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Cross-linguistic priming in comprehension facilitates change in adjective-noun order: Eye-tracking evidence from Romani-Romanian and Romani-Serbian bilinguals

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Cross-linguistic priming has recently been shown to play a role in language change in production, but there are no studies to date demonstrating its possible role in comprehension. In the present study, we test whether a facilitating effect of cross-linguistic priming also occurs in comprehension. We focus on the order of adjectives and nouns by comparing two groups of Vlax Romani speakers (Indic branch of the Indo-European language family), Gurbet and Kalderash, who have been in century-long contact with two different languages exhibiting different adjective-noun orders: Serbian (Slavic branch), with a dominant ADJ-N order, and Romanian (Romance

branch), with a dominant N-ADJ order. Prior research has shown that Gurbet speakers from Serbia, in contact with Serbian, use ADJ-N order as the default whereas Kalderash speakers from Romania, in contact with Romanian, use a N-ADJ order. We administered an eye-movement monitoring and a behavioural judgment experiment to 30 Gurbet Romani-Serbian and 25 Kalderash Romani-Romanian early bilinguals. Participants listened to 72 prime-target pairs of adjectival phrases in two possible orders (e.g., 'hen green', 'green hen'), with the prime in their simultaneously early-acquired language (Serbian or Romanian) and the target in their primary L1 Romani variety. Results show that the dominant N-ADJ order in Romanian led to significant cross-linguistic priming effects in the Kalderash-Romanian group. In comparison, Gurbet participants showed a small, temporary priming effect when prime-target pairs matched the unmarked ADJ-N order. We conclude that cross-linguistic priming effects facilitate comprehension for the dominant/unmarked word orders. We propose that a combination of cross-linguistic priming effects in both production and comprehension shapes the structural convergence that takes place between two languages in contact.

Keywords: cross-linguistic priming, contact-induced change, adjective-noun order, eye-tracking, acceptability judgment, Romani

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1. Introduction

Language contact can lead to contact-induced change at all levels, from lexicon and semantics to phonetics and phonology, morphology and syntax. The mechanisms in play start at the level of individual bilinguals and have the potential to impact an entire social network and, under some circumstances, change the language for future generations who may no longer be bilingual (see more recently Adamou & Matras, 2021; Kootstra & Muysken, 2017; Zenner et al., 2018). In this paper, we investigate the role of cross-linguistic structural priming in shaping contact-induced language change (Adamou et al., 2021; Kootstra & Doedens, 2016; Kootstra & Muysken, 2017; Kootstra & Şahin, 2018). While the effects of priming are initially temporary, they can have long-lasting effects through repetition (see Kootstra & Doedens, 2016, among others).

Since contact-induced language change begins at the level of the individual during language processing, while change at the level of community is completed over years or even centuries, it is difficult to combine both timescales within a single study (Adamou et al., 2023). On the one hand, studies in the field of bilingualism document the online mechanisms among bilinguals but do not document completed language change. On the other hand, studies in contact linguistics detect changes in a historical perspective—for instance, by examining written records—, while leaving online speech processes undocumented. Here, we propose a solution to this methodological impasse by comparing two bilingual populations who speak two closely-related in-group varieties but have been living in different language contact settings for at least a century and now speak different out-group languages with different structural characteristics (see Rothman et al., 2023 for a discussion of this option in bilingualism research, but cf. Di Garbo & Napoleão de Souza, 2023 for a different kind of sampling which allows for a worldwide comparison of contact scenarios).

Specifically, we focus on the order of adjectives and nouns in Vlach Romani (Indic, Southeastern Europe, glottocode vlx1238). The canonical order in the Romani complex noun phrase is adjective (ADJ)-noun (N), but it appears to be in variation with a N-ADJ order in some language contact settings (Adamou & Matras, 2020). Following the analysis of 3000 adjective phrases based on the responses of 119 Romani speakers to a dialectological questionnaire, Adamou et al. (2021) find that the N-ADJ order has increased in Romani

varieties characterized by sustained contact with Romance languages, as opposed to Romani varieties characterized by sustained contact with Slavic languages which maintain an ADJ-N order. The authors hypothesize that these different developments in Romani might be due to the fact that the N-ADJ order is dominant in Romance languages whereas the ADJ-N order is dominant in Slavic languages. Adamou et al. (2021) test this hypothesis by examining the role of cross-linguistic priming in the production of N-ADJ order among 90 Romani-Romanian bilinguals. The results of this production experiment show that these bilinguals used the N-ADJ order more frequently in Romani after having read out loud a N-ADJ order prime in Romanian, while the inherited ADJ-N order in Romani was used more frequently only after participants had read out loud a Romani noun phrase with the same order as a prime.

In the present study, we further investigate the role of cross-linguistic priming in language change by examining online processing during comprehension. Following recent evidence from comprehension studies (see Tooley, 2023 for an extensive review), we hypothesize that cross-linguistic structural priming is not only driving production, but that it also has possible facilitating effects in comprehension. In particular, we ask whether a facilitating effect of cross-linguistic priming occurs when the adjective-noun or noun-adjective order is the same in the two languages of the bilingual individual.

To capture the processing effects of cross-linguistic priming at the level of the bilingual which may account for observed changes, we conducted an eye-movement monitoring study during a listening experiment (Experiment 1) with two bilingual Romani populations from two different, century-long language contact settings in the Balkans. One group of bilinguals resides in Romania and speaks Romani Kalderash (Indic, Romania, glottocode kald1238) and Romanian (Romance, Romania, glottocode roma1327), while another group resides in Serbia and speaks Romani Gurbet (Indic, Serbia, glottocode roma1241) and Serbian (Slavic, Serbia, glottocode sout1528). The speakers of the two contact languages differ in word order preferences: whereas the unmarked order in Romanian is N-ADJ, the unmarked order in Serbian is ADJ-N. Examples in (1) and (2) illustrate the unmarked orders with the descriptive adjective *big*. Other orders are also possible in both languages, either for information structural reasons (in Serbian, see Predolac, 2011; Stanković, 2017) or depending on the semantic types of the adjectives or the intended (non-)restrictive interpretation (in Romanian, see Marchis & Alexiadou, 2007). The grammaticality

of the orders depends on the contexts in which the noun phrases are used. In this sense, noun phrases with a non-canonical order (N-ADJ in Serbian and ADJ-N in Romanian) can be considered ungrammatical in certain contexts. However, this is beyond the scope of the current study, which focuses on the phrase level without further sentential context.

(1) Romanian

un *măr* *mare*
 one.M.SG apple(M).SG big.SG
 ‘one/a big apple’

(2) Serbian

jedna *velika* *jabuka*
 one.F.SG big.F.SG apple(F).SG
 ‘one/a big apple’

Most Kalderash Romani speakers (henceforth Kalderash) use variable orders in Romani, with the N-ADJ order being the dominant order for descriptive adjectives such as those referring to colour and size, e.g., *baro* ‘big’ (Adamou et al., 2021). In comparison, Gurbet Romani speakers (henceforth Gurbet) predominantly use the ADJ-N order, with the N-ADJ order used occasionally for contrastive and information focus reasons or for stylistic effects, similar to Serbian (Mirić & Ćirković, 2023). See examples illustrating the dominant/unmarked orders in (3) and (4).

(3) Kalderash, Romania (Adamou et al., 2021, p. 1640)

[jekh žukel baro] daravel
 INDF dog(M).SG big.M.SG frighten.3SG

le ciknoren
 DEF.OBL children.OBL.PL
 ‘A big dog frightens the children.’

(4) Gurbet, Serbia (Ćirković & Mirić, 2017, p. 87)

jekh *baro* *prazniko*
 one.INDF big.M.SG holiday(M).SG
 ‘one/a big holiday’

To assess to which extent both ADJ-N and N-ADJ orders were acceptable to the participants who completed the eye-tracking experiment, we administered an acceptability judgment task to test both languages of the bilinguals (Experiment 2). Before presenting the two experiments in Sections 3 and 4, we offer some theoretical background in Section 2.

2. Theoretical and linguistic background

2.1. Cross-linguistic priming

Priming can be lexical, involving specific words, or structural, involving a syntactic construction; the latter is the type of priming we examine in this study (see Cai & Zhao, 2024 for a recent review of studies on structural priming). Structural priming is a general mechanism in language production and comprehension whereby the characteristics of a given structural stimulus, the *prime*, influence processing of a subsequent stimulus, the *target* (Bock, 1986; Pickering & Ferreira, 2008). For example, when speakers use a passive structure, they are more likely to produce it again. Cross-linguistic structural priming, in particular, occurs when a prime stimulus in one language affects a target response in another language, as bilingual individuals respond to a target after being exposed to a prime (see Ferreira & Bock, 2006; Hartsuiker & Pickering, 2008; Loebel & Bock, 2003).

However, a meta-analysis of production studies shows that structural priming is less robust across languages than within languages, possibly because there is no advantage from a *lexical boost* that takes place when critical content words are shared between a prime and a target (Mahowald et al., 2016). Cross-linguistic structural priming effects are nonetheless reported for various syntactic phenomena: for dative forms in groups of German-English bilinguals (Loebell & Bock, 2003), for passives in Dutch-English and Spanish-English bilinguals (Bernolet et al., 2007; Hartsuiker et al., 2004), for passive relative clauses in

Chinese-English bilinguals (Hsieh, 2017), for argument structure in Dutch-English (Schoonbaert et al., 2007) and Swedish-English bilinguals (Kantola & van Gompel, 2011), for genitive case marked structures in Dutch-English speakers (Bernolet et al., 2013), and for relative clause structures in Dutch-English (Desmet & Declercq, 2006) and English-German bilingual speakers (Kidd et al., 2015).

Such structural priming may plausibly lead to contact induced change over time, as Jäger & Rosenbach (2008) and Kootstra & Doedens (2016) argue. In line with dual-mechanism accounts that combine short-term and long-term mechanisms (Hartsuiker et al., 2008), short-term facilitating effects of priming, reflecting the mechanism of residual activation of a given structure (Pickering & Branigan, 1998), offer the basis for a change in the long run through implicit learning. This long-term mechanism strengthens structural knowledge through repetition and is independent of the conscious memory, known as *explicit memory* (Bock & Griffin, 2000; Chang et al., 2006).

Discussing cross-linguistic priming and language change, in particular, Travis et al. (2017) show that cross-linguistic priming is a modulator in Spanish subject pronouns among Mexican Spanish-English bilinguals residing in the US. Kootstra and Şahin (2018) also report that Papiamento-Dutch bilinguals living in the Netherlands produce more Dutch-like dative structures in Papiamento than those living in Aruba, where speakers use Dutch less frequently and the effect of cross-linguistic priming is therefore weaker. Moreover, Adamou et al. (2021) further confirm the significance of cross-linguistic priming in adjective-noun order change among Romani-Romanian bilinguals (see Introduction for details).

Structural priming presumably arises because the use of a given structure activates its corresponding structure in the mind, and this activation may have a facilitating effect on the use of the same or a similar structure immediately after. Priming can be studied in either production or comprehension; our study explores the latter, which has been much less investigated in language change.

While structural priming is robust in production, earlier studies have reported that it arises in comprehension only when the stimuli share not just the structure but also key lexical items, known as the lexical boost (see Tooley & Traxler, 2010). However, recent research findings confirm the relevance of priming in comprehension, as demonstrated by faster reading times, longer looks to a referent in the visual world paradigm,

changes in the blood-oxygen-level-dependent response, and changes in language-related event-related potential components (Kim et al., 2014; Tooley & Bock, 2014; Ziegler & Snedeker, 2019; Bosma et al., 2023, and Tooley, 2023 for a recent review).

In addition to the effects of structural priming in comprehension within a single language, cross-linguistic structural priming is also noted in second language learners (Nitschke et al., 2014; Weber & Indefrey, 2009; Wei et al., 2019). To our knowledge, there are virtually no studies on structural priming in comprehension among early bilinguals (e.g., Kidd et al., 2015 report an average onset of bilingualism at 13.7 years). Our study therefore helps fill this gap in the bilingualism literature by examining an under-researched population of early bilinguals.

2.2. Romani spoken in Serbia and Romania

Romani is an Indic language with 12 large groups of dialects (Elšík & Beníšek, 2020). In this study, we focus on two Romani varieties, Gurbet and Kalderash, which belong to the Vlax (pronounced [vlax]) dialectal group. The Gurbet variety belongs to the southern Vlax group. It is spoken in the southwest Balkans, including Serbia, where it represents one of the major dialects in terms of the number of speakers and its geographical distribution (Mirić & Ćirković, 2023). According to the 2022 census,¹ there are currently 131,936 citizens of the Republic of Serbia who identify ethnically as Roma, of whom 79,687 are Romani speakers, indicating a significant degree of language shift within the Romani community. The Kalderash variety belongs to the northern Vlax group (Matras, 2013). It is the most widely spoken Romani variety in Romania. Estimates of Romani speakers in Romania vary widely and range from 250,000 to more than two million speakers (Adamou et al., 2021). The literature specifically dedicated to the varieties analysed in this study is scarce (see Ćirković & Mirić, 2017; Mirić & Ćirković, 2022 for Gurbet Romani spoken in eastern Serbia, and Lee, 2010 for Kalderash Romani spoken in Romania).

Gurbet and Kalderash Roma are typically bilingual in their Romani varieties and the official state languages, Serbian and

¹ Census 2022 – Population by Nationality and Mother Tongue, by regions. Statistical Office of the Republic of Serbia. Available at: <https://data.stat.gov.rs//Home/Result/3104020304?languageCode=sr-Cyrl> (accessed November 8, 2023).

Romanian, respectively. As shown by linguistic studies dealing with these two Roma groups, they acquire both languages from an early age (Adamou et al., 2021, Mirić & Ćirković, 2022). Moreover, they employ both languages in their everyday communication, including in-group conversations with the members of their communities. While Serbian and Romanian are used as languages of formal instruction, Gurbet and Kalderash have also served as the basis for the Romani language standardization in their respective countries and are nowadays taught in schools. In Serbia and Romania, Romani is taught as an elective school subject in all grades of primary school and is not offered as a language of instruction. According to statistics by the Ministry of Education, in Romania, 18,284 pupils attended these classes in 2023-2024, and in Serbia, there were 1,310 enrolled pupils in the school year 2023-2024.²

Regarding their history in present-day territories, several facts about the Kalderash in Romania and the Gurbet in eastern Serbia should be mentioned. The Roma in Romania are first documented in the 14th century in Wallachia and Transylvania, and in the 15th century in Moldavia (Achim, 1998, p. 10). The Kalderash group, specifically referred to in Romania as *căldărari* ('boiler-makers'), is mentioned in the early 19th century, alongside the larger group of *lăeși* ('nomadic Roma') whose primary occupation was blacksmithing (Achim, 1998, p. 89). Many Kalderash Roma remained in Romania, but many also settled in Central and Western Europe after the abolition of slavery in Romania, finalized by legislation in 1855-1856 (Achim, 1998, p. 112). As for Serbia, in contrast to some other Roma groups who likely arrived in present-day Serbia during the 14th century, the Vlax-Romani-speaking groups arrived in Serbia during the second half of the 19th century, coming from Moldavia and Wallachia after the abolition of slavery (Gjorgjević, 1903/1906). The Gurbet group under study settled in eastern Serbia only during the 20th century. The Romani dialect formerly spoken in this region, described by Miklosich in 1877 (Miklosich, 1872-1880), was that of Arli, a Balcan Romani dialect which has since disappeared from the area (Sikimić, 2017). The Gurbet variety under study is characterized by retaining numerous loanwords from Romanian as well as some morphological traits, such as the suffix *-ura* in the nominative plural of masculine nouns (Mirić & Ćirković, 2022). This means that the N-ADJ order among Kalderash in Romania

2 Data are available at: <https://opendata.mpn.gov.rs/otvoreni-podaci/osnovno-obrazovanje.html> and https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister/2024/div/Rapoarte_sistem/Raport_Stare_invatamant_preuniv-2023-2024.pdf

In line with recent research summarized in Tooley (2023), our prediction is that processing should be facilitated—reflected in longer looks towards the target and faster object selection—when there is a match between the prime’s and the target’s order, compared to when there is a mismatch. We used the same meaning for the noun in both the prime and the target, which is expected to facilitate the priming effect, although not to the extent of a lexical boost (since in our study the lexical items differ and thus do not qualify as lexical boosts). As this similarity in meaning would be present in both matching and mismatching orders, we do not expect it to confound the design (see also discussion in Section 3.3.).

We also expect that priming may affect marked and less acceptable orders more than unmarked ones (Do & Kaiser, 2017; Snyder, 2000; Sprouse, 2007). Although the role of acceptability is rarely examined in the priming literature, Sprouse (2007) suggests that ungrammatical syntactic structures should not prime speakers. Some studies, nonetheless, note that, over time, satiation in a form of increased acceptability is taking place (Snyder, 2000), and therefore priming should be equally possible. Do and Kaiser (2017) confirm that priming and satiation can take place, but this depends on structures. Even though we are not dealing with ungrammatical structures but with marked ones, our study may provide additional insights into whether less preferred orders can be affected by priming.

3.1. Methodology

3.1.1. Participants

We recruited a total of 55 Romani bilinguals in two testing sites: 25 Kalderash Romani-Romanian bilinguals in Romania and 30 Gurbet Romani-Serbian bilinguals in Serbia. It is important to note here that recruiting speakers of minoritized languages is objectively difficult and often only allows a modest number of participants. Prior to their admission, all participants completed a short language-background questionnaire containing demographic, behavioural, and self-assessment questions. The questionnaire was administered by the researchers orally in Serbian or Romanian (an English translation of the questionnaire is provided in Appendix 1).

Table 1 summarizes the characteristics of all participants with respect to age, age of acquisition of each language, and self-declared proficiency. Twenty-five Kalderash speakers residing

primarily in Romania were tested in the Bucharest area (11 women; $n=25$; mean age = 31.30, $SD = 14.15$). Ten participants reported little to no elementary education, nine had completed elementary school, and six had completed high school. All participants reported acquiring Romani in naturalistic family settings. Twenty participants reported acquiring Romani from birth and five as children. Fifteen participants reported acquiring Romanian from birth and ten from early childhood. All participants stated that they use Romani mostly when communicating with family members and kin. On a 5-point scale, their average self-estimated level of proficiency was 4.56 for Romani and 4.68 for Romanian.

Group	N	Age	AoA		Proficiency	
			Romani	Ro./Srb.	Romani	Ro./Srb.
Romani in Romania	25	31.30 (14.15)	0.8 (0.4)	0.6 (1.5)	4.56 (0.76)	4.68 (0.47)
Romani in Serbia	30	44.5 (15.5)	2.8 (7.1)	1.65 (2.95)	4.27 (0.95)	4.63 (0.61)

Table 1: Demographic and relevant language background characteristics of the participants (AoA = Age of acquisition, standard deviations are given in parenthesis, proficiency is given on a scale from 1 (low) to 5 (high proficiency)).

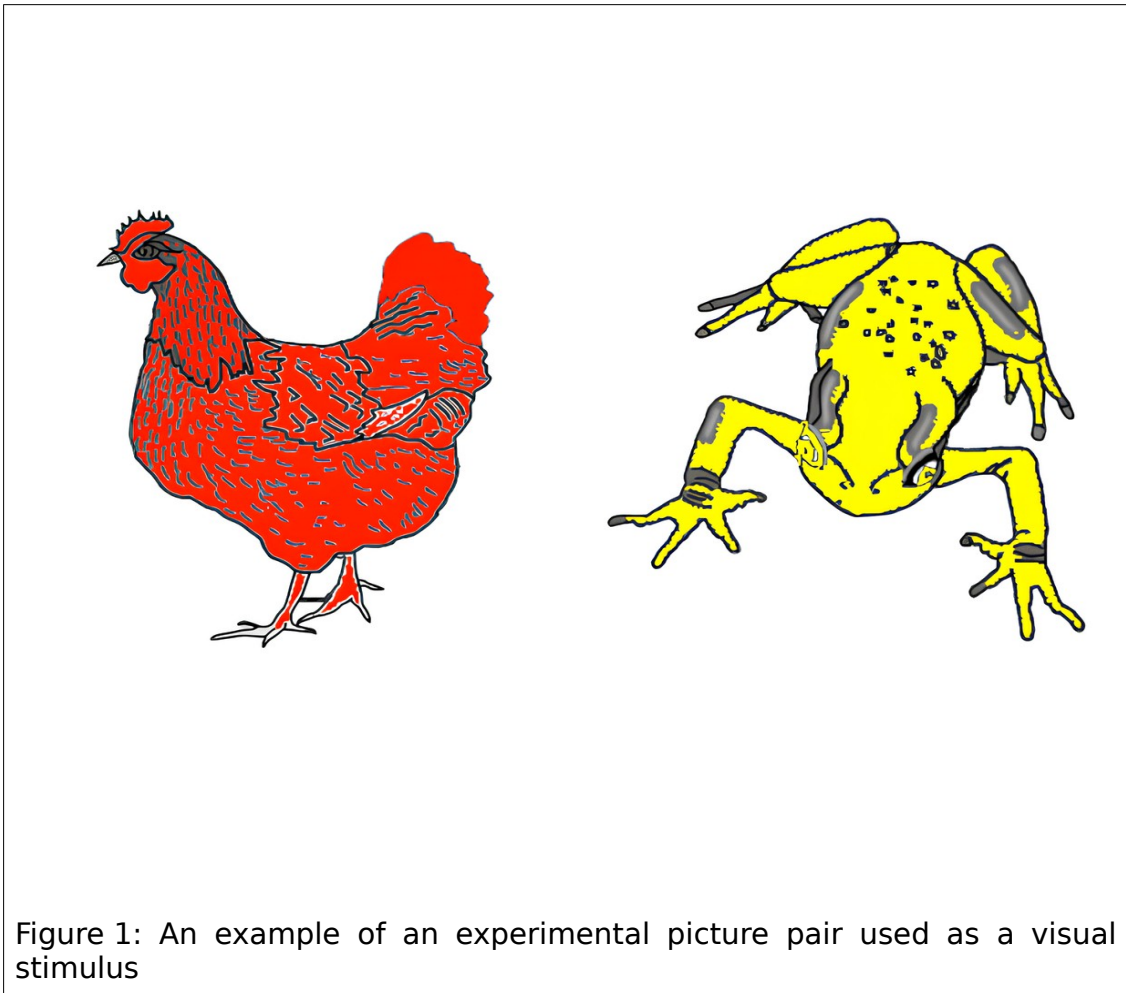
The Romani participants residing in Serbia were tested in Knjaževac, Eastern Serbia (16 women; $N = 30$; mean age = 44.5, $SD = 15.5$). Eleven participants reported little to no elementary education, thirteen stated graduating from elementary school and six reported graduating from high school. All participants had acquired Romani in Romani-speaking households. Twenty-five participants started acquiring Romani from birth, five later in early childhood and one as a young adult. Twenty-two participants reported acquiring Serbian from birth and eight from early childhood. All participants responded that they used Romani mostly when communicating with family members and kin. On a 5-point scale, their average self-

estimated level of spoken proficiency was 4.27 for Romani and 4.63 for Serbian.

All participants reported normal hearing and (corrected to normal) vision. None of the participants reported any disabilities that might interfere with language processing. They signed an informed consent form to participate in the study and received 10 euros as compensation for their time. The protocols described in this study were approved by the Research Ethics Committee of the Université Côte d'Azur (*Comité d'Éthique de la Recherche, CER AVIS n° 2023-040*).

3.1.2. Materials

Seventy-two visual displays, each comprising a pair of pictures presented side by side, were generated. One picture was the target (e.g., a red hen) and the other was the distractor (e.g., a yellow frog, see Figure 1). Each visual depicted an object corresponding to 18 noun phrases (N=18) shown across four conditions and resulting in 72 experimental trials per participant. Since we used a fully-crossed design, each participant saw all experimental items. We included two experimental conditions in which the prime stimulus was presented in two possible orders (ADJ-N vs. N-ADJ), and two other experimental conditions where the order of the adjective matched or mismatched the target stimulus. The pictures were taken from the MultiPic database (Duñabeitia et al., 2018) and were recoloured for the purpose of this study. Half of the objects used in the visual materials were animate, while the other half were inanimate, with this distribution counterbalanced across the trials. The visual displays contained either animate or inanimate objects acting as target-distractor pairs, but not a combination of both. Nouns of different genders were used across all four languages under scrutiny. Care was taken to ensure that all objects would have the same gender in the priming languages (Romanian or Serbian) as in the target varieties (Kalderash and Gurbet), so as to avoid processing differences due to gender mismatch. Gender was also counterbalanced across the objects used in the visual materials.



To depict noun phrases in visuals, we used colour adjectives *white*, *black*, *red*, and *blue* in both languages as well as *yellow* in Gurbet or *green* in Kalderash. These colours were selected to avoid cognate effects in priming, as several colour terms in Romani are also used in Serbian or Romanian and may, hence, have the same lexical representation. By selecting those five colour terms, we assured that adjectives were lexically different across language pairs. The visual objects were coloured accordingly. In prime-target pairs, we used different colour adjectives to avoid identity priming effects (i.e., prime: yellow hen, target: red hen, see Figure 1). The position of target and distractor pairs in visual displays was counterbalanced across trials by inverting their placement in half of the items, so that the target objects appeared equally on either the left or the right side of the visual display.

Seventy-two experimental linguistic stimuli were prepared in two sets: primes in Romanian and Serbian, and targets in Kalderash and Gurbet, as illustrated in Table 2 (the full set of items is given in Appendix 2).

	Serbian			Romanian		
Prime	<i>žuta</i>		<i>kokoška</i>	<i>verdea</i>		<i>găină</i>
	yellow.F		hen	green.F		hen
	‘the yellow hen’			‘the green hen’		
	Romani (Gurbet)			Romani (Kalderash)		
Target	<i>e</i>	<i>loli</i>	<i>khanji</i>	<i>i</i>	<i>loli</i>	<i>khaini</i>
	the	red.F	hen	the	red.F	hen
	‘the red hen’			‘the red hen’		

Table 2: An example set of prime and target linguistic stimulus materials

Primes were administered in two possible word orders: ADJ-N and N-ADJ (e.g., Romanian *găină verdea* ‘the hen green’ vs. *verdea găină* ‘the green hen’; Serbian: *žuta kokoška* ‘the yellow hen’ vs. *kokoška žuta* ‘the hen yellow’). Recall that in Romanian, the unmarked order is N-ADJ while in Serbian, it is ADJ-N. The colour adjectives were kept the same in both Romanian and Serbian prime sets as much as possible, except for only four items. More specifically, *yellow* was changed to *green* in Romanian primes due to the fact that the adjective *yellow* in Kalderash Romani (Romania) is also used in Romanian, while the adjective *green* was not used for Gurbet Romani (Serbia) as it is also used in Serbian. All linguistic stimuli included a definite noun phrase (see Section 2.3.). Serbian primes did not include a definite article, as (Standard) Serbian lacks articles. However, the adjectives were used in their forms marked for definiteness: a long form marked with a suffix for the masculine gender, and a specifically stressed form for the feminine gender. All target noun phrases in Romani were also administered in two possible word orders: DEF-ADJ-N (e.g., *e loli khanji* ‘the red hen’) or DEF-N-ADJ (e.g., *e khanji loli* ‘the hen red’). Romani targets always had an utterance-initial definite article.

In addition, we used 40 filler items in the experiment. Each participant saw 112 items in total: 72 experimental and 40 filler items. The filler items involved noun phrases with a structure

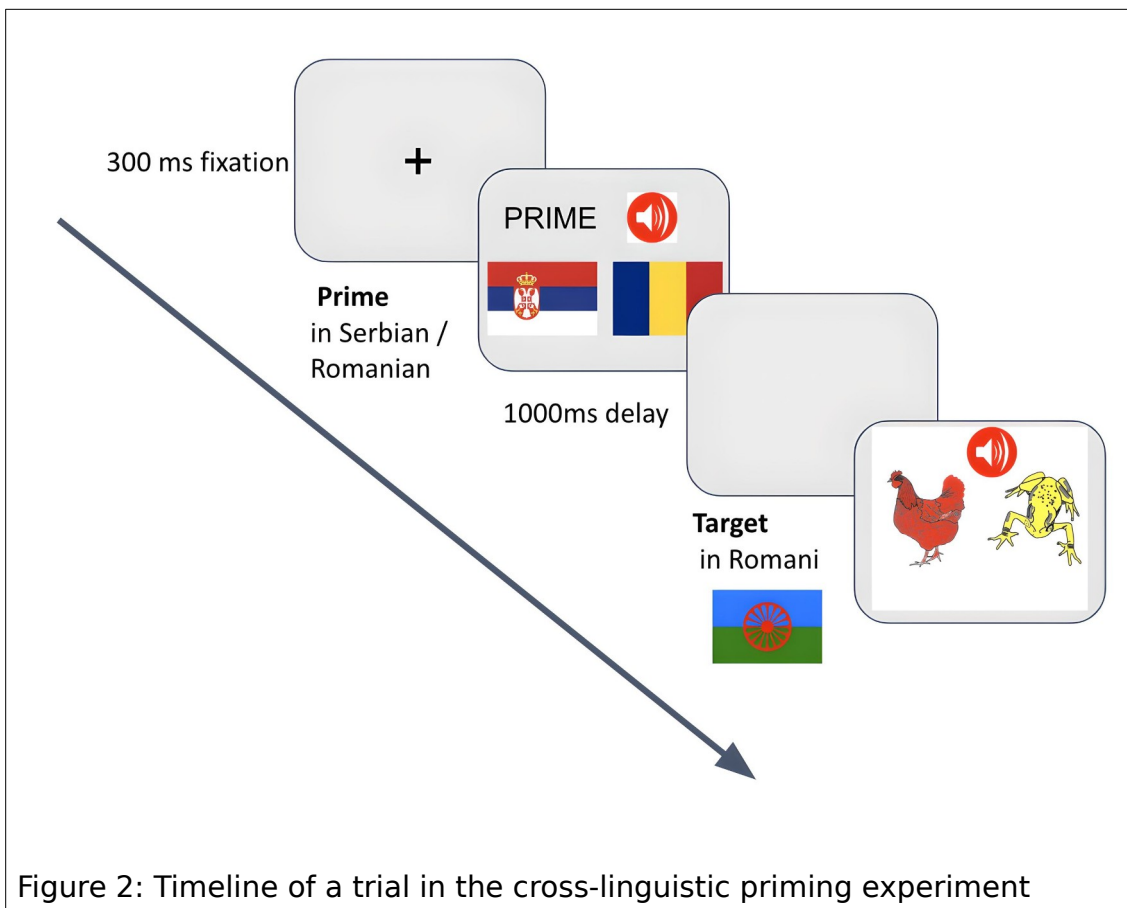
similar to the experimental items, but the colour adjectives and the prime and target object nouns differed. For example, we used colour adjectives such as *purple* or *grey* and objects such as *shirt* or *tree*, which were not used in the experimental trials. The object nouns in filler items did not match in gender across languages. Unlike the experimental items, which included only masculine and feminine nouns common to all languages in this study, filler items also included neuter nouns, where applicable, to allow for a wider choice of objects and nouns in the experiment. We also controlled for the order of the nouns and adjectives in the same way as in the experimental items. The complete set of linguistic materials was digitally recorded in high-quality audio format at a 44100 Hz sampling rate. Romanian and Kalderash materials were audio recorded by the fourth author, while Serbian and Gurbet materials were recorded by a 37-year-old male speaker of Gurbet Romani. Both speakers were highly proficient bilinguals in the two languages. They were instructed to use neutral prosody and intonation while recording the auditory stimuli. The target audio stimuli were 1.97 seconds on average (SD = 0.21).

3.1.3. Procedure

For participants in Serbia, the stimuli were programmed using the Gazepoint Control software V6.3.0 connected to a remote desk-mounted GP3 infrared eye-tracking system (Gazepoint, 2021). Due to travel restrictions in Romania in early 2022 following the war in Ukraine, we were unable to transport physical laboratory equipment. As a result, the experiment was re-programmed for participants in Romania using the Gorilla.sc platform (Anwyl-Irvine et al., 2020). The experimental protocol remained the same except that a web-based eye-tracking unit was used, recording at the same sampling rate as the GP3 tracker (60Hz). The experiments always took place under the supervision of a Kalderash-Romanian-speaking experimenter. See Özsoy et al. (2023) who showed that webcam-based eye-movement monitoring is reliably comparable to lab-based experimental setups in grammatical processing studies with groups of minoritized (heritage) language speakers.

The participants saw one display with two object pictures (see Figure 1 above) on a 1080x1080 pixel wide screen. Each object picture was programmed with an equal width and height of 540x540 pixels. The eye-tracking system was calibrated with a 5-point calibration for each participant at the beginning of experimental blocks. Each trial started with a 300ms fixation cross attracting the participants' gaze towards the centre of the

screen. A black fixation cross appeared on a grey background. After the fixation cross, a prime stimulus was presented auditorily (e.g., *žuta kokoška* ‘the yellow hen’ in Serbian), during which the screen remained blank. Following the auditory prime, a 1000ms delay was programmed before the participants saw the visual materials (e.g., a red hen and a yellow frog) and heard the target audio stimulus (e.g., *e loli khanji* ‘the red hen’ in Gurbet). The visual and target audio stimuli were presented simultaneously. This procedure, visually depicted in Figure 2, was applied the same across all experimental trials. Participants were instructed to click as fast as possible on the picture that correctly depicted the object presented in the target stimulus in Romani. Once participants responded, the presentation of the next trial began.



Participants were tested individually in a quiet and dimly lit room either in the local National library *Njegoš* in Knjaževac, Serbia, at the premises of the University of Bucharest, Romania or at their own homes for their comfort. They were seated around 70cm away from the stimulus screen, sitting in an upright position directly facing the screen in a comfortable

viewing angle. They were instructed to maintain their gaze on the screen, listen carefully to prime and target audio stimuli and then click on the picture that would be positioned on either the left or right side of the screen, correctly corresponding to the target stimulus in Romani. After reading the instructions displayed on the screen (in Serbian or Romanian), participants completed three practice trials to ensure they understood the task and had the opportunity to ask clarification questions, if they had any. Before the main eye-tracking experiment began, participants were reminded not to turn their gaze away from the screen.

3.1.4. Analysis

We analysed three variables: (i) accuracy of clicks indicating how accurate the participants were in clicking on the picture that corresponded to the target stimulus; accuracy was measured as a binary variable (1 = correct, 0 = incorrect), (ii) latency of clicks in milliseconds indicating the time that passed since the presentation of the target audio/image, and (iii) the proportions of looks towards target object images per visual display. The accuracy and latency data were analysed using (generalized) mixed-effects linear regression with the `lme4` package in R (Bates et al., 2015). We removed response times (RTs) shorter than 200ms and longer than 4000ms before the analysis. This removal corresponded to 18% of cases in the Kalderash data, and 5.8% in the Gurbet data. In statistical models, we included two fixed effects: Prime Default Order (which codifies whether the word order of the prime was dominant, i.e., the Default condition, or marked, i.e., the non-Default condition) and Mismatch (Match vs Mismatch, indicating whether the target word order matched the prime or not). In Romanian primes, the default order is N-ADJ and is hence coded as default, whereas in Serbian primes, the default order is ADJ-N. We included participants and items as random intercepts and slopes. RTs were log-transformed, and the fixed effects zero-to-sum coded. One participant in the Gurbet group was excluded due to acquiring Romani during adulthood, and two items from both experiments were removed due to a technical programming error before the analyses. Off-screen and imprecise looks were also removed from the raw data (about 19.8% of entire raw recordings).

Proportions of looks were calculated as 1-0 binary categorical data, indicating gazing towards the target region of interest (1) versus the non-target distractor region (0). The tracking system was programmed to collect data at a sampling rate of 60Hz, and

hence, for each trial, we recorded a proportion of look data approximately every 17ms. Eye-movement data were recorded in real time. We visually inspected the total 2600ms following the onset of the target stimuli and detected that critical condition differences emerged within the first 600ms. We extracted 600ms (0ms-600ms) and for the purpose of this analysis, we have extracted the time-window of 200ms-600ms following the onset of the target stimuli. The initial 200ms were excluded from the statistical analysis as this time-window is too short for humans to program any eye movements (Huettig & Altmann, 2005; Rayner et al., 1983).

The eye-movement data for the entire selected time window were pre-processed and averaged into 50ms time bins, and then transformed into empirical logit units via the *Elog* formula: $\log((Prop+0.5)/(1-Prop+0.5))$, using the `eyetrackerR` package (Dink & Ferguson, 2015). The *Elog* transformed data were submitted to a Growth Curve Analysis in R so as to be able to account for the non-linear nature of the eye-movement data (see Mirman et al., 2008). We included items and participants as random intercepts and slopes where applicable, and the colour of the target objects as a nested factor within items so as to control for random variation in looks towards different coloured objects. Following Mirman et al. (2008), we included orthogonal polynomials by including Time, Time² and Time³ as fixed effects so that non-linear change over the time course could be captured. However, due to not having observed significant effects for Time² and Time³, we report the models with only the linear Time term.

Further, to determine the time points at which between-condition differences emerged within the critical time window, we conducted a cluster-based permutation analysis following Maris and Oostenveld (2007). Time clusters with significant condition differences were identified using the `clust_analysis` function from the `eyetrackerR` package in R (Dink & Ferguson, 2015). We used linear regression models to statistically test each cluster, using a threshold of -2 or +2 *t* value, with 1000 samples at each node.

3.2. Results

3.2.1. Accuracy and latency of clicks

Mean accuracy and response latency data are given in Table 3, and the outputs from mixed effects regression models are given

in Table 4. The statistical outputs from response accuracy analyses showed for both the Kalderash and the Gurbet group that participants were highly accurate without any critical condition differences (in both groups >97%). However, we found critical differences in the Gurbet group's response latencies. The model returned a significant fixed effect of Prime Default Order, indicating that participants on average responded with slightly quicker RTs to the trials when the prime had a non-default order in Serbian (N-ADJ) than when it had a base/default one ($\beta = -0.05$, $t = -3.88$, see Table 4). Furthermore, we found a significant interaction between Prime Default Order and Mismatch ($\beta = 0.05$, $t = 2.42$), which seems to be modulated by the presence of a non-default option in prime order in Serbian. That is, in trials where the word order was non-default (i.e., N-ADJ in Serbian), the Gurbet participants were quicker to respond when the target matched than when not ($\beta = -0.05$, $SE = 0.01$, $t = -3.74$, $p < 0.001$), as shown by a post hoc comparison. This difference was not present when the word order was the default one ($\beta = -0.004$, $SE = 0.01$, $t = -0.32$, $p < 0.74$). This seems to indicate that when the order is non-default in both languages, and hence more noticeably marked, participants seem to complete the task more quickly. It is important to note here that although the differences are statistically significant in the Gurbet group, the sizes of those effects were rather small (see below for further discussion).

	<i>ADJ-N Match</i>	<i>ADJ-N Mismatch</i>	<i>N-ADJ Match</i>	<i>N-ADJ Mismatch</i>
<i>Romania (Kalderash group)</i>				
<i>Accuracy</i>	0.97	0.98	0.99	0.98
	(0.14)	(0.10)	(0.09)	(0.13)
<i>RTs</i>	2848.39	2865.09	2859.79	2914.28
	(706.53)	(683.29)	(666.20)	(703.09)
<i>Serbia (Gurbet group)</i>				
<i>Accuracy</i>	0.99	0.98	0.99	0.98
	(0.06)	(0.10)	(0.08)	(0.11)
<i>RTs</i>	2560.52	2550.31	2453.90	2565.27
	(614.49)	(611.26)	(663.78)	(598.0)

Table 3: Mean accuracy and response latency in milliseconds (RT = response time recorded from the beginning of the target visual/auditory stimulus in Romani), standard deviations are given in parenthesis. (Orders here represent the targets in Romani)

	<i>Response accuracy</i>				<i>Response latencies</i>			
	β	SE	z	p	β	SE	t	p
Romania (Kalderash group)								
(Intercept)	6.96	1.18	5.89	<0.001	7.94	0.04	222.18	<0.001
Prime Default Order [Non- Default]	-1.09	0.73	-1.50	0.133	-0.01	0.02	-0.30	0.761
Mismatch [Mismatch]	-0.44	0.81	-0.55	0.583	<0.00	0.02	0.17	0.866
Prime Default Order [Non- Default] × Mismatch [Mismatch]	0.63	0.99	0.64	0.525	0.02	0.03	0.61	0.541
Serbia (Gurbet group)								
(Intercept)	6.82	0.99	6.84	<0.001	7.82	0.03	230.42	<0.001
Prime Default Order [Non- Default]	-0.67	0.87	-0.77	0.440	-0.05	0.01	-3.88	<0.001
Mismatch [Mismatch]	-1.16	0.82	-1.40	0.161	<0.00	0.01	0.33	0.742
Prime Default Order [Non- Default] × Mismatch [Mismatch]	0.66	1.06	0.63	0.531	0.05	0.02	2.42	0.016
Sample R code: <code>glmer(Correct ~ PrimeDefaultOrder * Mismatch + (0 + Age.year Item_no) + (1 participant_id), family='binomial', control = glmerControl(optimizer='bobyqa'), data = Click_clean)</code>								
Table 4: Statistical outputs from mixed effect regression models computed with accuracy and response latencies data. Significant fixed effects are bolded. β represents logit proportions for accuracy data and log-transformed units for the RTs data, SE = standard error. In Mismatch, “match” was kept as the baseline level. In Prime Default Order, the default order was kept as a baseline.								

3.2.2. Proportions of looks

Figure 3 shows the per-millisecond proportions of looks towards the target picture over the distractor within a 600ms time window from the target stimulus onset. In eye-tracking studies with listening tasks, it is ideal that the participants' fixations do not show a strong preference for either visual at the onset; that is, the proportion of looks should be around 0.5 at rather chance level. However, over time, particularly following the presentation of a linguistic stimulus, participants start fixating increasingly on the intended visual that matches the stimulus. We analyse those trajectories in terms of the proportion of looks.

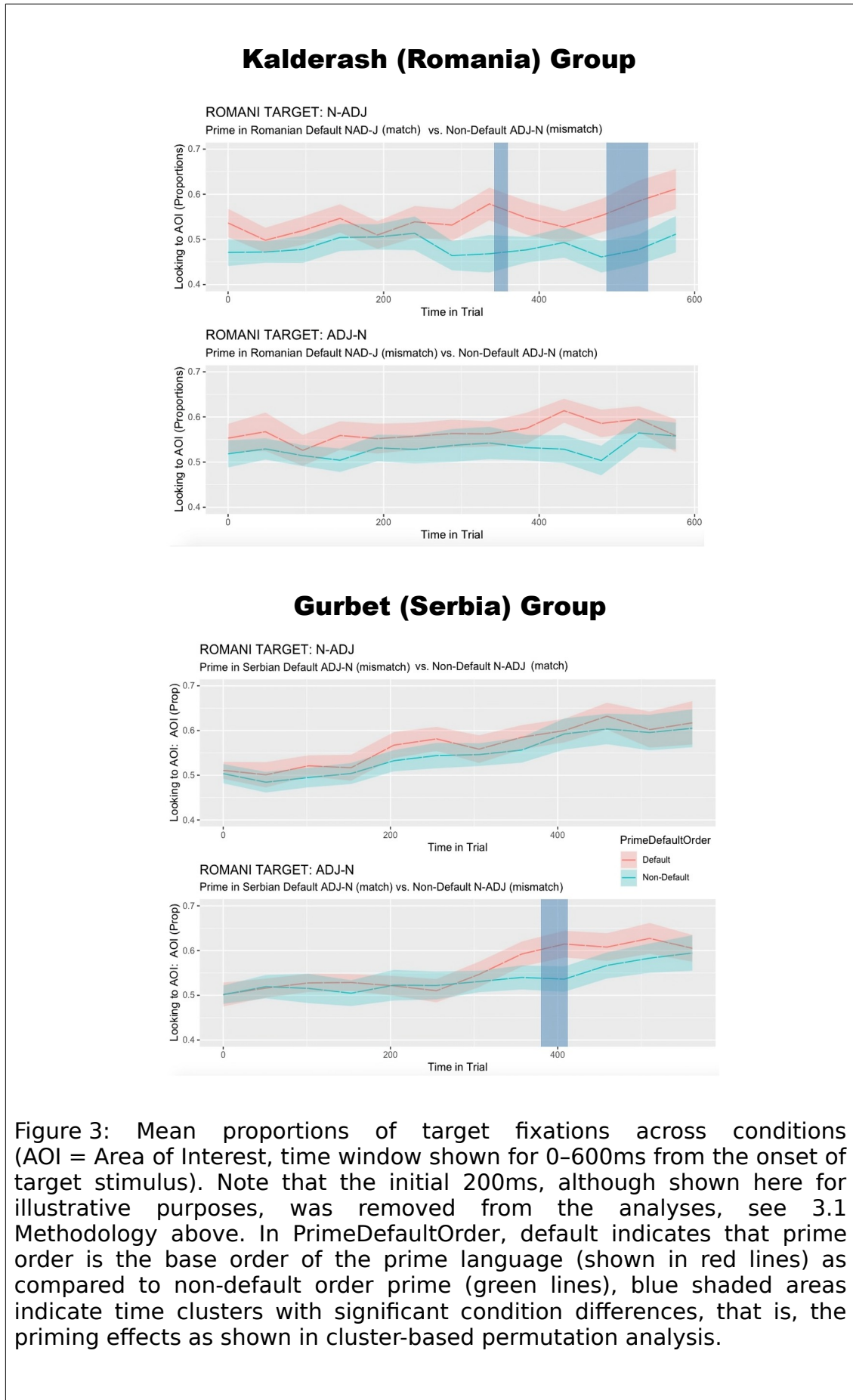
We first check whether the two curves in each compared pair of conditions are significantly different from each other over time. In order to detect those subtle changes in eye-movement data, we used growth curve models and cluster-based permutation techniques. A visual inspection of the data showed that Kalderash participants shifted their gaze towards the target pictures starting around 300ms, and again from approximately 500ms onward in trials where prime and target stimuli matched the default N-ADJ order. In Figure 3, blue shaded areas indicate significant clusters showing condition differences; that is, the priming effects as shown in cluster-based permutation analyses.

Statistical outputs from growth curve models (GCMs) are given in Table 5. Growth curve models were used to determine whether and when cross-linguistic priming effects emerged in participants' eye-movement trajectories. The outputs of Kalderash participants showed a significant coefficient for the interaction effect between the fixed effects of Prime Default Order and Mismatch (see Table 5). This suggests that cross-linguistic priming effects are present, with the dominant N-ADJ order in Romanian tending to lead to structural priming effects in Kalderash.

Figure 4 demonstrates the GCM-predicted proportions of looks towards the targets in the Kalderash data, and it is quite conceivable that the interaction effect is modulated by the default word order of the prime. That is, when the prime is in the default N-ADJ order (i.e., in Romanian), Kalderash participants have a greater tendency to increase their fixation on N-ADJ targets in Romani around 300ms post-stimulus, compared to trials with a non-default or mismatching prime (see Figure 4). We have further confirmed this difference using a post-hoc comparison; namely, when the prime-target pairs matched the N-ADJ order, looks towards the target were more

frequent in the default Prime Default Order in Romanian (N-ADJ) than in its non-default counterpart ($\beta = 0.26$, $SE = 0.053$, $z = 5.01$, $p < .0001$). As this GCM model was applied to a broadertime window (i.e., 200-600ms), we further analysed the data using cluster-based permutations to determine during which clusters—i.e., smaller time windows—these condition differences emerged. In the N-ADJ target order, permutation analysis returned two significant clusters showing differences between non-default and default prime order conditions: one between 342 and 360ms (sum statistics = -2.37 , $p < 0.05$) and a second cluster between 486 and 540ms (sum statistics = -2.71 , $p < 0.05$). No effects were found for ADJ-N target orders. This analysis aligned with the previous observation which showed that the target image was more likely to be gazed on when the Romanian prime matched the Romani target in the default N-ADJ order.

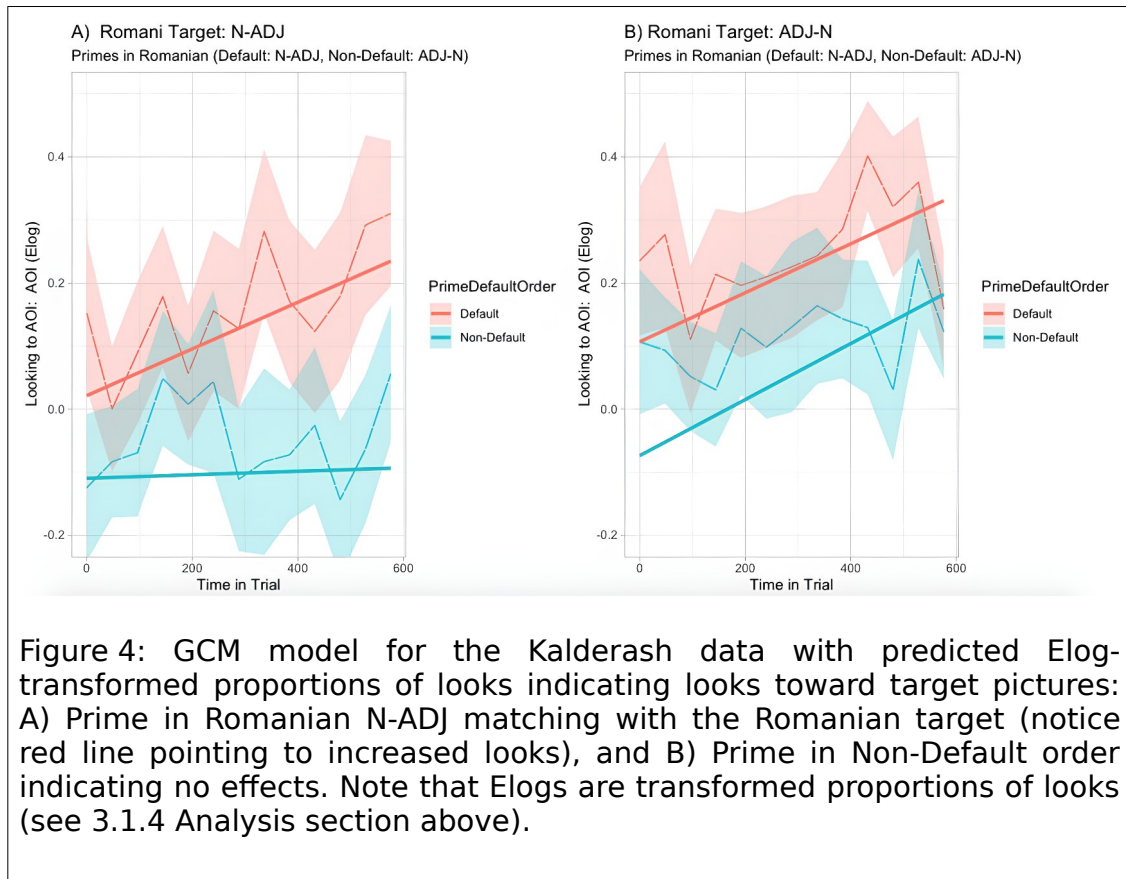
As for the Gurbet, as shown in Figure 3, there is a facilitating priming effect when the ADJ-N order, which is the default option in both Serbian and Gurbet, matches in the prime and target pairs. Table 5 demonstrates the outputs from a GCM model. According to those outputs, the Gurbet data showed significant fixed effects of Mismatch and a significant interaction effect between the fixed-effects of Prime Default Order and Mismatch. A significant fixed effect of Mismatch signals that the Gurbet participants had slightly elevated proportions of looks when the prime and target pairs did not match (see Table 5; $\beta = 0.12$, $p = 0.031$). A significant interaction between Prime Default Order and Mismatch with a negative estimate value ($\beta = -0.23$, $p = 0.005$) indicates that when the prime order is non-default (N-ADJ in Serbian), the participants had fewer looks following mismatch targets; that is, following the ADJ-N order in Gurbet. In other words, they had more frequent looks in the opposite pattern: when the Serbian prime and Gurbet target matched in the default ADJ-N order. We further confirmed this facilitating effect using a cluster-based permutation analysis. This analysis showed that significant condition differences occurred over time in trials where prime-target pairs matched in the ADJ-N order, specifically within a cluster from 390 to 410ms post-stimulus (sum statistics = 2.28 , $p < .05$).



<i>Predictors</i>	<i>Kalderash (Romanian) Group</i>				<i>Gurbet (Serbian) Group</i>			
	β	<i>SE</i>	<i>t</i>	<i>p</i>	β	<i>SE</i>	<i>t</i>	<i>p</i>
(Intercept)	0.13	0.05	2.35	0.019	0.17	0.10	1.66	0.097
Time	0.24	0.30	0.81	0.420	0.40	0.25	1.59	0.113
Prime Default Order [Non-Default]	-0.07	0.08	-0.94	0.349	0.03	0.06	0.61	0.544
Mismatch [Mismatch]	0.09	0.08	1.18	0.240	0.12	0.06	2.16	0.031
Time × Prime Default Order [Non-Default]	0.05	0.32	0.15	0.882	0.06	0.24	0.25	0.803
Time × Mismatch [Mismatch]	0.01	0.31	0.04	0.970	0.01	0.24	0.03	0.978
Prime Default Order [Non-Default] × Mismatch [Mismatch]	-0.25	0.11	-2.24	0.025	-0.23	0.08	-2.82	0.005
Time × Prime Default Order [Non-Default] × Mismatch [Mismatch]	-0.28	0.45	-0.62	0.532	-0.10	0.34	-0.28	0.781
Random Effects								
σ^2	2.53				3.00			
τ_{11} Participant.Time	0.40				0.40			
τ_{11} Item.Time	0.27				0.15			
Marginal R2 /	0.008 /				0.003 /			
Conditional R2	0.023				0.073			

Sample R code: `lmer(Elog ~ (ot1)*PrimeDefaultOrder*Mismatch + (0+ot1 | participant_id) + (0+ot1 | Item_no) , control = lmerControl(optimizer='bobyqa'), data = gaze_model)`

Table 5: Output from growth curve approach models with mixed effects. Time represents linear time, β indicates e-logit transformed proportions of looks, SE = standard error, σ^2 refers to the mean square error. In Mismatch, “match” was kept as the baseline level. In the PrimeDefaultOrder, the default order (ADJ-N in Serbian and N-ADJ in Romanian) was kept as a baseline. Note that targets were always in Romani (ADJ-N or N-ADJ).



3.3. Discussion

The aim of the eye-movement monitoring experiment was to understand whether and how cross-linguistic priming facilitates processing in comprehension. To this end, we administered two priming experiments to two groups of bilinguals: Romani Kalderash-Romanian speakers in Romania, for whom a change in the inherited Romani ADJ-N order is attuning to the Romanian N-ADJ order (Adamou et al., 2021), and Romani Gurbet-Serbian speakers in Serbia, for whom no change in the Romani ADJ-N order is noted (Mirić & Ćirković, 2023).

Our results show that both groups performed virtually at ceiling accuracy without any critical differences, which means that accuracy and response latencies are not informative about whether there is priming. This is not entirely unexpected since the task used under this experiment was rather easy to accomplish (i.e., a participant needed to find the visual depiction of the target phrase, e.g., *the yellow hen*, and click on it). Nevertheless, we should note that the standard deviations around the mean response accuracies were as high as 14%

(see Table 3 above), suggesting that participants in fact showed moderate individual variability. It seems to us that participants had high accuracy in responding to the task; however, interesting online psycholinguistic effects emerged during the time course of processing. Regarding the response latencies, critical differences emerged in the Gurbet but not in the Kalderash group. The Gurbet group obtained quicker click responses for the matching N-ADJ, than for the ADJ-N order, with the non-default N-ADJ primes (see Table 4 above). We believe this is because in both Gurbet Romani and Serbian, as opposed to Romanian, the N-ADJ order is rather less frequent and marked for information structure and contrastive focus purposes at the level of noun phrase (see Mirić & Ćirković, 2023). Hence, we may speculate that the marked nature of this order makes it rather quickly noticeable. This conclusion is, in fact, in line with the inverse frequency effect in structural priming; that is, a less frequent structure, as in the case of the non-default form in our experiment, might lead to stronger facilitatory priming effects than relatively frequent ones (for example, see Bernolet & Hartsuiker, 2010; Kaschak et al., 2011; Jaeger & Snider, 2013). This result, however, does not indicate a priming effect, but rather shows that participants were quicker in completing the task when presented with the marked N-ADJ order in the Serbian prime. This is why we do not observe the same facilitatory effect in looks towards the target visuals in eye-movements.

Compared to accuracy and response latencies, eye movements are more informative as they inform us about the fine-grained time course of linguistic processing. The eye-movement data reveal that Kalderash participants gazed more often towards target pictures in the N-ADJ condition when Romanian prime and Romani target matched in the default N-ADJ order as compared to a mismatching baseline. We identified two clusters (namely, around 340-360ms and 490-540ms) where this priming effect reached significance. The last cluster seemed sustained, continuing beyond the designated time window. We therefore confirm that the dominant N-ADJ order in Romanian leads to structural priming effects in Kalderash. However, this is not the case in the ADJ-N order.

In contrast, Gurbet participants showed a priming effect when prime-target pairs matched in the default ADJ-N order, as also evidenced by an interaction effect between Prime Default Order and Mismatch (see Table 5 and Figure 3). In particular, Gurbet participants had more frequent looks when the Serbian prime and Gurbet target matched in the default ADJ-N order. That is, the eye-movement data from the Gurbet group showed a cross-

linguistic influence similar to that observed in the Kalderash variety, meaning that, in both cases, the dominant default order in the prime language facilitated processing (i.e., ADJ-N in Serbian and N-ADJ in Romanian). However, please note that the nature of this effect was different across the two Romani varieties. Specifically, the Romanian prime order is different from the Kalderash one, leading hence to language change. In contrast, the default orders in Serbian and Gurbet are the same, resulting in facilitating priming without evidence of language change.

It is important to note that, given the nature of the ADJ-N order under investigation, participants only needed to pay attention to the noun in order to be able to choose the correct target picture (i.e., the target object always contrasted with another object, not with the same object in a different colour). Since in half of the target audio stimuli nouns were presented before the adjectives (i.e., *hen red*), one could argue that noun-initial phrases offered an advantage to comprehenders, as compared to adjective-initial phrases. As a result, one could further argue that the early significant cluster with condition differences (i.e., as early as 340-360ms) observed for the Kalderash group might be due to the noun-initial nature of the stimulus rather than a structural effect, as this is a rather early time window to analyse the lexical representation of the stimulus. Therefore, it is possible to assume that reliable cross-linguistic priming effects occurred in the later clusters (i.e., around 500ms). However, this early activation effect occurred only in the Kalderash group, but not in the Gurbet group. We therefore rule out a possible design issue here since, if this were the case, we should have observed a similar early effect in the Gurbet variety as well, which we did not. In addition, both groups' proportion of looks were around 50% at the beginning of the trials, suggesting that they were not significantly biased for either of the options at the target baseline.

4. Experiment 2: Phrasal acceptability judgment

Following the eye-movement experiment, which examined online, per-millisecond processing, we administered offline phrasal decision tasks to understand whether the noun phrases used in the eye-movement study are judged as acceptable by Romani bilinguals in both of the languages they speak, given the differences in word order (see Section 2.3.). Offline linguistic

judgment tasks are often conducted to norm stimulus materials to see if they work the way they are intended to work and to complement online measures in psycholinguistic studies. Therefore, the goal of Experiment 2 was to understand how the different adjective-noun orders used in the stimuli of the online eye-movement experiment are judged by participants.

Although acceptability judgments were developed for highly educated populations speaking standardized languages, recent research shows that populations who speak minoritized and non-standardized language varieties and have little to no formal education can respond to acceptability judgments in a fine-grained way as long as the questions and stimuli are culturally and linguistically adapted (Adamou, 2023). Therefore, we conducted an offline phrasal acceptability task without time constraints following the main eye-tracking experiment.

4.1. Methodology

4.1.1. Participants

The same bilingual Kalderash-Romanian and Gurbet-Serbian participants that participated in Experiment 1 also took part in this experiment. After analysing the results and in order to understand them better, we also conducted a Serbian judgment task with 20 Serbian monolingual speakers recruited in the town of Knjaževac, Eastern Serbia—the same location as the Romani speakers (12 females; mean age = 50.2, age range = 23–68, SD = 11.9). The Serbian monolingual group had overall higher levels of formal education than the Romani bilinguals: one participant had completed elementary school, twelve had finished high school, and seven held a university degree.

4.1.2. Stimuli and procedure

We used the same auditory stimuli as in Experiment 1. In each language judgment task, there were 18 experimental trials with two conditions: ADJ-N (i.e., *the red hen*) and N-ADJ (i.e., *the hen red*), summing to a total of 36 trials. Additionally, there were 40 filler trials. Participants were instructed to listen to each auditory stimulus and provide its acceptability rating on a 5-point scale (1 = not acceptable, 2 = fairly acceptable, 3 = moderately acceptable, 4 = acceptable, 5 = highly acceptable). In addition, they were instructed not to focus on whether the object or animal represented in the stimuli could realistically be that colour. The experiment was administered to

each participant individually. The Gurbet group was tested in Serbian and Gurbet, and the Kalderash group was tested in Romanian and Kalderash. The order of the language judgment tasks was counterbalanced across participants. Acceptability ratings were recorded and analysed using the linear mixed-effects regression models with the `lme4` package in R (Bates et al., 2015).

4.2. Results

Table 6 shows the mean acceptability ratings of each language judgment task across the two conditions of phrasal order possibilities. The Kalderash group preferred the N-ADJ order over its ADJ-N counterpart both in Kalderash ($\beta = 0.35$, $SE = 0.06$, $t = 5.23$, $p < 0.001$) and Romanian judgment tasks ($\beta = 1.34$, $SE = 0.06$, $t = 19.87$, $p < 0.001$). The Gurbet group showed no condition differences in Gurbet ($\beta = -0.02$, $SE = 0.06$, $t = -0.38$, $p = 0.70$) and Serbian judgment tasks ($\beta = -0.08$, $SE = 0.06$, $t = -1.36$, $p = 0.17$), indicating that they considered both the ADJ-N and N-ADJ order highly and equally acceptable in both languages.³

The judgment data from Serbian monolinguals revealed a distinct pattern compared to the Gurbet-Serbian bilinguals. Specifically, the monolinguals rated the ADJ-N order ($M = 3.45$, $SD = 1.46$) as more acceptable than the N-ADJ one ($M = 3.00$, $SD = 1.44$). This difference was statistically significant ($\beta = -0.44$, $SE = 0.08$, $t = -5.02$, $p < 0.001$). In contrast, the Gurbet group showed no clear preference, unlike Serbian monolinguals, rating both word orders in Serbian with comparable levels of acceptability.

3 An anonymous reviewer suggested that analysing acceptability data on a 5-point scale using linear mixed effects models might be problematic. Therefore, we performed an alternative ordinal analysis using the cumulative link mixed effects models from the `ordinal` package in R (Christensen, 2015) and obtained similar results for Kalderash ($\beta = 0.27$, $SE = 0.05$, $z = 5.25$, $p < 0.001$), Romanian ($\beta = 0.99$, $SE = 0.05$, $z = 19.8$, $p < 0.001$), Gurbet ($\beta = -0.03$, $SE = 0.07$, $z = -0.38$, $p = 0.70$), and Serbian ($\beta = -0.13$, $SE = 0.07$, $z = -1.67$, $p = 0.10$).

	Kalderash group		Gurbet group	
	ADJ-N	N-ADJ	ADJ-N	N-ADJ
Romanian	2.38 (1.47)	3.72 (1.42)	-	-
Romani	3.25 (1.52)	3.60 (1.45)	4.21 (1.24)	4.19 (1.25)
Serbian	-	-	4.01 (1.43)	3.92 (1.41)

Table 6: Mean acceptability ratings of noun phrases (and standard deviations)

4.3. Discussion

The purpose of this offline phrasal decision task was to understand whether noun phrase orders in the languages under investigation were explicitly judged as more or less acceptable by the two groups of Romani bilinguals.

Our results show that the Kalderash-Romanian group preferred the N-ADJ over the ADJ-N order in both Kalderash and Romanian. This preference is stronger in Romanian than in Kalderash. These results align with findings from previous studies (e.g., Adamou et al., 2021), as well as with our eye-movement data, indicating that Kalderash speakers from Romania attune to the dominant Romanian N-ADJ order. This is possibly due to ongoing contact-induced change in Kalderash under the influence of Romanian.

However, the Gurbet-Serbian group showed no condition differences in either Gurbet or Serbian, judging both ADJ-N and N-ADJ orders as being equally acceptable. This was somewhat unexpected, given that Serbian has an unmarked ADJ-N order (Predolac, 2011; Stanković, 2017). The fact that monolingual Serbians displayed the expected pattern of favoring the ADJ-N word order over the N-ADJ one suggests that this discrepancy was not caused by our experimental task. Nevertheless, we note that the marked N-ADJ order among Serbian monolinguals had a mean rating of 3 out of 5, compared to 3.45 for the default. The relative preference is therefore moderate even for these speakers. This suggests that the marked order used for

information structural reasons allows participants to still rate it as moderately acceptable.

Moreover, differences between the ratings of the bilingual Gurbet-Serbian and the monolingual Serbian groups may be due to the exposure effect. That is, after encountering numerous examples with the marked N-ADJ order in Experiment 1, bilinguals were more likely to rate it more favourably in Experiment 2, compared to monolinguals who did not participate in Experiment 1. Indeed, a study by Luka and Barsalou (2005) shows that acceptability ratings increase when participants are exposed to the stimuli prior to the judgment task. Finally, another potential explanation for the group difference is that there could be also an effect of education, given that monolingual Serbian participants reported higher levels of education than Gurbet-Serbian bilinguals. In this sense, greater exposure to standard Serbian through education might have reinforced the canonical ADJ-N word order and have thus produced stricter judgments of acceptability.

In sum, the results of the acceptability judgment task (Experiment 2) show that Kalderash-Romanian bilinguals preferred the N-ADJ order in both Kalderash and Romanian, in line with previous production findings (Adamou et al., 2021). In contrast, Gurbet-Serbian bilinguals accepted both word orders in Gurbet and Serbian. The comparison group of Serbian-speaking monolinguals rated the dominant ADJ-N order in Serbian more highly than the N-ADJ order, although the latter was rated as moderately acceptable. While the differences in Serbian order judgments between Serbian monolinguals and Romani-Serbian bilinguals in our Gurbet group may suggest greater flexibility among bilinguals, these findings can also be understood as a result of using the N-ADJ order in appropriate contexts based on information structure. Furthermore, acceptability ratings may have been influenced by satiation effects, as bilingual participants were repeatedly exposed to the two structures in the priming experiment before completing the judgment task (Luka & Barsalou, 2005).

Despite these somewhat unexpected judgments among the Gurbet group, it appears that the more acceptable orders in the primes had a stronger facilitating effect than the less-acceptable ones (Do & Kaiser, 2017; Snyder, 2000; Sprouse, 2007). An interesting finding is that, in the Gurbet group, the cross-linguistic priming effect obtained in Experiment 1 was smaller than the priming effect found in the Kalderash group. This may be due to the fact that Gurbet

Romani speakers rated the N-ADJ order similarly to its ADJ-N counterpart in both Gurbet and Serbian. To better understand the connection between acceptability ratings and the strength of priming effects, further research is needed.

5. General discussion and conclusion

In the present study, we investigated whether and to which extent cross-linguistic priming facilitates processing of adjective-noun orders during comprehension. We also examined whether this facilitatory effect—when the order of adjectives and nouns match—could drive changes in adjectival order in the long term.

Two under-studied Romani varieties were investigated: Gurbet, in contact with Serbian, and Kalderash, in contact with Romanian. Previous research shows that the Kalderash variety is undergoing contact-induced change, with the ADJ-N order shifting under the pressure of the N-ADJ order in Romanian (Adamou et al., 2021), whereas the Gurbet variety retains the inherited ADJ-N order which happens to align with that of its contact language, Serbian (Mirić & Ćirković, 2023). Comparing these two groups of Romani speakers allowed us to assess the precise role of cross-linguistic priming in language change.

Across two experiments with Kalderash-Romanian and Gurbet-Serbian bilinguals, we examined the processing of possible adjective-noun orders using cross-linguistic priming during an eye-tracking task (Experiment 1) and evaluated their acceptability using behavioural phrasal acceptability judgments (Experiment 2).

The eye-movement monitoring results from Experiment 1 showed that the dominant N-ADJ order in Romanian led to significant priming effects among Kalderash-Romanian speakers. In Gurbet speakers' responses, by contrast, the default Serbian ADJ-N order still led to facilitation for ADJ-N targets in Romani, as both Serbian and Gurbet share the dominant ADJ-N order. However, this facilitatory effect did not lead to observable patterns of contact-induced language change in Gurbet. Our study therefore confirms the role of cross-linguistic priming in the adjective-noun order change in Kalderash, consistent with the findings of a production experiment conducted by Adamou et al. (2021). According to Tooley's review (2023), structural priming takes place in both production and comprehension. In line with this, the eye-tracking results from both bilingual groups showed that Romani

speakers processed faster those word orders that matched the dominant order of the contact language (Serbian or Romanian). In other words, a match between the dominant order in a bilingual speaker's two languages facilitates sentence processing during comprehension. These results from early bilinguals complement previous experimental findings from late learners (Kidd et al., 2015). They also confirm that lexical overlap is not needed in order for priming to take place in comprehension (Tooley, 2023), since, even though their meanings were the same, the lexical items differed in our study.

Our findings have important implications for theories of language contact that take processing at the level of the bilingual as the starting point of language change in the long run (e.g., Adamou & Matras, 2020; Kootstra & Muysken, 2017; Zenner et al., 2018). Here, we suggest that convergence between the order of nouns and adjectives in the two languages of a bilingual facilitates language processing, both in production and comprehension, and constitutes a mechanism driving long-term language change. This is in agreement with earlier proposals that highlighted the role of priming in contact-induced language change (Kootstra & Doedens, 2016).

If such cross-linguistic structural priming exists and leads to long-term syntactic change, then why don't we observe more such structural changes in the languages of the world? We suggest that this may have to do with community-level factors that block the change. Prescriptive attitudes of the speech community can influence speakers' linguistic repertoires (see Matras, 2009). According to Adamou (2016, p. 206), there are non-linguistic factors that need to be taken into consideration when dealing with the more or less extensive use of contact words and pattern replication which differ across communities and languages. These include the vitality of a bilingual community, prescriptive attitudes, institutional support for a standard variety, and the patterns inherited from past contact settings.

As this is the first study of cross-linguistic priming using eye-tracking among Romani bilingual speakers, the results hold relevance for several fields of study. First, by investigating two bilingual populations that share related L1s but also speak different L1's (simultaneously early acquired languages) with different linguistic characteristics, we were able to reconcile two research approaches: the examination of language processing at the level of bilingual speakers and the study of ongoing contact-induced language change. Our results are significant to

theories of language contact as they illustrate how cross-linguistic priming contributes to structural change (as seen in Kalderash Romani in Romania), and strengthens existing linguistic structures (as seen in Gurbet Romani in Serbia). Secondly, by applying contemporary methodology from psycholinguistics, we provide novel insights into word order preferences in an under-studied language like Romani and an under-studied population like that of early bilinguals. Finally, the fields of psycholinguistics and bilingualism can also benefit from the current research as it confirms that (structural) cross-linguistic priming as a cognitive mechanism is as relevant in comprehension as it is in production (e.g., Adamou et al., 2021; Kootstra & Doedens, 2016; Kootstra & Şahin, 2018).

To conclude, this is the first study of cross-linguistic priming using eye-tracking and acceptability judgment tasks among Romani bilingual speakers to investigate the order of adjectives and nouns. In that sense, our results should be considered exploratory. Nonetheless, we believe that experimental data from such diverse bilingual populations shed light on phenomena that can otherwise be difficult to study, as is the case of ongoing contact-induced change.

Author contributions

Conceptualization, E.A. and S.A.; Methodology, E.A. M.M. and S.A.; Stimuli creation and data collection, S.A., M.M., S.Ć., C.P; Data curation, S.A.; Writing—original draft, E.A., S.A., M.M.; Writing—Review and Editing, E.A., S.A., M.M.; Supervision, E.A. All authors have read and agreed to the published version of the manuscript.

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Abbreviations

Glossing abbreviations:

3SG:	third person singular
DEF:	definite article
F:	feminine
INDF:	indefinite article
M:	masculine
OBL:	oblique case
PL:	plural
SG:	singular

Other abbreviations:

ADJ:	adjective
AoA:	age of acquisition
N:	noun
Ro.:	Romanian
RT:	reaction time
SD:	standard deviation
Srb.:	Serbian

Data accessibility statement

The data and all supplementary files associated with the submission are publicly available at OSF: <https://osf.io/dpmy7>. The available code and data are anonymized and simplified for practical and ethical purposes.

Ethics and consent

All procedures under this study conform to the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards for research on human subjects. This study was approved by the research ethics committee of the Université Côte d'Azur (*Comité d'Éthique de la Recherche, CER AVIS n° 2023-040*).

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Competing interests

The authors declare that they have no competing interests.

References

Achim, Viorel (1998). *The Roma in Romanian History*. Central European University Press.

Adamou, Evangelia (2016). *A Corpus-Driven Approach to Language Contact: Endangered Languages from a Comparative Perspective*. De Gruyter Mouton. DOI: <https://doi.org/10.1515/9781614516576>

Adamou, Evangelia (2023). Experimental methods to study cultural differences in linguistics. In Zufferey, Sandrine & Gygax, Pascal (eds.), *The Routledge Handbook of Experimental Linguistics*, 458-472. Routledge.
DOI: <https://doi.org/10.4324/9781003392972>

Adamou, Evangelia & Bullock, Barbara E. & Toribio, Almeida Jacqueline (2023). *Understanding Language Contact*. Routledge. DOI: <https://doi.org/10.4324/9781003167952>

Adamou, Evangelia & Feltgen, Quentin & Padure, Cristian (2021). A unified approach to the study of language contact: Cross-language priming and change in adjective/noun order. *International Journal of Bilingualism* 25(6), 1635-1654. DOI: <https://doi.org/10.1177/13670069211033909>

Adamou, Evangelia & Matras, Yaron (2020). Romani syntactic typology. In Matras, Yaron & Tenser, Anton (eds.), *The Palgrave Handbook of Romani Language and Linguistics*, 187-227. Palgrave Macmillan. DOI: <https://doi.org/10.1007/978-3-030-28105-2>

Adamou, Evangelia & Matras, Yaron (2021). *The Routledge Handbook of Language Contact*. Routledge. DOI: <https://doi.org/10.4324/9781351109154>

Anjum, Javad & Hallowell, Brooke (2019). Validity of an eyetracking method for capturing auditory-visual cross-format semantic priming. *Journal of Clinical and Experimental Neuropsychology* 41(4), 411-431. DOI: <https://doi.org/10.1080/13803395.2019.1567692>

Anwyl-Irvine, Alexander L. & Massonnié, Jessica & Flitton, Adam & Kirkham, Natasha & Evershed, Jo K. (2020). Gorilla in our midst: An online behavioral experiment builder. *Behavior Research Methods* 52(1), 388-407. DOI: <https://doi.org/10.3758/s13428-019-01237-x>

Arai, Manabu & van Gompel, Roger P.G. & Scheepers, Christoph (2007). Priming ditransitive structures in comprehension. *Cognitive Psychology* 54(3), 218-250. DOI: <https://doi.org/10.1016/j.cogpsych.2006.07.001>

Bates, Douglas & Mächler, Martin & Bolker, Ben & Walker, Steve (2015). Fitting Linear Mixed-Effects Models Using lme4. *Journal of Statistical Software* 67(1), 1-48.

DOI: <https://doi.org/10.18637/jss.v067.i01>

Bernolet, Sarah & Hartsuiker, Robert J. (2010). Does verb bias modulate syntactic priming? *Cognition* 114(3), 455-461.

DOI: <https://doi.org/10.1016/j.cognition.2009.11.005>

Bernolet, Sarah & Hartsuiker, Robert J. & Pickering, Martin J. (2007). Shared syntactic representations in bilinguals: Evidence for the role of word-order repetition. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 33(5), 931-949.

DOI: <https://doi.org/10.1037/0278-7393.33.5.931>

Bernolet, Sarah & Hartsuiker, Robert J. & Pickering, Martin J. (2013). From language-specific to shared syntactic representations: The influence of second language proficiency on syntactic sharing in bilinguals. *Cognition* 127(3), 287-306.

DOI: <https://doi.org/10.1016/j.cognition.2013.02.005>

Bock, J. Kathryn (1986). Meaning, sound, and syntax: Lexical priming in sentence production. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 12(4), 575-586.

DOI: <https://doi.org/10.1037/0278-7393.12.4.575>

Bock, J. Kathryn & Griffin, Zenzi M. (2000). The persistence of structural priming: Transient activation or implicit learning? *Journal of Experimental Psychology: General* 129(2), 177-192.

DOI: <https://doi.org/10.1037/0096-3445.129.2.177>

Bosma, Evelyn & Ayçiçek, Seda & Mikawa, Momo & Muller, Melissa & Visser, Ella & Kootstra, Gerrit Jan (2023). Structural priming and cross-linguistic influence in L2 comprehension of Dutch relative clauses and PP-attachments: Differences between German and English learners of Dutch. *International Journal of Bilingualism* 27(6), 908-924.

DOI: <https://doi.org/10.1177/13670069221129045>

Boretzky, Norbert (2000). The definite article in Romani dialects. In Elšík, Viktor & Matras, Yaron (eds.), *Grammatical Relations in Romani: The Noun Phrase*, 31-64. John Benjamins.

DOI: <https://doi.org/10.1075/cilt.211.05bor>

Cai, Zhenguang G. & Zhao, Nan (2024). Structural priming: An experimental paradigm for mapping linguistic representations. *Language and Linguistics Compass* 18(2), Article e12507.

DOI: <https://doi.org/10.1111/lnc3.12507>

Chang, Franklin & Dell, Gary S. & Bock, J. Kathryn (2006). Becoming syntactic. *Psychological Review* 113(2), 234-272. DOI: <https://doi.org/10.1037/0033-295X.113.2.234>

Christensen, Rune Haubo B. (2015). *Analysis of ordinal data with cumulative link models—Estimation with the R-package ordinal* (Version 28) [Computer software manual]. CRAN. <https://CRAN.R-project.org/package=ordinal>

Ćirković, Svetlana & Mirić, Mirjana (2017). *Romsko-srpski rečnik knjaževačkog gurbetskog govora* [Romani-Serbian dictionary of the Knjaževac Gurbet dialect]. Knjaževac: Narodna biblioteka „Njegoš“.

Cornilescu, Alexandra (2016). The low definite article and the evolution of the Romanian DP. *Generative Grammar in Geneva* 9, 3-26.

Desmet, Timothy & Declercq, Mieke (2006). Cross-linguistic priming of syntactic hierarchical configuration information. *Journal of Memory and Language* 54(4), 610-632. DOI: <https://doi.org/10.1016/j.jml.2005.12.007>

Di Garbo, Francesca & Napoleão de Souza, Ricardo (2023). A sampling technique for worldwide comparisons of language contact scenarios. *Linguistic Typology* 27(3), 553-589. DOI: <https://doi.org/10.1515/lingty-2022-0005>

Dink, Jacob W. & Ferguson, Brock (2015). *eyetrackingR: An R Library for Eye-tracking Data Analysis*. Retrieved from <http://www.eyetrackingr.com>

Do, Monica L. & Kaiser, Elsi (2017). The Relationship between Syntactic Satiation and Syntactic Priming: A First Look. *Frontiers in Psychology* 8, Article 1851. DOI: <https://doi.org/10.3389/fpsyg.2017.01851>

Duñabeitia, Jon Andoni & Crepaldi, Davide & Meyer, Antje S. & New, Boris & Pliatsikas, Christos & Smolka, Eva & Brysbaert, Marc (2018). MultiPic: A standardized set of 750 drawings with norms for six European languages. *Quarterly journal of experimental psychology* 71(4), 808-816. DOI: <https://doi.org/10.1080/17470218.2017.1310261>

Elšík, Viktor & Beníšek, Michael (2020). Romani Dialectology. In Matras, Yaron & Tenser, Anton (eds.), *The Palgrave Handbook of Romani Language and Linguistics*, 389-427. Palgrave Macmillan. DOI: <https://doi.org/10.1007/978-3-030-28105-2>

Ferreira, Victor S. & Bock, J. Kathryn (2006). The functions of structural priming. *Language and Cognitive Processes* 21(7-8), 1011-1029. DOI: <https://doi.org/10.1080/01690960600824609>

Gazepoint (2021). *GP3 Eye-Tracker* [Eye-tracker hardware and software]. Retrieved from <https://www.gazept.com>

Gjorgjević, Tihomir R. (1903). *Die Zigeuner in Serbien: Ethnologische Forschungen I* [The Gypsies in Serbia: Ethnological Research I]. PhD dissertation, Ludwig-Maximilians-Universität München. Budapest: Thalia.

Gjorgjević, Tihomir R. (1906). *Die Zigeuner in Serbien: Ethnologische Forschungen II* [The Gypsies in Serbia: Ethnological Research II]. PhD dissertation, Ludwig-Maximilians-Universität München. Budapest: Thalia.

Hartsuiker, Robert J. & Bernolet, Sarah & Schoonbaert, Sofie & Speybroeck, Sara & Vanderelst, Dieter (2008). Syntactic priming persists while the lexical boost decays: Evidence from written and spoken dialogue. *Journal of Memory and Language* 58(2), 214-238. DOI: <https://doi.org/10.1016/j.jml.2007.07.003>

Hartsuiker, Robert J. & Pickering, Martin J. (2008). Language integration in bilingual sentence production. *Acta Psychologica* 128(3), 479-489. DOI: <https://doi.org/10.1016/j.actpsy.2007.08.005>

Hartsuiker, Robert J. & Pickering, Martin J. & Veltkamp, Eline (2004). Is Syntax Separate or Shared Between Languages? Cross-linguistic Syntactic Priming in Spanish-English Bilinguals. *Psychological Science* 15(6), 409-414. DOI: <https://doi.org/10.1111/j.0956-7976.2004.00693.x>

Hsieh, Yufen (2017). Structural priming during sentence comprehension in Chinese-English bilinguals. *Applied Psycholinguistics* 38(3), 657-678. DOI: <https://doi.org/10.1017/S0142716416000382>

Huettig, Falk & Altmann, Gerry T. M. (2005). Word meaning and the control of eye fixation: semantic competitor effects and the visual world paradigm. *Cognition* 96(1), B23-B32. DOI: <https://doi.org/10.1016/j.cognition.2004.10.003>

Jaeger, T. Florian & Snider, Neal E. (2013). Alignment as a consequence of expectation adaptation: syntactic priming is affected by the prime's prediction error given both prior and recent experience. *Cognition* 127(1), 57-83. DOI: <https://doi.org/10.1016/j.cognition.2012.10.013>

Jäger, Gerhard & Rosenbach, Anette (2008). Priming and unidirectional language change. *Theoretical Linguistics* 34(2), 85-113. DOI: <https://doi.org/10.1515/THLI.2008.008>

Kantola, Leila & van Gompel, Roger P. G. (2011). Between-and within-language priming is the same: Evidence for shared bilingual syntactic representations. *Memory & Cognition* 39(2), 276-290. DOI: <https://doi.org/10.3758/s13421-010-0016-5>

Kaschak, Michael P. & Kutta, Timothy J. & Jones, John L. (2011). Structural priming as implicit learning: cumulative priming effects and individual differences. *Psychonomic Bulletin & Review* 18(6), 1133-1139.

DOI: <https://doi.org/10.3758/s13423-011-0157-y>

Kidd, Evan & Tennant, Emilie & Nitschke, Sanjo (2015). Shared abstract representation of linguistic structure in bilingual sentence comprehension. *Psychonomic Bulletin & Review* 22(4), 1062-1067. DOI: <https://doi.org/10.3758/s13423-014-0775-2>

Kim, Christina S. & Carbary, Kathleen M. & Tanenhaus, Michael K. (2014). Syntactic priming without lexical overlap in reading comprehension. *Language and Speech* 57(2), 181-195. DOI: <https://doi.org/10.1177/0023830913496052>

Kootstra, Gerrit Jan & Doedens, Willemijn J. (2016). How multiple sources of experience influence bilingual syntactic choice: Immediate and cumulative cross-language effects of structural priming, verb bias, and language dominance. *Bilingualism: Language and Cognition* 19(4), 710-732.

DOI: <https://doi.org/10.1017/S1366728916000420>

Kootstra, Gerrit Jan & Muysken, Pieter (2017). Cross-linguistic priming in bilinguals: Multidisciplinary perspectives on language processing, acquisition, and change. *Bilingualism: Language and cognition* 20(2), 215-218.

DOI: <https://doi.org/10.1017/S1366728916001127>

Kootstra, Gerrit Jan & Şahin, Hülya (2018). Crosslinguistic structural priming as a mechanism of contact-induced language change: Evidence from Papiamentu-Dutch bilinguals in Aruba and the Netherlands. *Language* 94(4), 902-930.

DOI: <https://doi.org/10.1353/lan.2018.0050>

Lee, Ronald (2010). *Romani Dictionary: Kalderash-English*. Magoria Books.

Loebell, Helga & Bock, J. Kathryn (2003). Structural priming across languages. *Linguistics* 41(5), 791-824.

DOI: <https://doi.org/10.1515/ling.2003.026>

Luka, Barbara J. & Barsalou, Lawrence W. (2005). Structural facilitation: Mere exposure effects for grammatical acceptability as evidence for syntactic priming in comprehension. *Journal of Memory and Language* 52(3), 436-459.

DOI: <https://doi.org/10.1016/j.jml.2005.01.013>

Mahowald, Kyle & James, Ariel & Futrell, Richard & Gibson, Edward (2016). A meta-analysis of syntactic priming in language production. *Journal of Memory and Language* 91, 5-27.

DOI: <https://doi.org/10.1016/j.jml.2016.03.009>

Marchis, Michaela & Alexiadou, Artemis (2007). On the distribution of adjectives in Romanian: The *cel* construction. In Aboh, Enoch O. & van der Linden, Elisabeth & Quer, Josep & Sleeman, Petra (eds.), *Romance Languages and Linguistic Theory: Selected papers from 'Going Romance' Amsterdam 2007*, Vol. 1, 161-178. John Benjamins. DOI: <https://doi.org/10.1075/rllt.1.09mar>

Maris, Eric & Oostenveld, Robert (2007). Nonparametric statistical testing of EEG-and MEG-data. *Journal of Neuroscience Methods* 164(1), 177-190.

DOI: <https://doi.org/10.1016/j.jneumeth.2007.03.024>

Matras, Yaron (2009). *Language contact*. Cambridge: Cambridge University Press.

DOI: <https://doi.org/10.1017/CBO9780511809873>

Matras, Yaron (2013). Mapping the Romani dialects of Romania. *Romani Studies* 23(2), 199-243.

DOI: <https://doi.org/10.3828/rs.2013.11>

Miklosich, Franz (1872-1880). *Über die Mundarten und Wanderungen der Zigeuner Europas* [On the dialects and migrations of the Gypsies of Europe] (Vols. I-XII). Karl Gerold's Sohn.

Mirić, Mirjana & Ćirković, Svetlana (2022). Gurbetski romski u kontaktu. Analiza balkanizama i pozajmljenica iz srpskog jezika [Gurbet Romani in Contact: The Analysis of Balkanisms and Serbian Loanwords]. Balkanološki institut SANU.

Mirić, Mirjana & Ćirković, Svetlana (2023). The postnominal position of modifiers in the Gurbet Romani noun phrase: A corpus-based study. *Zbornik Matice srpske za filologiju i lingvistiku* 66(1), 137-173.

DOI: https://doi.org/10.18485/ms_zmsfil.2023.66.1.7

Mirman, Daniel & Dixon, James A. & Magnuson, James S. (2008). Statistical and computational models of the visual world paradigm: Growth curves and individual differences. *Journal of*

Memory and Language 59(4), 475-494.

DOI: <https://doi.org/10.1016/j.jml.2007.11.006>

Nitschke, Sanjo & Serratrice, Ludovica & Kidd, Evan (2014). The effect of linguistic nativeness on structural priming in comprehension. *Language, Cognition and Neuroscience* 29(5), 525-542. DOI: <https://doi.org/10.1080/01690965.2013.766355>

Özsoy, Onur & Çiçek, Büsra & Özal, Zeynep & Gagarina, Natalia & Sekerina, Irina A. (2023). Turkish-German heritage speakers' predictive use of case: webcam-based vs. in-lab eye-tracking. *Frontiers in Psychology* 14, Article 1155585.

DOI: <https://doi.org/10.3389/fpsyg.2023.1155585>

Pickering, Martin J. & Branigan, Holly P. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language* 39(4), 633-651. DOI: <https://doi.org/10.1006/jmla.1998.2592>

Pickering, Martin J. & Ferreira, Victor S. (2008). Structural priming: A critical review. *Psychological Bulletin* 134(3), 427-459. DOI: <https://doi.org/10.1037/0033-2909.134.3.427>

Predolac, Nikola (2011). *Syntax and Information Structure: Free Constituent Order and Flexible Relative Prominence in Serbian*. PhD dissertation, Cornell University.

Rayner, Keith & Slowiaczek, Maria L. & Clifton, Charles & Bertera, James H. (1983). Latency of sequential eye movements: Implications for reading. *Journal of Experimental Psychology: Human Perception and Performance* 9(6), 912-922. DOI: <https://doi.org/10.1037/0096-1523.9.6.912>

Rothman, Jason & Bayram, Fatih & DeLuca, Vincent & Di Pisa, Grazia & Dunabeitia, Jon Andoni & Gharibi, Khadih & Hao, Jiuzhou & Kolb, Nadine & Kubota, Maki & Kupisch, Tanja & Laméris, Tim & Luque, Alicia & van Osch, Brechje & Pereira Soares, Sergio Miguel & Prystauka, Yanina & Tat, Deniz & Tomić, Aleksandra & Voits, Toms & Wulff, Stefanie (2023). Monolingual comparative normativity in bilingualism research is out of "control": Arguments and alternatives. *Applied Psycholinguistics* 44(3), 316-329.

DOI: <https://doi.org/10.1017/S0142716422000315>

Schoonbaert, Sofie & Hartsuiker, Robert J. & Pickering, Martin J. (2007). The representation of lexical and syntactic information in bilinguals: Evidence from syntactic priming. *Journal of Memory and Language* 56(2), 153-171.

DOI: <https://doi.org/10.1016/j.jml.2006.10.002>

Sikimić, Biljana (2017). Miklošičeva zbirka reči „iz Timoka“ [Miklošič's collection of words 'from the Timok Region']. Knjaževac: Narodna biblioteka „Njegoš“.

Snyder, William (2000). An experimental investigation of syntactic satiation effects. *Linguistic Inquiry* 31(3), 575-582. DOI: <https://doi.org/10.1162/002438900554479>

Sprouse, Jon (2007). Continuous Acceptability, Categorical Grammaticality, and Experimental Syntax. *Biolinguistics* 1, 123-134. DOI: <https://doi.org/10.5964/bioling.8597>

Stanković, Branimir (2017). DP and mandatory determiners in article-less Serbo-Croatian. *Acta Linguistica Academica* 64(2), 257-279. DOI: <https://doi.org/10.1556/2062.2017.64.2.5>

Tooley, Kristen M. (2023). Structural priming during comprehension: A pattern from many pieces. *Psychonomic Bulletin & Review* 30(3), 882-896. DOI: <https://doi.org/10.3758/s13423-022-02209-7>

Tooley, Kristen M. & Bock, J. Kathryn (2014). On the parity of structural persistence in language production and comprehension. *Cognition* 132(2), 101-136. DOI: <https://doi.org/10.1016/j.cognition.2014.04.002>

Tooley, Kristen M. & Traxler, Matthew J. (2010). Syntactic priming effects in comprehension: A critical review. *Language and Linguistics Compass* 4(10), 925-937. DOI: <https://doi.org/10.1111/j.1749-818X.2010.00249.x>

Travis, Catherine E. & Cacoullos, Rena Torres & Kidd, Evan (2017). Cross-language priming: A view from bilingual speech. *Bilingualism: Language and Cognition* 20(2), 283-298. DOI: <https://doi.org/10.1017/S1366728915000127>

Weber, Kirsten & Indefrey, Peter (2009). Syntactic priming in German-English bilinguals during sentence comprehension. *NeuroImage* 46(4), 1164-1172. DOI: <https://doi.org/10.1016/j.neuroimage.2009.03.040>

Wei, Hang & Boland, Julie E. & Cai, Zhenguang G. & Yuan, Fang & Wang, Min (2019). Persistent structural priming during online second-language comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 45(2), 349-359. DOI: <https://psycnet.apa.org/doi/10.1037/xlm0000584>

Zenner, Eline & Backus, Ad & Winter-Froemel, Esme (2018). *Cognitive Contact Linguistics: Placing Usage, Meaning and Mind at the Core of Contact-induced Variation and Change*. De Gruyter Mouton. DOI: <https://doi.org/10.1515/9783110619430>

Ziegler, Jayden & Snedeker, Jesse (2019). The use of syntax and information structure during language comprehension: Evidence from structural priming. *Language, Cognition and Neuroscience* 34(3), 365-384.

DOI: <https://doi.org/10.1080/23273798.2018.1539757>

Appendix 1: Background questionnaire (exemplified for Romani Gurbet and Serbian)

Information on the participants

1. Participant's number _____
2. Participant's age/birth year _____
3. Participant's gender _____
4. Participant's education level (or the number of years of education) _____

Information on the languages which the participants speak.

1. Which languages do you speak? _____
2. At what age did you start acquiring/learning each of the languages you previously mentioned? _____
3. With whom (in which situations) do you speak Romani?

4. With whom (in which situations) do you speak Serbian?

5. Did you learn Romani at school? _____
6. Did you learn Serbian at school? _____

Self-assessment of the linguistic competence

Please evaluate on a scale from 1 to 5 how well you use Romani and Serbian according to the skills listed below (1 - not at all/very weakly, 2 - weakly, 3 - well, 4 - very well, 5 - excellently). We do not evaluate your knowledge, but you are the ones to judge to what extent you use the languages you speak.

1. How well do you speak Romani?

very weakly 1 2 3 4 5 excellently

2. How well do you speak Serbian?

very weakly 1 2 3 4 5 excellently

3. How well do you read Romani?

very weakly 1 2 3 4 5 excellently

4. How well do you read Serbian?

very weakly 1 2 3 4 5 excellently

5. How well do you write in Romani?

very weakly 1 2 3 4 5 excellently

6. How well do you write in Serbian?

very weakly 1 2 3 4 5 excellently

7. How often do you read in Romani (1 - never, 2 - sometimes, 3 - often)?

never 1 2 3 often

8. How often do you read in Serbian (1 - never, 2 - sometimes, 3 - often)?

never 1 2 3 often

9. How often do you write in Romani (1 - never, 2 - sometimes, 3 - often)?

never 1 2 3 often

10. How often do you write in Serbian (1 - never, 2 - sometimes, 3 - often)?

never 1 2 3 often

Appendix 2: List of stimulus materials used in the Gurbet (Serbia) and Kalderash (Romania) experiments (in N-ADJ and ADJ-N orders)

Item no	Prime (Serbian)	Prime (Eng. Translation)	Target (Gurbet)	Target (Eng. Translation)
1	ovca crvena	the red sheep	e parni bakri	the white sheep
2	svinja crna	the black pig	e parni bali	the white pig
3	petao žuti	the yellow rooster	o vāneto bašno	the blue rooster
4	kukuruz beli	the white corn	o galbeno bobo	the yellow corn
5	crv crveni	the red worm	o vāneto ermo	the blue worm
6	dečak zeleni	the green boy	o galbeno čhavrro	the yellow boy
7	devojčica narandžasta	the orange girl	e loli čhorri	the red girl
8	zub ljubičasti	the purple tooth	o parno dand	the white tooth
9	pas sivi	the grey dog	o galbeno džuel	the yellow dog
10	crkva siva	the grey church	e loli khandjiri	the red church
11	kokoška žuta	the yellow hen	e loli khanji	the red hen
12	spomenik žuti	the yellow grave	o parno ljimori	the white grave
13	sveća plava	the blue candle	e loli memelji	the red candle
14	prst sivi	the grey finger	o vāneto naj	the blue finger
15	šerpa narandžasta	the orange pot	e loli piri	the red pot
16	kašika zelena	the green spoon	e kali rroj	the black spoon
17	dim ljubičasti	the purple smoke	o galbeno thuv	the yellow smoke
18	žaba žuta	the yellow frog	e kali žamba	the black frog

Item no	Prime (Romanian)	Prime (Eng. Translation)	Target (Kalderash)	Target (Eng. Translation)
1	roșia oaie	the red sheep	i parni bakri	the white sheep
2	negrul porc	the black pig	i parni bali	the white pig
3	verdele cocoș	the green rooster	o vuneto bašno	the blue rooster
4	albul porumb	the white corn	o zeleno bobo	the green corn
5	roșul vierme	the red worm	o vuneto kermo	the blue worm
6	galbenul băiat	the yellow boy	o zeleno čhavorro	the green boy
7	portocalia fată	the orange girl	i loli čheiorri	the red girl
8	movul dinte	the purple tooth	o parno dand	the white tooth
9	griul câine	the grey dog	o zeleno džukel	the green dog
10	gria biserică	the grey church	i loli khangeri	the red church
11	verdea găină	the green hen	i loli khajni	the red hen
12	verdele mormânt	the green grave	o parno limori	the white grave
13	albastra lumânare	the blue candle	i loli momeli	the red candle
14	griul deget	the grey finger	o vuneto naj	the blue finger
15	portocalia oală	the orange pot	e loli piri	the red pot
16	verdea lingură	the green spoon	e kali rroi	the black spoon
17	violetul fum	the purple smoke	o zeleno thuv	the green smoke
18	verdea broască	the green frog	e kali žamba	the black frog