Processing SVO and OVS Word Order in Croatian

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Introduction

Croatian - flexible word order, case marking, gender marking, animacy marking
     -canonical word order SVO (Greenberg 1966).
     - incremental argument interpretation relies on case marking (MacWhinney & Bates 1989)

Tested: morpho-syntactic, semantic and information-structural principles in word ordering:

S>O   Animate > Inanimate   Given information > New information

3 experiments :

Materials: temporarily ambiguous input (case syncretism)

Methods: self-paced reading   +   acceptability judgment task   (Ibex farm)
                        ⇩   ⇩
               incremental interpretation of   preference
                        arguments

Methods and design

Participants: native speakers of Croatian

Design: 2x2

Item structure: N1 AUX V N2, controlled for length

Measures	Analysis (R 3.6.3.)
Acceptability ratings (Likert scale 1-5)	CLMM
Reaction times for acceptability judgments	GLMM (family: inverse Gaussian, link: identiy)
Reaction times for V, N2 (disambiguation regions)	GLMM (family: inverse Gaussian, link: identiy)

Experiment 1: Subject 1st

Factors: Order (SO, OS)**, Ambiguity** (AMB,UNAMB)

Conditions:

1.**SO_AMB**
 Vjetar   je   otpuhao   brod-ić.
 wind.M.SG.NOM(/ACC) AUX.3SG blow.away.PTCP.M.SG boat-DIM.M.SG.(NOM/)ACC
"The wind blew away the boat. "

2. **OS_AMB**
Brod-ić   je   otpuhao   vjetar.
boat-DIM.M.SG.(NOM/)ACC AUX.3SG blow.away.PTCP.M.SG wind.M.SG.NOM(/ACC)
"The wind blew away the boat. " / #"The boat blew away the wind."

Experiment 1: Subject 1st

3. SO_UNAMB

Plaht-a   je   pokrila   fotelj-u.

sheet-F.SG.NOM AUX.3SG cover.PTCP.F.SG armchair-F.SG.ACC

"The sheet covered the armchair."

4. OS_UNAMB

Fotelj-u je pokrila plaht-a.

Armchair-F.SG.ACC AUX.3SG cover-PTCP.F.SG sheet-F.SG.NOM

 "The sheet covered the armchair."

Participants: n=40 (M=9), mean age = 22.75

Materials: 48 experimental items (12 /condition)

2 lists: 24 experimental items(6/condition) + 24 filler items + 6 practice items

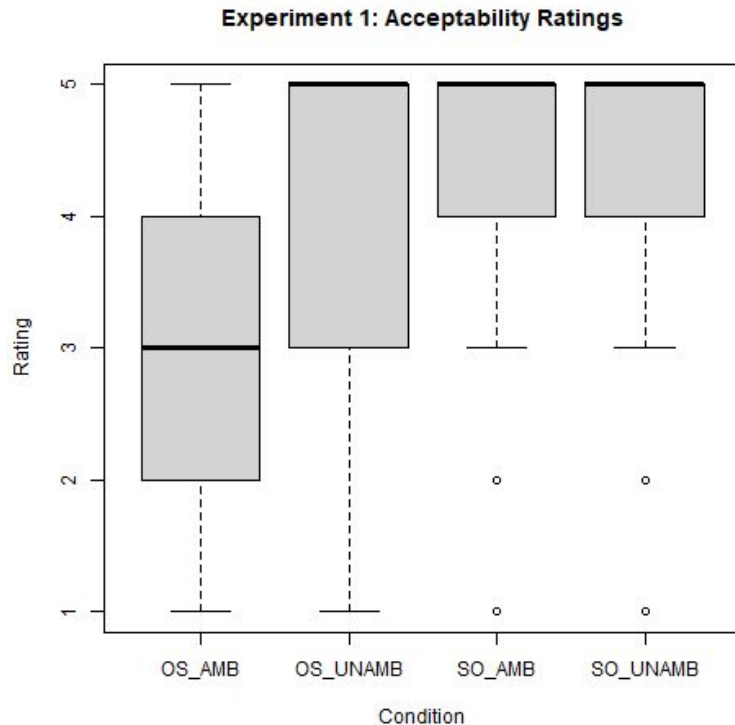# Results: acceptability judgments

formula:
zscore_Rating ~ Order*Ambiguity +(1 + Order + Ambiguity | Subject) +
(1 | Item)
Intercept: OS_AMB

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)	
Order SO	3.8038	0.5376	7.076	1.49e-12	***
Ambiguity UNAMB	2. 1069	0.4728	4.456	8.35e-06	***
Interaction:	-1.7139	0.6533	-2.623	0.00871	**

morphological marking matters for OS


Experiment 1: Acceptability Ratings

Results: RT V (disambiguation region)

Prediction: longer RTs for OS_AMB - Minimality Principle (Bornkessel and Schleschewsky, 2006)

formula: RT_V ~ Order * Ambiguity + (1 + Order + Ambiguity | Subject) + (1 | Item)

Fixed effects:	Estimate	Std. Error	t value	Pr(>|z|)
OS_AMB (Intercept)	2661.04	41.68	63.842	< 2e-16 ***
AmbiguityUNAMB	-58.266	21.722	-2.682	0.00731 **

shorter RTs for verbs preceded by unambiguous N

Order*Ambiguity effect plot
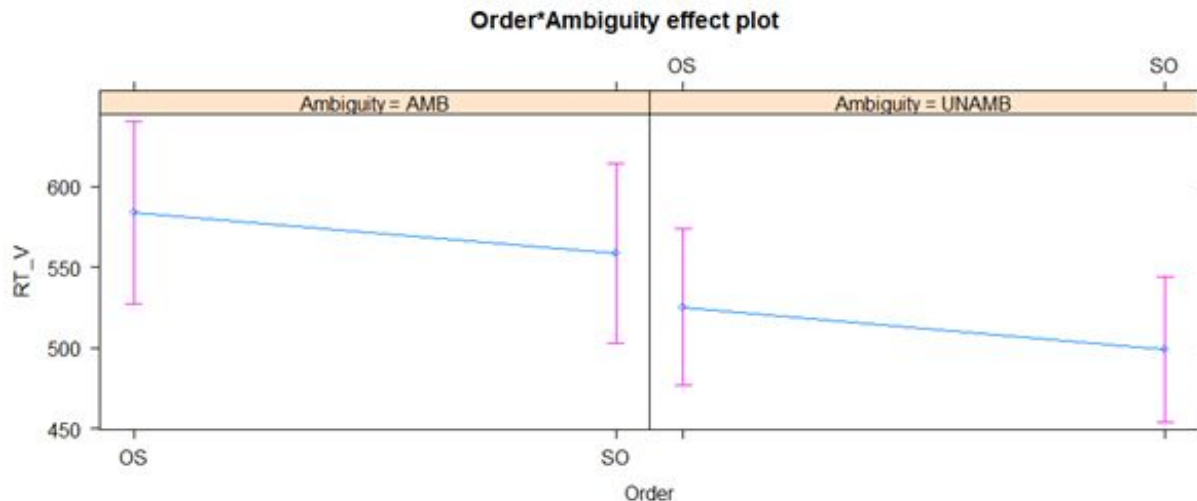
Experiment 2: Animate 1st

Factors: Order_Argument (SO, OS)**, Order_Animacy** (IA, AI)

Conditions:

1. **SO_AI**
Policajk-e   su   ugledale   novčanic-e.
policewoman-F.PL.NOM(/ACC) AUX.3PL see.PTCP.F.PL banknote-F.PL.(NOM/)ACC
 "The policewomen saw the banknotes.“

2. **OS_AI**
Policajk-e   su   začudile   novčanic-e.
policewoman-F.PL.(NOM/)ACC AUX.3PL astonish.PTCP.F.PL banknote-F.PL.NOM(/ACC)
 'The banknotes astonished the policewomen."/# 'The policewomen astonished the banknotes."

Experiment 2: Animate 1st

3. OS_IA

Novčanic-e su ugledale policajk-e.
banknote-F.PL.(NOM/)ACC AUX.3PL see-PTCP.F.PL policewoman-F.PL.NOM(/ACC)
'The policewomen saw the banknotes. "/# "The banknotes saw the policewomen."

4. SO_IA

Novčanic-e su začudile policajk-e.
Banknote-F.PL.NOM(/ACC) AUX.3PL astonish- PTCP.F.PL policewoman-F.PL.(NOM/)ACC
'The banknotes astonished the policewomen."

Participants: n=40 (M=10), mean age=22.34
Materials: 96 experimental items (24 /condition)
          4 lists: 24 experimental items(6/condition) + 24 filler items + 6 practice items

Results: acceptability judgments

formula:
zscore_Rating ~ Order_Animacy * Order_Argument +
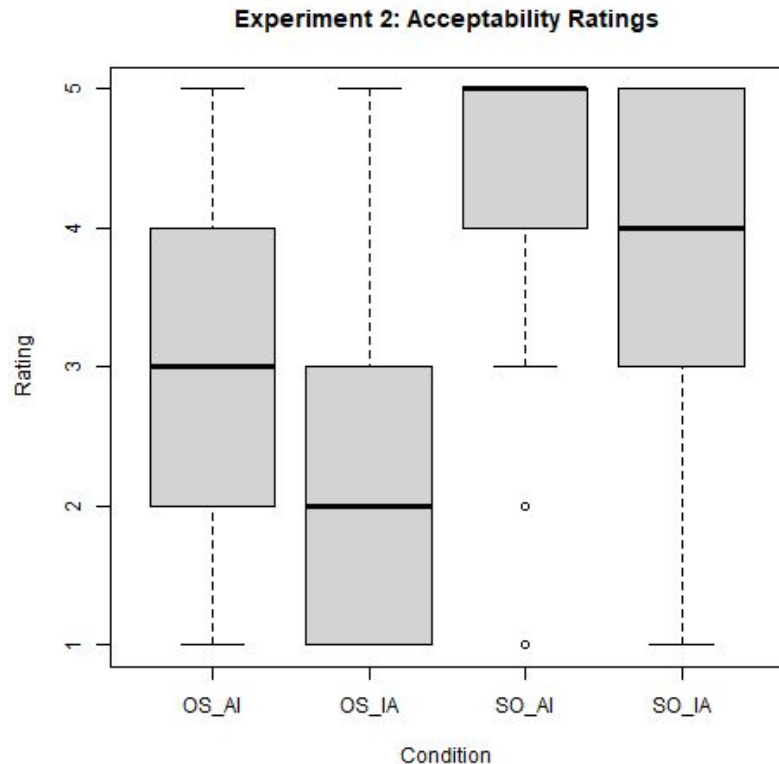(1 + Order_Animacy + Order_Argument | Subject) +
(1 | Item)
Intercept: OS_AI

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)	
Order_AnimacyIA	-0.9701	0.2408	-4.029	5.59e-05	***
Order_ArgumentSO	3.7772	0.3884	9.725	< 2e-16	***

SO > OS

Animate 1st


Experiment 2: Acceptability Ratings

Results: RT N2

Prediction: preference for animate subjects (Mak et al. 2006 Jackson & Roberts 2010) → **longer RTs for OS_AI vs. SO_AI?**

formula: RT_N2 ~ Order_Animacy * Order_Argument + (1 + Order_Argument | Subject) + (1 | Item)

Fixed effects:	Estimate	Std. Error	t value	Pr(>|z|)
OS_AI (Intercept)	1106.92	58.26	18.998	< 2e-16 ***
Order_ArgumentSO	-155.32	54.37	-2.857	0.00428 **

shorter RTs in SO conditions

Order_Animacy*Order_Argument effect plot
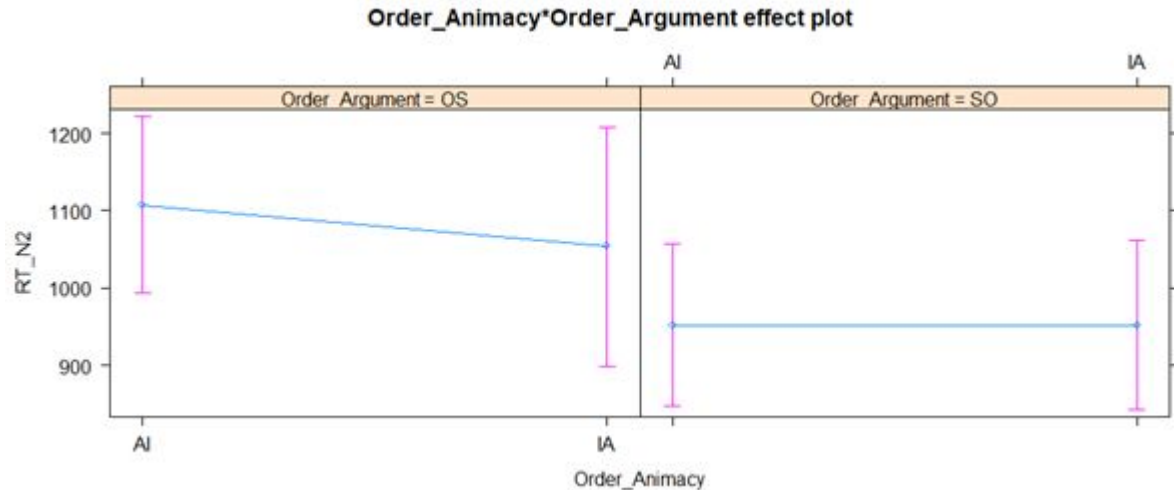
Experiment 3: Given 1st

Factors: Order (SO, OS)**, Givenness** (SG, OG)

Conditions:

Context 1: Zapuhao je snažan vjetar. (A strong wind started to blow.)

1. **SO_SG**
Vjetar   je   otpuhao   brod-ić.
wind.M.SG.NOM(/ACC) AUX.3SG blow.away.PTCP.M.SG boat-DIM.M.SG.(NOM)/ACC
"The wind blew away the boat."

2. **OS_SG**
Brod-ić   je   otpuhao   vjetar.
boat-DIM.SG.M.(NOM)/ACC AUX.3SG blow.away.PTCP.M.SG wind.SG.M.NOM(/ACC)
"The wind blew away the boat. " / #"The boat blew away the wind."

Experiment 3: Given 1st

Context 2: Htjeli smo uzeti <u>brodić</u> i otploviti na more, ali nismo mogli. (We wanted to take the boat out to sea, but we coludn't.)

3. **SO_OG**
Vjetar   je   otpuhao   <u>brod-ić.</u>
wind.M.SG.<u>NOM(/ACC)</u> AUX.3SG blow.away.PTCP.M.SG boat-DIM.M.SG.(NOM)/ACC
"The wind blew away the boat. "

4. **OS_OG**
<u>Brod-ić</u>   je   otpuha-o vjetar.
boat-DIM.SG.M.<u>(NOM)/ACC</u> AUX.3SG blow.away-PTCP.M.SG wind.SG.M.NOM(/ACC)
"The wind blew away the boat. " / <u>#"The boat blew away the wind."</u>

Participants: n=37 (M=13), mean age=22.75
Materials: 96 experimental items (24 /condition)
              4 lists: 24 experimental items(6/condition) + 24 filler items + 6 practice items
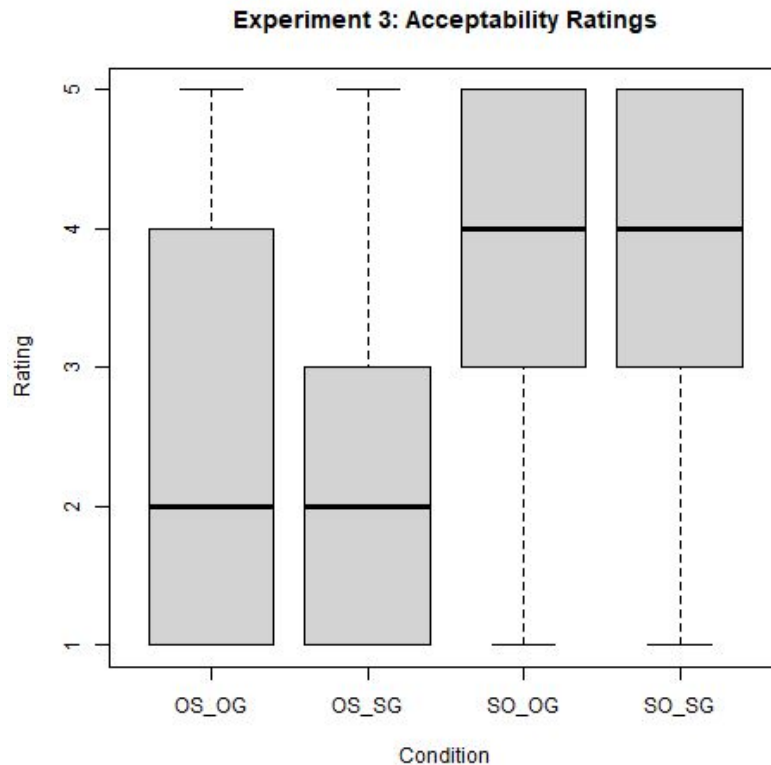
Results: acceptability judgments

formula:
zscore_Rating ~ Order * Givenness + (1 + Order +
Givenness | Subject) + (1 | Item)
Intercept: OS_AI

Fixed effects:

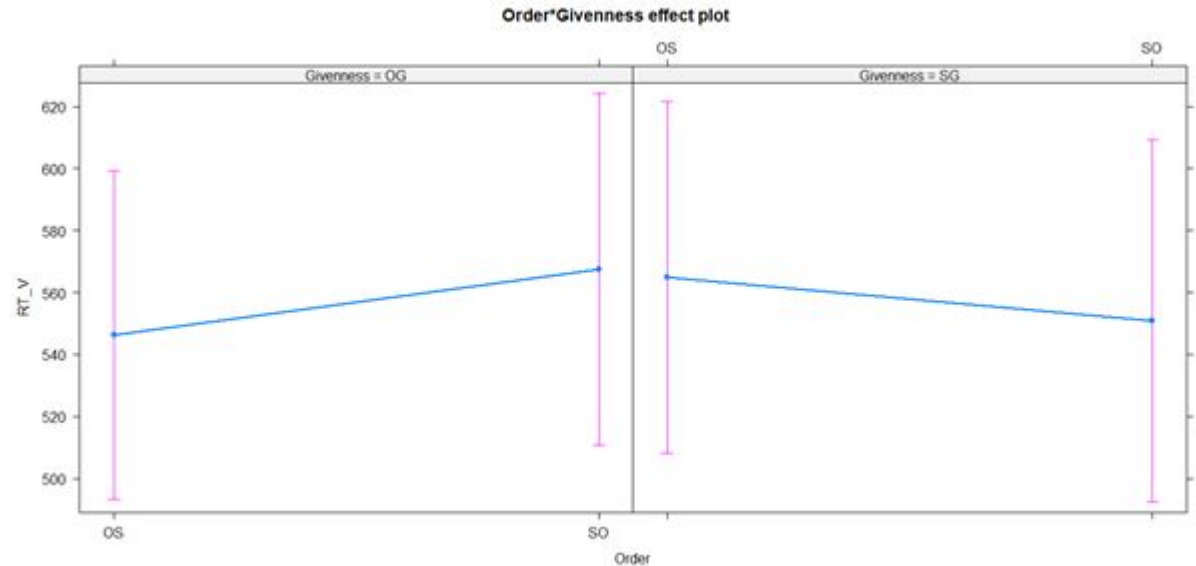|	Estimate	Std. Error	z value	Pr(>|z|)	
OrderSO	2.9110	0.4452	6.538	6.24e-11	***

SO > OS

Experiment 3: Acceptability Ratings

Results: RT V (disambiguation region)

formula: RT_V ~ Order * Givenness + (1 | Subject) + (1 | Item)

no significant effects

Order*Givenness effect plot

Conclusion

preference for SVO + faster processing (exp 1,2,3) → **minimal structure**

OVS - morphology plays a role in licensing, givenness is not enough

preference for animate > inanimate for both SVO and OVS → **independent Animate 1st principle** (exp 2)
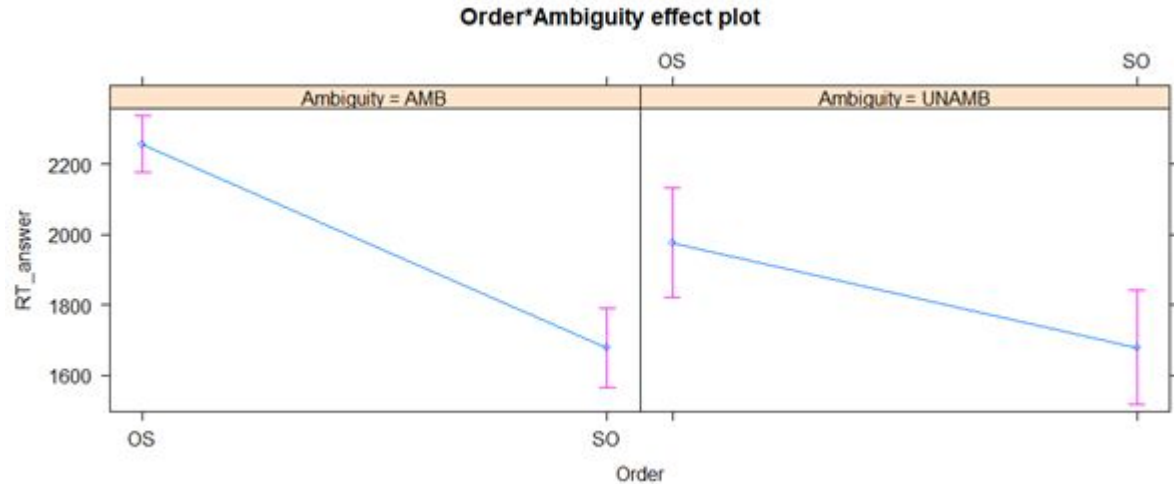
THANK YOU!

Experiment 1: RTs for acceptability judgments

formula: RT_answer ~ Order * Ambiguity + (1 + Order + Ambiguity | Subject) +   (1 | Item)

Fixed effects:	Estimate	Std. Error	t value	Pr(>|z|)	
OS_AMB(Intercept)	2454.88	42.94	57.176	< 2e-16	***
OrderSO	-538.93	40.99	-13.147	< 2e-16	***
AmbiguityUNAMB	-310.85	46.75	-6.649	2.94e-11	***
Interaction:	226.58	41.54	5.454	4.92e-08	***

slower for OS
slower for AMB
ambiguity more important for OS
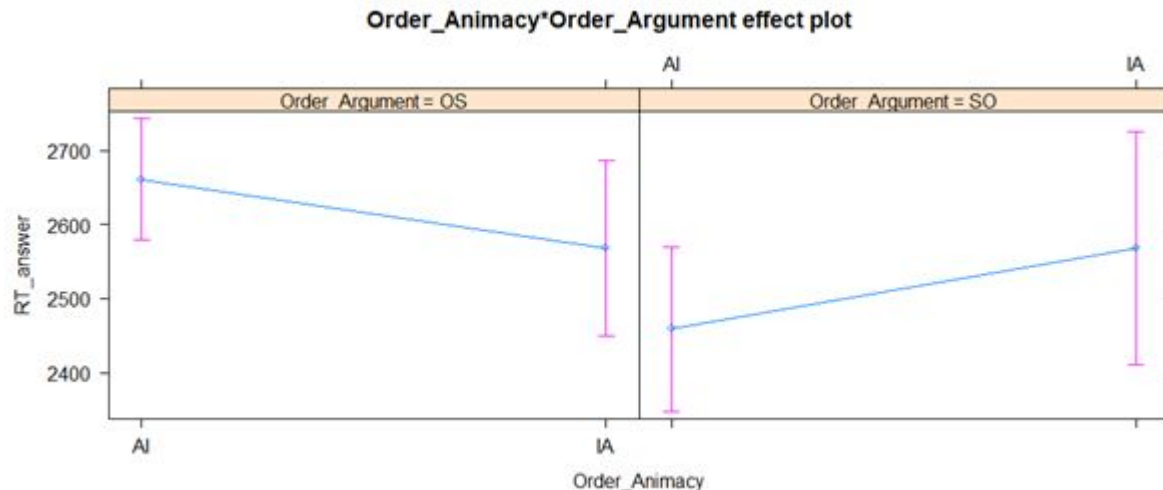

Order*Ambiguity effect plot

Experiment 2: RTs for acceptability judgments

formula: : RT_answer ~ Order_Animacy * Order_Argument + (1 + Order_Argument | Subject) + (1 | Item)

Fixed effects:	Estimate	Std. Error	t value	Pr(>|z|)	
OS_AI(Intercept)	2661.04	41.68	63.842	< 2e-16	***
O_AnimacyIA	-92.58	46.36	-1.997	0.0458	*
O_ArgumentSO	-201.95	47.11	-4.286	1.82e-05	***
Interaction:	202.36	41.84	4.837	1.32e-06	***

shortest for best and worst rated

Order_Animacy*Order_Argument effect plot

Experiment 3: RTs for acceptability judgments

formula: : RT_answer ~ Order_Animacy * Order_Argument + (1 + Order_Argument | Subject) + (1 | Item)

Fixed effects:	Estimate	Std. Error	t value	Pr(>|z|)	
OS_OG(Intercept)	2153.71	68.87	31.272	< 2e-16	***
OrderSO	-638.60	56.82	-11.238	< 2e-16	***
GivennessSG	-290.46	56.82	-5.112	3.20e-07	***
Interaction:	415.06	76.05	5.457	4.83e-08	***

it takes more time to rate OS
when the object is given!

Order*Givenness effect plot