is only a stipulation, as a statistical comparison was not made. Further research would need to address this question to ensure no effects of English on the Slovenian participants.

The survey has been conducted online, using convenience sampling of participants over social media. That attracted a heterogeneous sample in terms of sex and native language, but a homogenous sample in terms of education level (see Figure 2), at least to the extent of almost everyone having a high school education, and the majority being students. To a certain extent, that characteristic shows that a similar socio-economic background (to each other, and the researcher) can be inferred. That could be an indicator of

response bias, which occurs when only highly motivated people return a survey. Out of all participants that attempted the survey (n = 306), 67 of them completed less than 90% of the survey, which was the cut-off point for inclusion in further analysis. These participants were therefore not included in the study, which means that a part of the population (less motivated one) was not represented, which leads to a potential low external validity of the study. Further research would benefit from recruiting a more representative sample of the population.

Other cognitive implications of having dual in the native language could be investigated as well, for example, memory. If the assumption that language cues attention is correct, the retention of the number of items could be affected by different number systems of languages. This phenomenon could be compared between the Slovenian language and a language without the dual number, or the between the different dialects of Slovenian.

9 Conclusion

This study attempted to investigate whether the participants' native language affects their mental representations and categorisations. A grouping task was used to compare Slovenian and English native speakers. The relevant difference between these two languages is their different grammatical number systems. The Slovenian language has three grammatical numbers – singular, dual, and plural, whereas the English language only uses two grammatical numbers – singular and plural. The experimental hypothesis was that Slovenian native speakers would group items in the Dual Plural and Plural Dual conditions significantly more by number. In contrast, English native speakers would group them by the entity. This hypothesis was based on the theory of linguistic relativity, which would suggest that since Slovenian language has three distinctive categories for number, that distinction in the language would reflect in the mental representations. The mental representations were tested by grouping pictures of a different kind (human, animal, object) and different grammatical gender (masculine and feminine) in an arrangement of either one, two, or three items combined according to different conditions (DP, PD, DS, SD, PS, SP). The results failed to reject the primary null hypothesis. There was a difference found between dual and nondual dialects of Slovenian, but further research needs to confirm it with a more robust experimental design. There was a significant difference found between results from participants solving the survey on a phone versus a computer. This flaw in the design needs to be considered in further research. The theory of linguistic relativity was not supported by the results.

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Packages used for the data analysis in R (R Core Team, 2018) were 'car' (Fox & Weisberg, 2011), 'tidry' (Wickham & Henry, 2019), and 'dplyr' (Wickham et al., 2019).

11 Appendices

11.1 Appendix One: Acronyms Used

CSS	**Central Standard Slovene**
SD	Singular Dual
SP	Singular Plural
DS	Dual Singular
DP	Dual Plural
PS	Plural Singular
PD	Plural Dual
DISP	Distinct Picture
DISN	Distinct Number
SPSN	Same Picture Same Number
d	Distinct Picture (DISP) is of distinct grammatical gender to the Same Picture
s	Distinct Picture (DISP) is of the same grammatical gender to the Same Picture

11.2 Appendix Two: Full List of Pictures Used

Slovenian translations are in the brackets.

1. Human masculine:
    a. boy (fant)
    b. man (moški)
    c. ballet dancer male (baletnik)
    d. king (kralj)
    e. male teacher (učitelj)
    f. clown (klovn)
2. Human feminine:
    a. girl (punca)
    b. woman (ženska)
    c. queen (kraljica)
    d. female farmer (kmetica)
    e. ballerina (baletka)
    f. female teacher (učiteljica)
3. Animal masculine:
    a. dog (pes)
    b. bull (bik)
    c. rabbit (zajec)
    d. eagle (orel)

   e. ram (oven)
   f. rooster (petelin)
4. Animal feminine:
   a. cow (krava)
   b. cat (mačka)
   c. bird (ptica)
   d. hen (kura)
   e. sheep (ovca)
   f. squirrel (veverica)
5. Object masculine:
   a. pen (svinčnik)
   b. mobile phone (telefon, mobitel)
   c. laptop (računalnik)
   d. notebook (zvezek)
   e. chair (stol)
   f. pot (lonec)
6. Object feminine:
   a. table (miza)
   b. bottle (steklenica)
   c. spoon (žlica)
   d. eraser (radirka)
   e. folder (mapa)
   f. handbag (torbica)

11.3 Appendix Three: List of Questions and Conditions that Each Group of Participants Saw

Participants in group A saw:

1. 1aSD d	2. 1bSP s	3. 1cDS d	4. 1dDP d	5. 1ePS d	6. 1fPD s
7. 2aSD d	8. 2bSP d	9. 2cDS d	10. 2dDP s	11. 2ePS s	12. 2fPD s
13. 3aSD d	14. 3bSP d	15. 3cDS s	16. 3dDP s	17. 3ePS s	18. 3fPD d
19. 4aSD d	20. 4bSP d	21. 4cDS s	22. 4dDP d	23. 4ePS s	24. 4fPD s
25. 5aSD d	26. 5bSP d	27. 5cDS s	28. 5dDP s	29. 5ePS s	30. 5fPD d
31. 6aSD d	32. 6bSP s	33. 6cDS d	34. 6dDP s	35. 6ePS d	36. 6fPD s

Participants in group B saw:

1. 1aSP d	2. 1bDS d	3. 1cDP s	4. 1dPS s	5. 1ePD d	6. 1fSD s
7. 2aSP d	8. 2bDS d	9. 2cDP s	10. 2dPS s	11. 2ePD s	12. 2fSD d
13. 3aSP d	14. 3bDS d	15. 3cDP s	16. 3dPS s	17. 3ePD s	18. 3fSD d
19. 4aSP d	20. 4bDS s	21. 4cDP d	22. 4dPS d	23. 4ePD s	24. 4fSD s
25. 5aSP d	26. 5bDS s	27. 5cDP s	28. 5dPS d	29. 5ePD d	30. 5fSD s
31. 6aSP d	32. 6bDS d	33. 6cDP s	34. 6dPS d	35. 6ePD s	36. 6fSD s

Participants in group C saw:

1. 1aDS d	2. 1bDP d	3. 1cPS d	4. 1dPD s	5. 1eSD s	6. 1fSP s
7. 2aDS d	8. 2bDP d	9. 2cPS d	10. 2dPD s	11. 2eSD s	12. 2fSP s
13. 3aDS d	14. 3bDP d	15. 3cPS d	16. 3dPD s	17. 3eSD s	18. 3fSP s
19. 4aDS d	20. 4bDP d	21. 4cPS d	22. 4dPD s	23. 4eSD s	24. 4fSP s
25. 5aDS d	26. 5bDP d	27. 5cPS d	28. 5dPD s	29. 5eSD s	30. 5fSP s
31. 6aDS d	32. 6bDP d	33. 6cPS d	34. 6dPD s	35. 6eSD s	36. 6fSP s

Participants in group D saw:

1. 1aDP d	2. 1bPS d	3. 1cPD d	4. 1dSD s	5. 1eSP s	6. 1fDS s
7. 2aDP d	8. 2bPS d	9. 2cPD d	10. 2dSD s	11. 2eSP s	12. 2fDS s
13. 3aDP d	14. 3bPS d	15. 3cPD d	16. 3dSD s	17. 3eSP s	18. 3fDS s
19. 4aDP d	20. 4bPS d	21. 4cPD d	22. 4dSD s	23. 4eSP s	24. 4fDS s
25. 5aDP d	26. 5bPS d	27. 5cPD d	28. 5dSD s	29. 5eSP s	30. 5fDS s
31. 6aDP d	32. 6bPS d	33. 6cPD d	34. 6dSD s	35. 6eSP s	36. 6fDS s

Participants in group E saw:

1. 1aPS s	2. 1bPDs	3. 1cSD s	4. 1dSP d	5. 1eDSd	6. 1fDP d
7. 2aPS s	8. 2bPDs	9. 2cSD s	10. 2dSP d	11. 2eDSd	12. 2fDP d
13. 3aPS s	14. 3bPDs	15. 3cSD s	16. 3dSP d	17. 3eDSd	18. 3fDP d
19. 4aPS s	20. 4bPDs	21. 4cSD s	22. 4dSP d	23. 4eDSd	24. 4fDP d
25. 5aPS s	26. 5bPDs	27. 5cSD s	28. 5dSP d	29. 5eDSd	30. 5fDP d
31. 6aPS s	32. 6bPDs	33. 6cSD s	34. 6dSP d	35. 6eDSd	36. 6fDP d

Participants in group F saw:

1. 1aPD s	2. 1bSD s	3. 1cSP s	4. 1dDS d	5. 1eDP d	6. 1dPS d
7. 2aPD s	8. 2bSD s	9. 2cSP s	10. 2dDS d	11. 2eDP d	12. 2fPS d
13. 3aPD s	14. 3bSD s	15. 3cSP s	16. 3dDS d	17. 3eDP d	18. 3fPS d
19. 4aPD s	20. 4bSD s	21. 4cSP s	22. 4dDS d	23. 4eDP d	24. 4fPS d
25. 5aPD s	26. 5bSD s	27. 5cSP s	28. 5dDS d	29. 5eDP d	30. 5fPS d
31. 6aPD s	32. 6bSD s	33. 6cSP s	34. 6dDS d	35. 6eDP d	36. 6fPS d

11.4 Appendix Four: Participant Information Form, Consent Form, and Debriefing Form

PARTICIPANT INFORMATION SHEET – ENGLISH:

You are being asked to take part in a research study on the connection between language and cognition. This study aims to investigate whether there is a difference in mental representations between Slovenian and English native speakers.

This research is being conducted as part of Honours Dissertation in Psychology by [redacted], 4th-year student of Cognitive Science (Humanities). It is supervised by Professor Martin Pickering, Department of Psychology, University of Edinburgh. For more information, please contact me on [redacted]@sms.ed.ac.uk or the supervisor on mpickering@ed.ac.uk.

You will be asked to group certain pictures and to complete a few demographic questions at the end.
The whole survey will not last more than 10 minutes. Please respond to the questions as fast as you can because we are interested in your immediate opinions.

You can decide to stop being a part of the research study at any time without explanation. You have the right to ask that any data you have supplied to that point be withdrawn/destroyed.

You have the right to omit or refuse to answer or respond to any question that is asked of you.

You have the right to have your questions about the procedures answered (unless answering these questions would interfere with the study's outcome). If you have any questions as a result of reading this information sheet, you should ask the researcher before the study begins.

There are no known benefits or risks for you in this study.

Your participation in this study is voluntary. I immensely appreciate your help. The data we collect does not contain any other personal information about you. No one will link the data you provided to the identifying information you supplied (e.g., email, age, area of domicile). Your data will be anonymised and stored on a password-protected computer. From that time, there will be no record that links the data collected from you with any personal data from which you could be identified. Up until the point at which your data have been anonymised, you can decide not to consent to have your data included in further analyses.

CONSENT FORM – ENGLISH:

By clicking to proceed, you are confirming that:

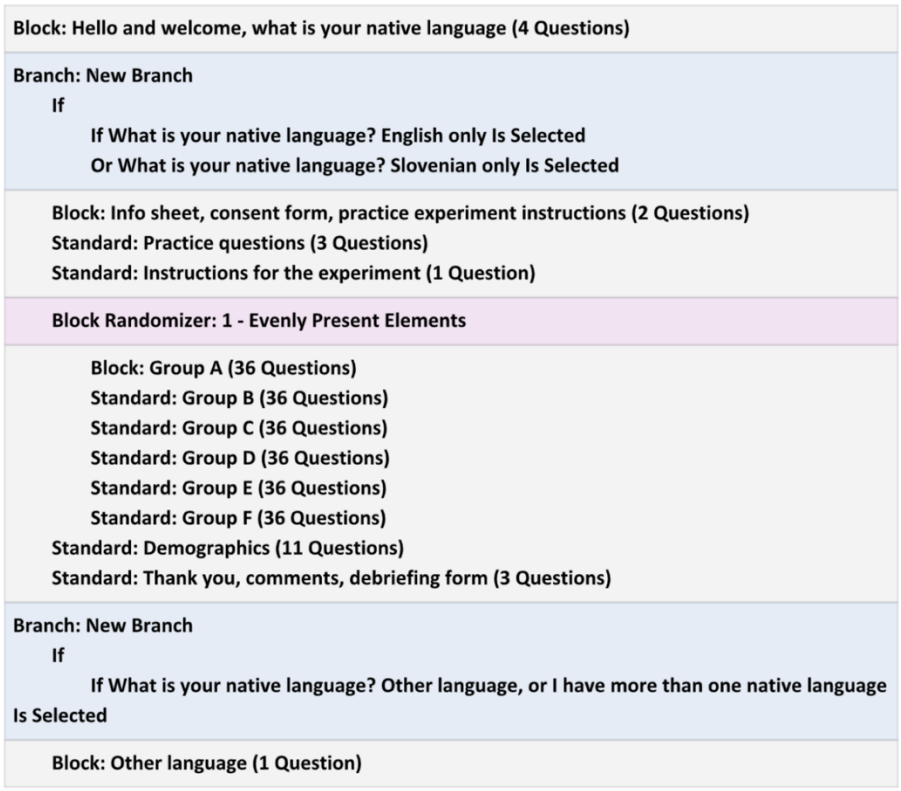
(1) you have read and understood the above information,
(2) questions about your participation in this study have been answered satisfactorily,
(3) you are aware of the potential risks (if any),
(4) you have the right to withdraw your participation at any point without giving a reason,
(5) you are taking part in this research study voluntarily (without coercion), and
(6) your anonymised data may be used for the purposes of this research.

DEBRIEFING SHEET – ENGLISH:

Here is a summary of what I was researching. If you have any further questions, please feel free to contact me ([redacted]) on [redacted]@sms.ed.ac.uk, or my supervisor (Prof. Martin Pickering, Department of Psychology, University of Edinburgh) on mpickering@ed.ac.uk.

This research is following the logic of Phillips and Boroditsky (2003) on how quirks of grammar can affect the way you think. They were testing whether the grammatical gender of inanimate objects leads people to think of them as having a gender. They found the effects of grammatical gender on people's perceptions of objects in a variety of settings. Instead of looking at gender, the present research will be exploring the effects of the dual grammatical number on people's perceptual inclination towards groups of two versus groups of three. Slovenian, a South Slavic Indo-European language, still has the dual number in the standard language and many of its spoken dialects. This part of grammar died out in other Indo-European languages (except in Sorbian) centuries ago. The possible difference in cognitive representations is investigated by comparing Slovenian and English native speakers' responses to a grouping task.

Hypotheses:
Null hypothesis: If grammar does not guide thought, then Slovenian and English native speakers will not differ in the way that they group items.



Experimental hypothesis: If grammar guides thought, then Slovenian native speakers will be less likely to put groups of two and three people/animals/objects together than English native speakers.

11.5 Appendix Five: Survey Flow from Qualtrics

Showing the design of the experiment.
Survey Flow