Interpreting negation in polar questions: a cross-Slavic naturalness rating study

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Introduction

- an experimental study into negation interpretation in PQs in Czech, Polish, and Russian
- exploring two main groups of PQ strategies – OVERT interrogative marking vs. SVO word order
- using the same method – acceptability rating – and the same design
- results point to a continuum:
  - in Cz, both PQ strategies have an unambiguous negation interpretation
  - in Ru, the OVERT strategy is unambiguous, but the SVO strategy is ambiguous
  - in Pol, both strategies are ambiguous

Overt PQ strategies

- Cz in (1): interrogative word order – VS (Křížková, 1968; Štícha, 1995)
- Pol in (2): sentence-initial question particle *czy* (Golka, 2010; Bielec, 2012)
- Ru in (3): verb movement to front and question particle *li* attached to it (Restan, 1972; Esipova & Korotkova, 2024)

(1) Koupil si Petr auto?
bought REFL Petr car
'Did Petr buy a car?' (Cz)

(2) Czy Agata ma kapibarę?
CZY Agata has capybara
'Does Agata have a capybara?' (Pol)

(3) Narisovala li Kira kartinu?
painted LI Kira picture
'Did Kira paint a picture?' (Ru)

SVO strategy

- declarative word order – SVO (dominant in Slavic languages Siewierska & Uhlířová, 1998)
- intonational contour marking questionhood
  - Cz and Pol: (mostly) final (fall-)rise (Daneš, 1957; Palková, 1994; Wodarz, 1962; Sawicka, 2001)
  - Ru: Q-peak, either on the verb or on the linearly last stressed syllable (Meyer & Mleinek, 2006; Esipova, 2025)
- intonation not included in the experiment

(4) Petr si koupil auto?
Petr REFL Petr car

'Petr bought a car?'/'Did Petr buy a car?' (Cz)

(5) Agata ma kapibarę?
Agata has capybara

'Does Agata have a capybara?'/'Agata has a capybara?' (Pol)

(6) Kira narisovala kartinu?
Kira painted picture

'Did Kira paint a picture?'/'Kira painted a picture?' (Ru)

Negation in PQs

Ladd (1981); Brown & Franks (1995); Büring & Gunlogson (2000); Romero & Han (2004); Abels (2005); Repp (2013)

- **outer negation** (aka expletive negation) – asking 'whether p', speaker bias for p, either in neutral context or after evidence for $\neg p$
- **inner negation** (aka semantic negation) – asking 'whether $\neg p$', in English: evidence for $\neg p$ required

Negation in PQs

- only inner negation reading licences negative polarity items (NPIs) – (7) with positive PI vs. (8) with NPI

(7) Isn't Jane coming **too**? **PPI → outer neg**

(8) Isn't Jane coming **either**? **NPI → inner neg**

- often used as a test for the interpretation of negation (e.g., Büring & Gunlogson, 2000; Romero & Han, 2004; Sudo, 2013)
- in our experiments – negative concord items (NCIs) used
  - Cz *žádný*, Pol *żaden*, Ru *nikakoj* 'no-which'
  - we assume: NCIs are only possible if licensed by the interpreted negation
  - one semantic negation expressed by several items

Contextual evidence

Büring & Gunlogson (2000); van Rooij & Šafářová (2003); Sudo (2013); Roelofsen & Farkas (2015); a.o.

- "Evidence that has just become mutually available to the participants of the current discourse situation."

  (Büring & Gunlogson, 2000, p. 7)
- different types and polarities of PQs have different requirements on the contextual evidence to be felicitous
- in our experiment: negative (for $\neg p$) or neutral

(9) *[**Context:** D. asked his partner S. to buy kiwi. After S. is back from the store, D. opens the shopping bag and sees no trace of the delicious fruit. D asks:]*

negative evidence (for $\neg p$ = 'S. didn't buy kiwi')

a. Didn't you buy kiwi?

b. Did you not buy kiwi?

Experiments

To explore:

- negation interpretation in polar questions;
- in Cz, Pol, and Ru;
- after neutral or negative context;
- method used: acceptability rating.

Research questions

RQ1 Is negation interpreted as outer or as inner in the OVERT and SVO PQ strategies in Cz, Pol and Ru?

RQ2 Is negative (evidence for $\neg p$) or neutral context preferred in negated PQs of the OVERT and the SVO strategy in Cz, Pol and Ru?

RQ3 Is negative or neutral context preferred in PQs with the outer and with the inner negation reading in Cz, Pol and Ru?

Design

negative questions
32 items

condition	CONTEXT	STRATEGY	PI
a	negative	overt	NCI
b	negative	overt	PPI
c	negative	SVO	NCI
d	negative	SVO	PPI
e	neutral	overt	NCI
f	neutral	overt	PPI
g	neutral	SVO	NCI
h	neutral	SVO	PPI

Table 1: Manipulations across conditions

Overt strategies:

- Cz – verb-initial
- Pol – with sentence-initial question particle *czy*
- Ru – verb-initial and with question particle *li*

PI is a proxy for negation interpretation:

- PPI $\rightarrow$ outer negation
- NCI $\rightarrow$ inner negation

Procedure and participants

- Written short dialogues in the form A: context, B: question
- Task: rate how natural the question of B is in the given context
- Likert scale from 1 (completely unnatural) to 7 (completely natural)
- Run online on L-Rex (Starschenko & Wierzba, 2024)
- Items were distributed into lists by Latin Square design (Dodge, 2008)
- Participants – Cz: 75, Pol: 67, Ru: 68

Items: Overt strategies

(10) **Context**
p = Jana listened to a podcast.

a. Jana was wearing the headphones that she got for Christmas. (neut)

b. Jana was wearing the headphones (neg)
through which she was listening to music.

Cz	Neposlouchala	Jana	{ žádný / nějaký }	podcast?	
	not-listened	J.	any.NCI / some.PPI	podcast	
Pol	Czy	Jana	nie słuchała	{ żadnego / jakiegoś }	podcastu?
	Q	J.	not listened	any.NCI / some.PPI	podcast
Ru	Ne slušala	li	Jana	{ nikakoj / kakoj-nibuď }	podkast?
	not listened	Q	J.	any.NCI / some.PPI	podcast
	'Didn't Jana / Did Jana not listen to some / any podcast?'				

Table 2: Overt PQ marking in Cz, Pol, Ru

Items: SVO strategy

(11) **Context**
p = Jana listened to a podcast.

a. Jana was wearing the headphones that she got for Christmas. (neut)

b. Jana was wearing the headphones (neg)
through which she was listening to music.

Cz	Jana	neposlouchala	{ žádný / nějaký }	podcast?
Pol	Jana	nie słuchała	{ żadnego / jakiegoś }	podcastu?
Ru	Jana	ne slušala	{ nikakoj / kakoj-nibuď }	podkast?
	J.	not-listened	any.NCI / some.PPI	podcast
	'Didn't Jana / Did Jana not listen to some / any podcast?'			

Table 3: SVO PQs in Cz, Pol, Ru

Items: an example

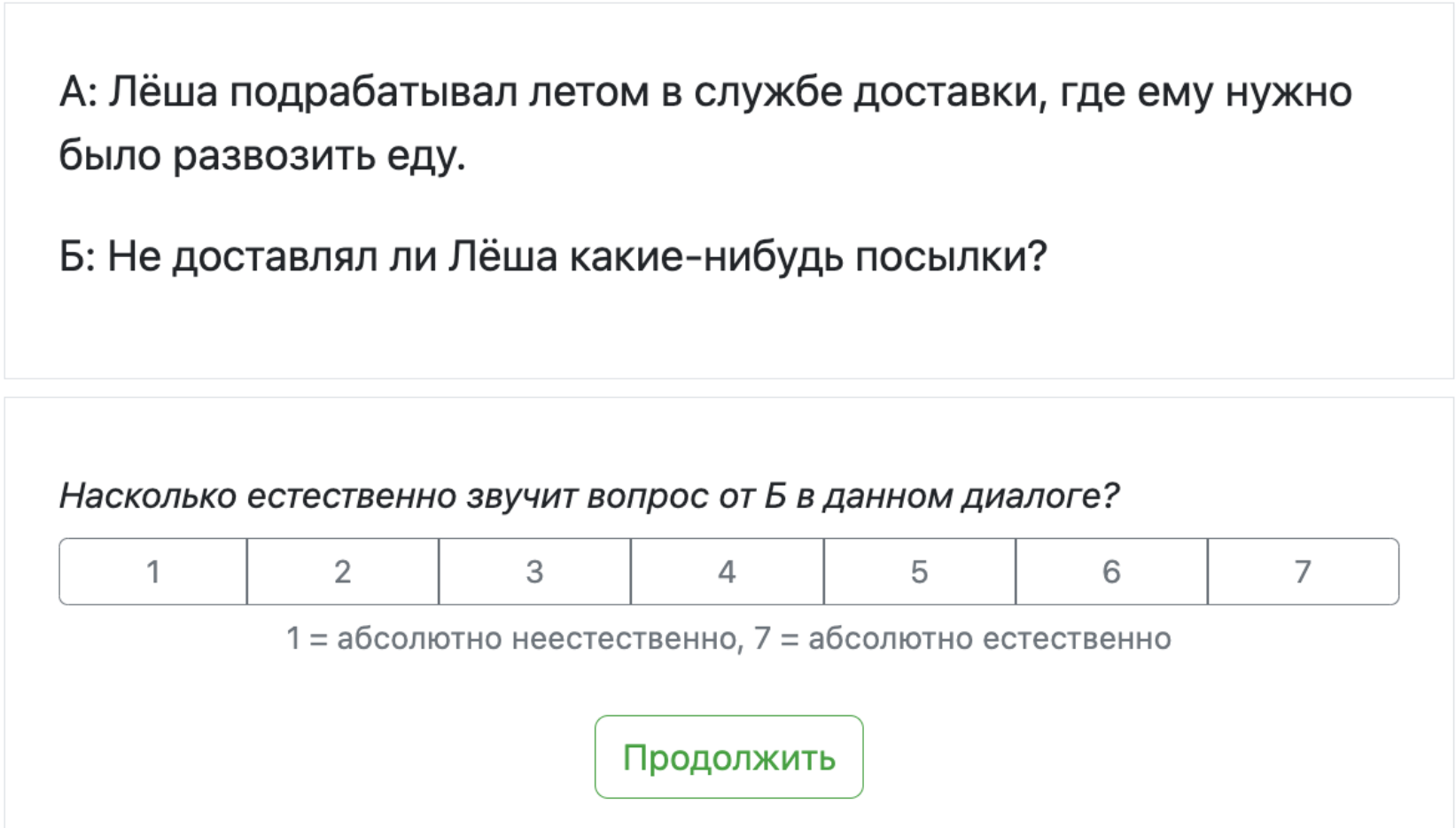
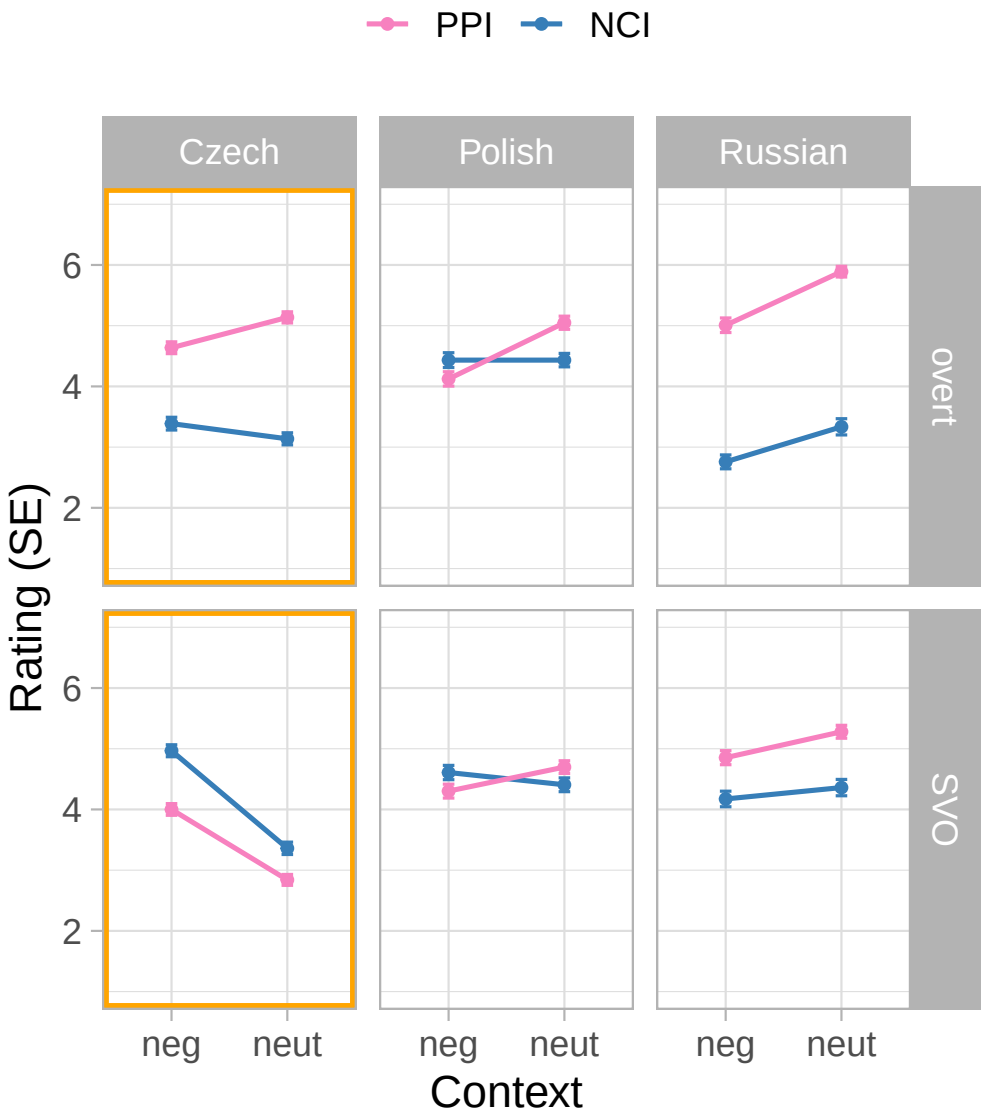


Figure 1: A stimuli example from Ru with evidence for $\neg p$ and an OVERTPQ with a PPI from L-Rex

Analysis

- Statistical analysis run using R in RStudio (R Core Team, 2024)
- Descriptive results were plotted using the packages `ggplot2` (Wickham, 2016), `tidyr` (Wickham et al., 2024), and `dplyr` (Wickham et al., 2023)
- Inferential analysis: Cumulative Link Mixed Models (CLMM) from the package `ordinal` (Christensen, 2023), `emmeans` (Lenth, 2017)

Within-language results: Czech



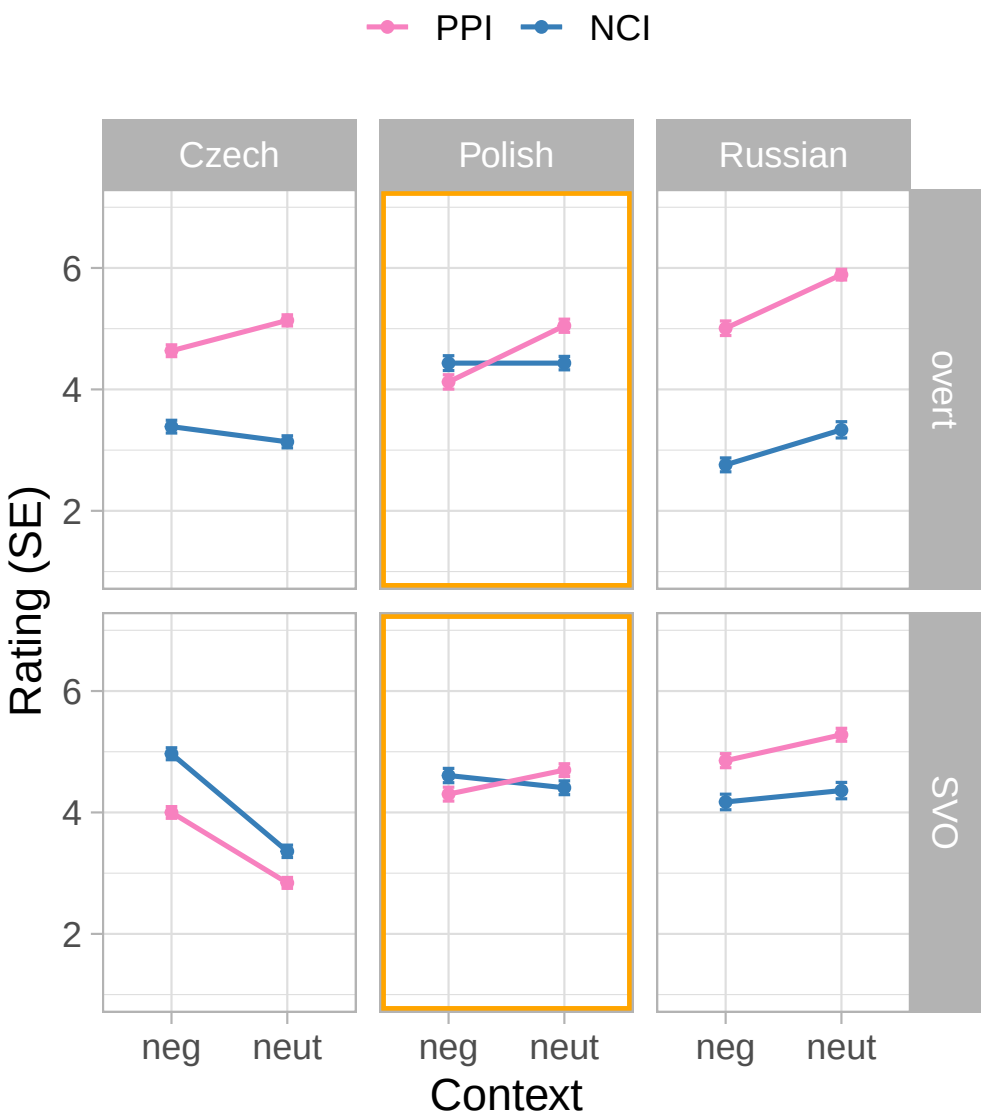
OVERT strategy:

- main effect of PI ($z = -15.67, p < .01$)
- no effect of CONTEXT ($z = -1.58, p = 0.11$)
- CONTEXT and PI interaction ($z = 3.82, p < .01$)

SVO strategy:

- main effect of PI ($z = 8.23, p < .01$)
- main effect of CONTEXT ($z = 14.44, p < .01$)
- CONTEXT and PI interaction ($z = 2.78, p < .01$)

Within-language results: Polish



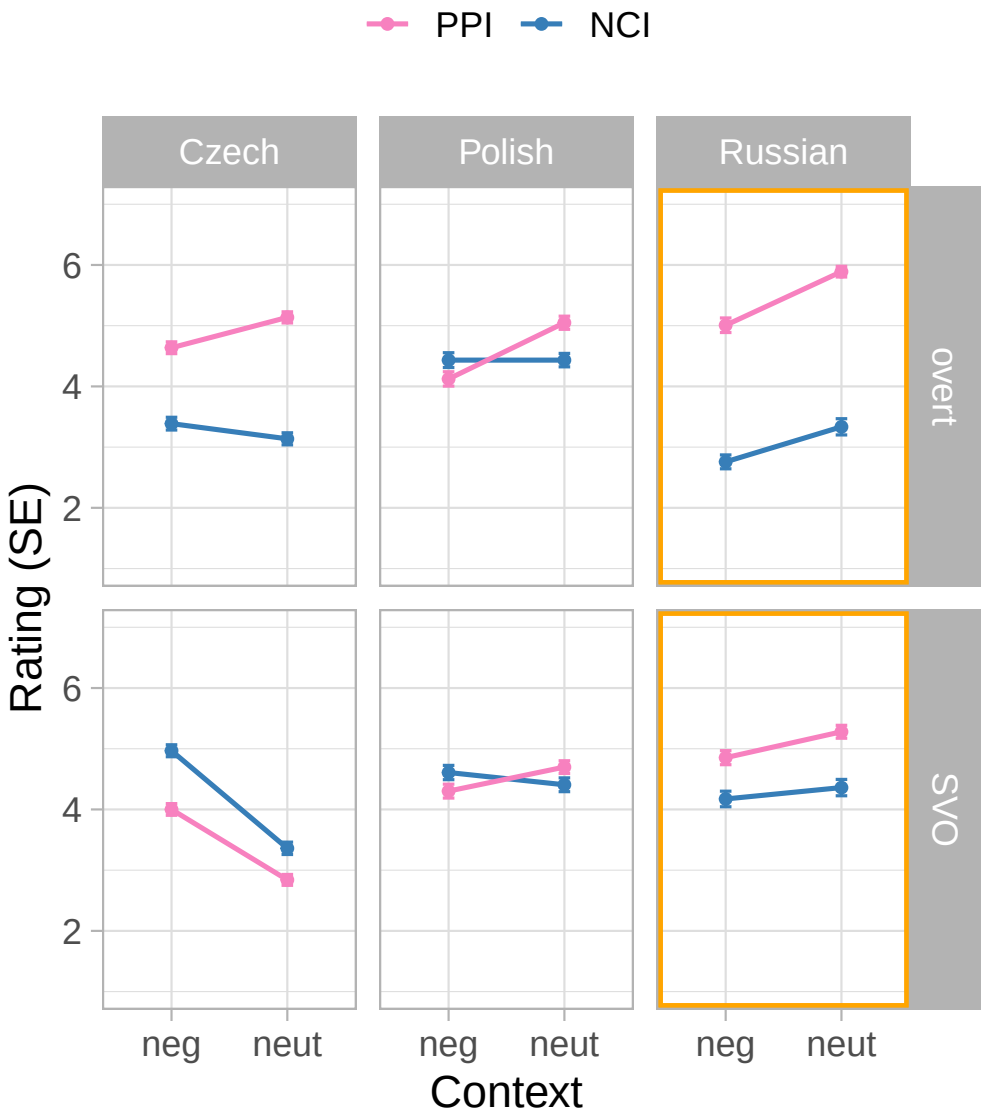
OVERT strategy:

- no effect of PI
  $(z = 1.073, p = 0.283)$
- effect of CONTEXT
  $(z = 4.136, p < .01)$
- CONTEXT and PI interaction
  $(z = 5.23, p < .01)$:
  - NCIs $(z = -0.792, p = 0.428)$
  - PPIs $(z = 6.574, p < .01)$

SVO strategy:

- no effect of PI
  $(z = -0.629, p = 0.529)$
- no effect of CONTEXT
  $(z = 0.698, p = 0.485)$
- CONTEXT an PI interaction
  $(z = 3.25, p = 0.001)$:
  - NCIs $(z = 0.792, p = 0.428)$
  - PPIs $(z = 2.806, p < 0.005)$

Within-language results: Russian



OVERT strategy:

- main effect of PI ($z = -18.43, p < .01$)
- main effect of CONTEXT ($z = -6.43, p < .01$)
- no CONTEXT and PI interaction ($z = 1.61, p = 0.11$)

SVO strategy:

- main effect of PI ($z = -7.54, p < .01$)
- main effect of CONTEXT ($z = -2.56, p = .01$)
- no CONTEXT and PI interaction ($z = 0.94, p = 0.35$)

Overall account: continuum

Based on the results from the three separate experiments, we propose the following continuum.

Continuum

- OVERT PQ strategy: negation in Cz and Ru is outer, in Pol ambiguous
- SVO PQ strategy: negation in Cz is inner, Pol and Ru is ambiguous

Overall account: continuum

Based on the results from the three separate experiments, we propose the following continuum.

Continuum

- OVERT PQ strategy: negation in Cz and Ru is outer, in Pol ambiguous
- SVO PQ strategy: negation in Cz is inner, Pol and Ru is ambiguous

- a large model with all three languages as an independent variable
- the results from the model partially support the continuum
- more investigation is necessary for SVO strategy with intonation

Cross-language results: OVERT strategy

Table 4: Overt strategy: Pairwise language contrasts averaging over PI and CONTEXT (mean-class scale; *p*-value adjustment: Holm method)

contrast	estimate	SE	df	z.ratio	p.value
Czech - Polish	-0.426	0.076	Inf	-5.58	$< .001$
Czech - Russian	-0.115	0.077	Inf	-1.50	0.292
Polish - Russian	0.310	0.081	Inf	3.81	$< .001$

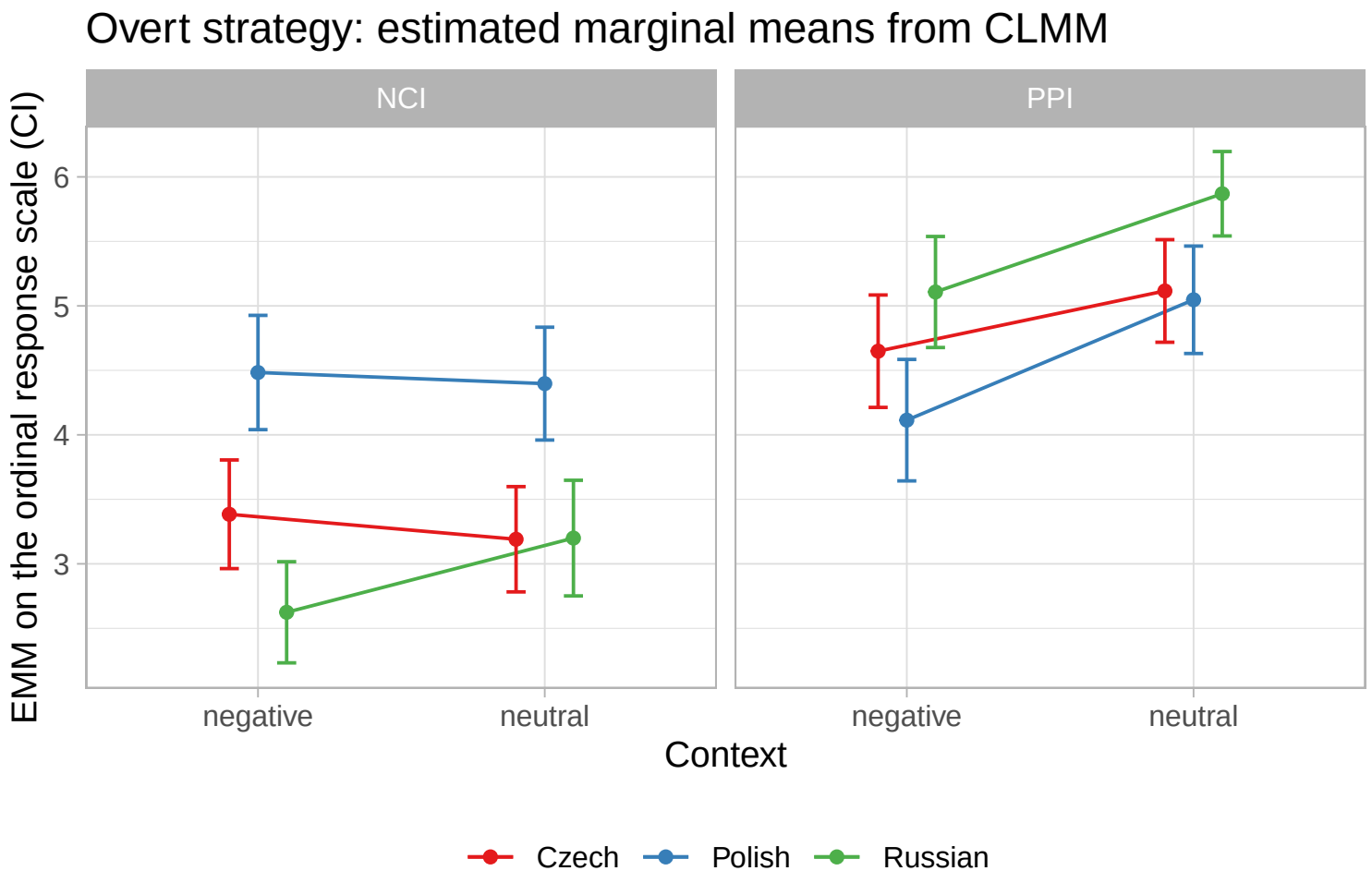
- Czech responses are significantly lower compared to Polish
- Czech is somewhat lower than Russian, but not significant at 0.05
- Polish is significantly higher than Russian

Continuum: yay!

- Polish tends to yield higher ratings than both Czech and Russian
- Czech is clearly lower than Polish, but only marginally different from Russian
- Russian is in between, closer to Czech

Cross-language results: OVERT strategy

- similar to the plot with interactions but **estimates from CLMM**
- y-axis: Estimated marginal means on the ordinal response scale (1-7)
- the continuum for NCIs (Cz and Ru are closer), all are outer with PPIs



Cross-language results: SVO strategy

Table 5: SVO strategy: Pairwise language contrasts averaging over PI and CONTEXT (mean-class scale; *p*-value adjustment: Holm method)

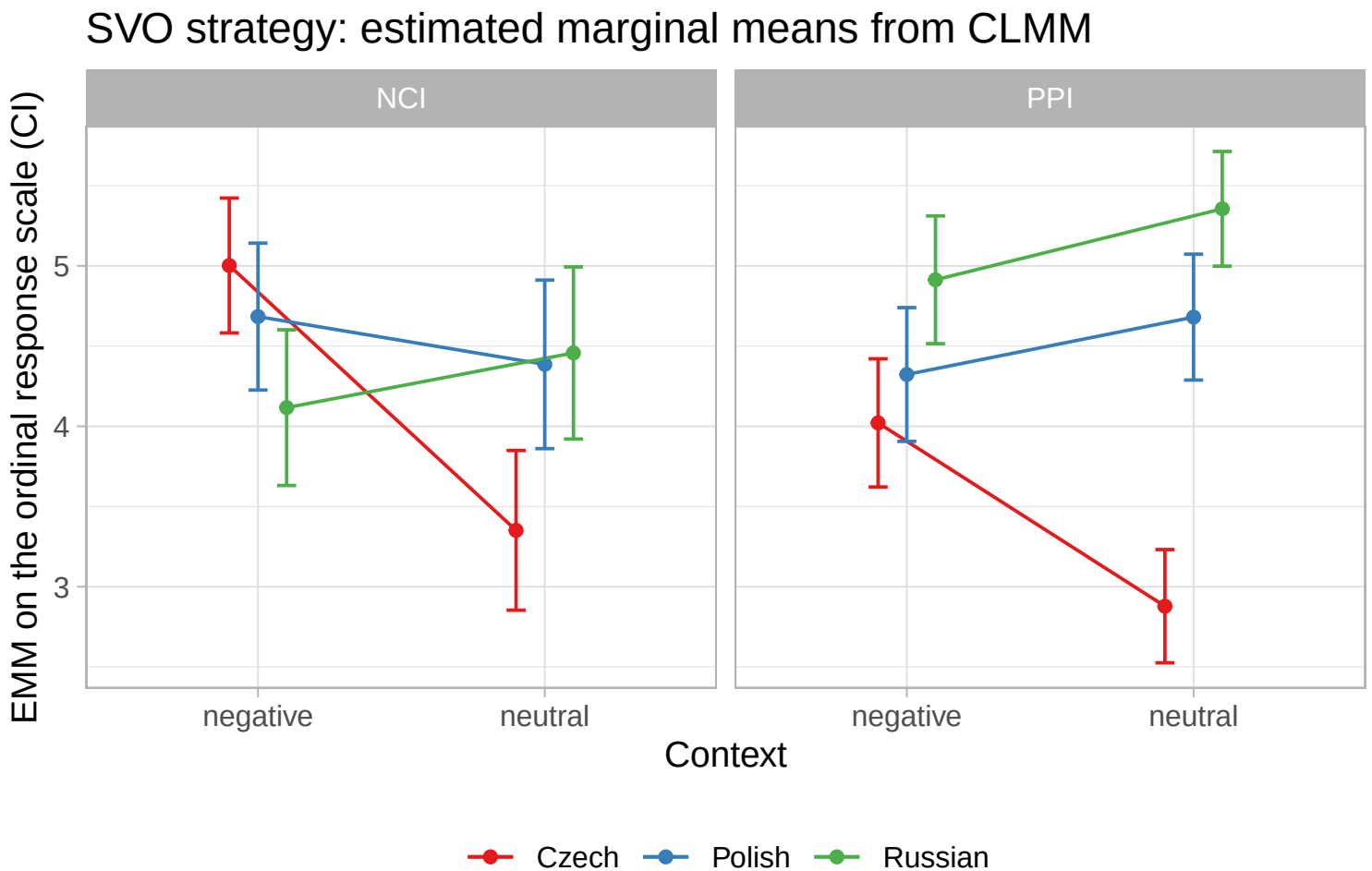
contrast	estimate	SE	df	z.ratio	p.value
Czech - Polish	-0.705	0.075	Inf	-9.35	$< .001$
Czech - Russian	-0.897	0.079	Inf	-11.32	$< .001$
Polish - Russian	-0.192	0.083	Inf	-2.32	0.053

Continuum: yay but very cautiously

- Czech is very different from Polish and Russian (significantly lower ratings)
- Polish also yields slightly lower ratings than Russian, but the difference is small
- SVO strategy should be investigated with intonation

Cross-language results: SVO strategy

- similar to the plot with interactions but **estimates from CLMM**
- y-axis: Estimated marginal means on the ordinal response scale (1-7)
- the continuum: Cz is very different



Discussion and outlook

The continuum?

- syntactic movement in the OVERT strategy in Cz and Ru: unambiguous outer interpretation of negation
- no syntactic movement in Pol OVERT strategy: ambiguous between inner and outer, pragmatic cues needed for distinguishing meaning
- more research with intonation is required for SVO strategy

Discussion and outlook

The continuum?

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- more research with intonation is required for SVO strategy

NCIs behave differently in Slavic OVERT PQs.

- why is Polish fine with NCIs in OVERT PQs while Czech and Russian are not? Syntactic movement?
  - Zanon (2024) on verb movement and NCI licensing in Ru OVERT PQs
- do other Slavic not allow NCIs in negative OVERT PQs?
  - in Serbian *i*-NPIs, but not *ni*-NCIs, are licensed in the OVERT strategy (Todorović, 2024)

Discussion and outlook

Open questions:

- Is the PI test reliable for distinguishing outer from inner negation?
  - Challenged for American English by Goodhue (2022) and for Russian by Onoeva & Razguliaeva (2024) for SVO strategy.
- Is the reason for NCIs not being licensed in OVERTPQs in Cz and Ru purely syntactic and not semantic, as proposed for Ru by Zanon (2024); a similar account was proposed for *i*-NPIs in BSMC by Todorović (2024).

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Overall account

RQ1 Is negation interpreted as outer or as inner in the OVERT and SVO PQ strategies in Cz, Pol and Ru?

RQ2 Is negative (evidence for $\neg p$) or neutral context preferred in negated PQs of the OVERT and the SVO strategy in Cz, Pol and Ru?

RQ3 Is negative or neutral context preferred in PQs with the outer and with the inner negation reading in Cz, Pol and Ru?

	Czech		Polish		Russian	
	OVERT	SVO	OVERT	SVO	OVERT	SVO
RQ1	PPIs prefered → outer	NCIs prefered → inner	no PI effect → outer & inner		PPIs prefered → outer	PPIs prefered but NCIs accepted → outer & inner
RQ2	neutral	negative	neutral	neut & neg	neutral	
RQ3	PPIs neutral NCIs negative	PPIs negative NCIs negative	PPIs neutral		PPIs neutral NCIs neutral	

Appendix: Models information

- within-language model

```
LANG_df_e1_STRATEGY.clmm <- clmm(rating1 ~ indef * context +
            (1 | item) + (1 | participant),
  contrasts = list(indef="contr.sum", context="contr.sum"),
  data=LANG_df_e1_STRATEGY)
```

- a large model for the three languages
- No random slopes by participant (each person only saw one language)

```
df_e1_all_STRATEGY.clmm <- clmm(rating1 ~ lang * indef * context +
        (1 + indef + context + indef:context | participant) +
        (1 + indef + context + indef:context | item),
  contrasts = list(lang="contr.sum", indef="contr.sum", context="contr.sum"),
  data=df_e1_all_STRATEGY,
  Hess = TRUE)

emmeans(df_e1_all_STRATEGY.clmm, ~ lang * indef * context,
        mode = "mean.class", adjust = "holm")
pairs(emmeans(df_e1_all_STRATEGY.clmm, ~ lang,
        mode = "mean.class", adjust = "holm"))
```

Appendix: OVERT strategy

Table 6: Overt strategy: Estimated marginal means by LANGUAGE, PI and CONTEXT (Fig. 20 source; mean-class scale; *p*-value adjustment: Holm method)

lang	indef	context	mean.class	SE	df	asymp.LCL	asymp.UCL
Czech	NCI	negative	3.38	0.147	Inf	2.96	3.81
Polish	NCI	negative	4.48	0.155	Inf	4.04	4.93
Russian	NCI	negative	2.62	0.137	Inf	2.23	3.02
Czech	PPI	negative	4.65	0.152	Inf	4.21	5.08
Polish	PPI	negative	4.11	0.164	Inf	3.64	4.58
Russian	PPI	negative	5.11	0.150	Inf	4.68	5.54
Czech	NCI	neutral	3.19	0.142	Inf	2.78	3.60
Polish	NCI	neutral	4.40	0.153	Inf	3.96	4.83
Russian	NCI	neutral	3.20	0.156	Inf	2.75	3.65
Czech	PPI	neutral	5.12	0.139	Inf	4.72	5.51
Polish	PPI	neutral	5.05	0.145	Inf	4.63	5.46
Russian	PPI	neutral	5.87	0.114	Inf	5.54	6.20

Appendix: OVERT strategy

Table 7: Overt strategy: Pairwise language contrasts by PI and CONTEXT (mean-class scale; *p*-value adjustment: Holm method)

contrast	indef	context	estimate	SE	df	z.ratio	p.value
Czech - Polish	NCI	negative	-1.099	0.155	Inf	-7.092	0.000
Czech - Russian	NCI	negative	0.760	0.150	Inf	5.073	0.000
Polish - Russian	NCI	negative	1.859	0.158	Inf	11.796	0.000
Czech - Polish	PPI	negative	0.535	0.154	Inf	3.477	0.001
Czech - Russian	PPI	negative	-0.459	0.153	Inf	-3.009	0.007
Polish - Russian	PPI	negative	-0.994	0.161	Inf	-6.175	0.000
Czech - Polish	NCI	neutral	-1.207	0.151	Inf	-7.996	0.000
Czech - Russian	NCI	neutral	-0.009	0.160	Inf	-0.057	0.998
Polish - Russian	NCI	neutral	1.198	0.167	Inf	7.163	0.000
Czech - Polish	PPI	neutral	0.068	0.138	Inf	0.497	0.873
Czech - Russian	PPI	neutral	-0.754	0.128	Inf	-5.878	0.000
Polish - Russian	PPI	neutral	-0.822	0.135	Inf	-6.112	0.000

Appendix: SVO strategy

Table 8: SVO strategy: Estimated marginal means by LANGUAGE, PI and CONTEXT (Fig. 22 source; mean-class scale; *p*-value adjustment: Holm method)

lang	indef	context	mean.class	SE	df	asymp.LCL	asymp.UCL
Czech	NCI	negative	5.00	0.147	Inf	4.71	5.29
Polish	NCI	negative	4.68	0.160	Inf	4.37	5.00
Russian	NCI	negative	4.12	0.169	Inf	3.78	4.45
Czech	PPI	negative	4.02	0.139	Inf	3.75	4.29
Polish	PPI	negative	4.32	0.146	Inf	4.04	4.61
Russian	PPI	negative	4.91	0.139	Inf	4.64	5.19
Czech	NCI	neutral	3.35	0.174	Inf	3.01	3.69
Polish	NCI	neutral	4.39	0.183	Inf	4.03	4.75
Russian	NCI	neutral	4.46	0.187	Inf	4.09	4.82
Czech	PPI	neutral	2.88	0.123	Inf	2.64	3.12
Polish	PPI	neutral	4.68	0.137	Inf	4.41	4.95
Russian	PPI	neutral	5.36	0.125	Inf	5.11	5.60

Appendix: SVO strategy

Table 9: SVO strategy: Pairwise language contrasts by PI and CONTEXT (mean-class scale; *p*-value adjustment: Holm method)

contrast	indef	context	estimate	SE	df	z.ratio	p.value
Czech - Polish	NCI	negative	0.333	0.154	Inf	2.165	0.077
Czech - Russian	NCI	negative	0.898	0.162	Inf	5.534	0.000
Polish - Russian	NCI	negative	0.566	0.167	Inf	3.396	0.002
Czech - Polish	PPI	negative	-0.297	0.149	Inf	-1.997	0.113
Czech - Russian	PPI	negative	-0.897	0.155	Inf	-5.794	0.000
Polish - Russian	PPI	negative	-0.600	0.160	Inf	-3.744	0.001
Czech - Polish	NCI	neutral	-1.024	0.153	Inf	-6.684	0.000
Czech - Russian	NCI	neutral	-1.095	0.163	Inf	-6.723	0.000
Polish - Russian	NCI	neutral	-0.071	0.167	Inf	-0.422	0.906
Czech - Polish	PPI	neutral	-1.819	0.151	Inf	-12.050	0.000
Czech - Russian	PPI	neutral	-2.549	0.161	Inf	-15.799	0.000
Polish - Russian	PPI	neutral	-0.730	0.160	Inf	-4.575	0.000