

SUPPLEMENTARY MATERIALS

Time Contingency and Social Engagement Shape Interaction Choices in Autism and Neurotypical Development

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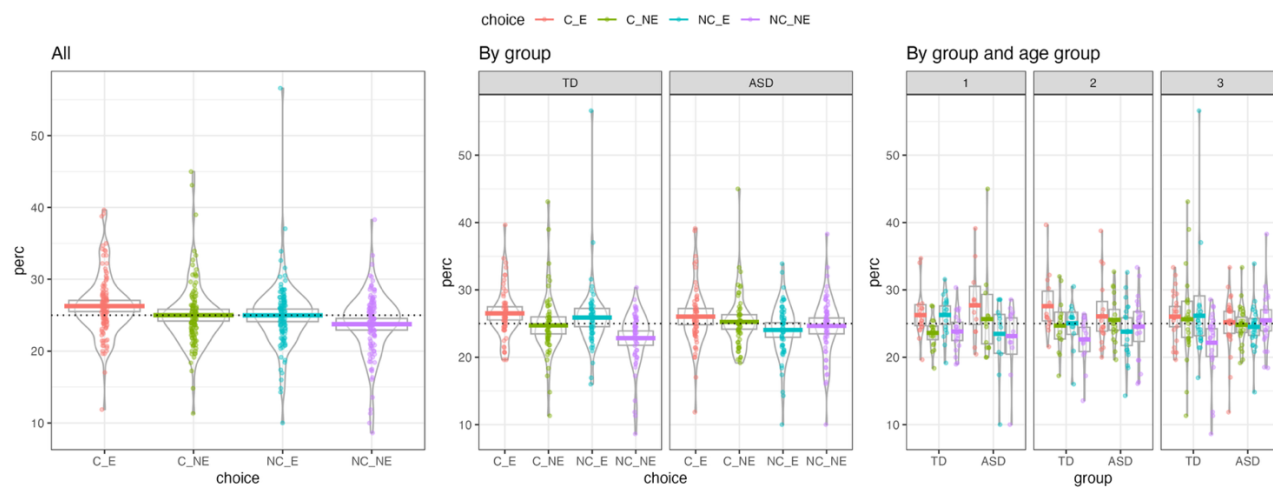
1. CHOICES DURING INTERACTION

1.1 Descriptives

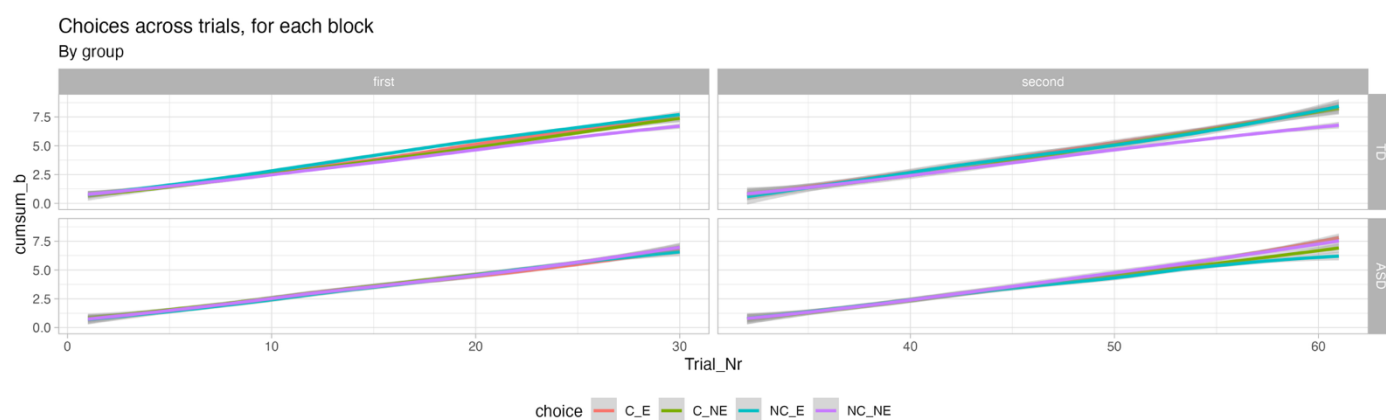
Table of percentage of choices. Mean(SD)

		TD	ASD
Younger children	C_E	26.26 (3.46)	27.71 (5.20)
	C_NE	23.63 (2.24)	25.66 (6.75)
	NC_E	26.27 (3.02)	23.47 (5.32)
	NC_NE	23.84 (2.97)	23.15 (4.97)
Older children	C_E	27.60 (4.38)	26.07 (4.90)
	C_NE	24.71 (3.92)	25.56 (3.42)
	NC_E	25.04 (3.25)	23.81 (4.58)
	NC_NE	22.66 (3.56)	24.56 (4.90)
Adults	C_E	26.04 (3.76)	25.18 (4.23)
	C_NE	25.64 (6.68)	24.82 (2.98)
	NC_E	26.15 (7.39)	24.51 (3.28)
	NC_NE	22.17 (5.16)	25.49 (4.09)

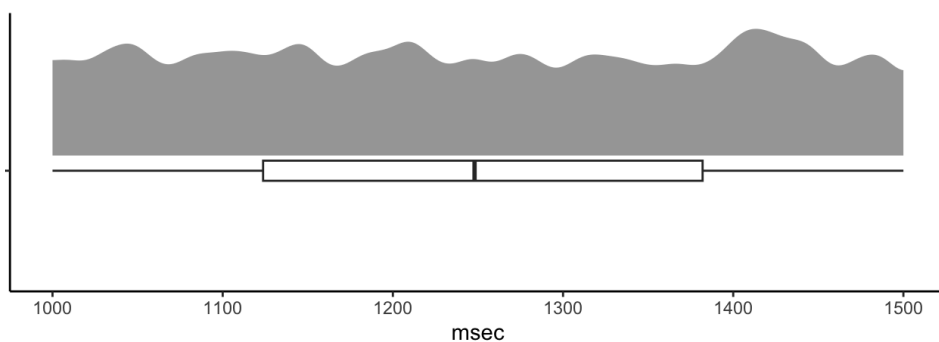
Descriptive plot of percentage of choice during interaction phase of all participants, by group and by group x age_group



Descriptive plot of cumulative sum of choice during interaction phase across trials by block x group



Distribution of delays for Not Contingent stimuli



Mean = 1250.33 msec

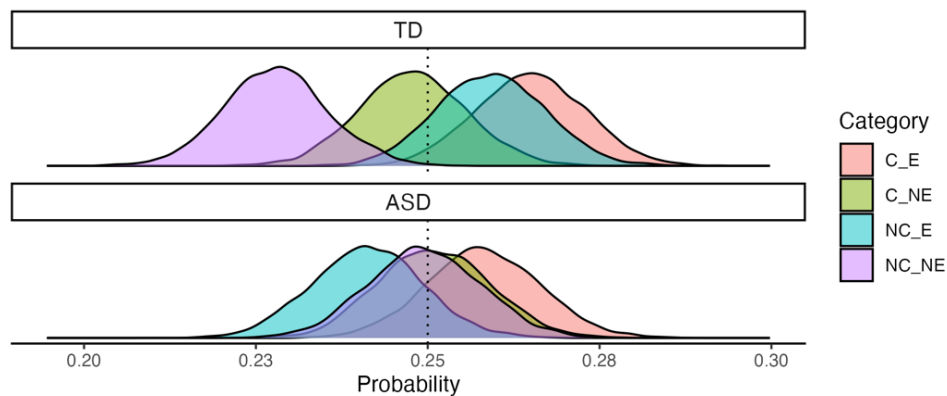
SD = 145.29

Range: 1000 to 1500

1.2 Table with probabilities and chance level

Group	Category	MAP	HPDI low	HPDI high	P > 0.25	P < 0.25
TD	C_E	0.265	0.252	0.278	0.972	0.028
	C_NE	0.246	0.235	0.259	0.384	0.616
	NC_E	0.260	0.247	0.271	0.887	0.113
	NC_NE	0.229	0.216	0.240	0.002	0.998
ASD	C_E	0.257	0.245	0.271	0.838	0.162
	C_NE	0.250	0.237	0.263	0.536	0.464
	NC_E	0.241	0.229	0.254	0.133	0.867
	NC_NE	0.248	0.237	0.262	0.474	0.526

Posterior probabilities across categories, within groups

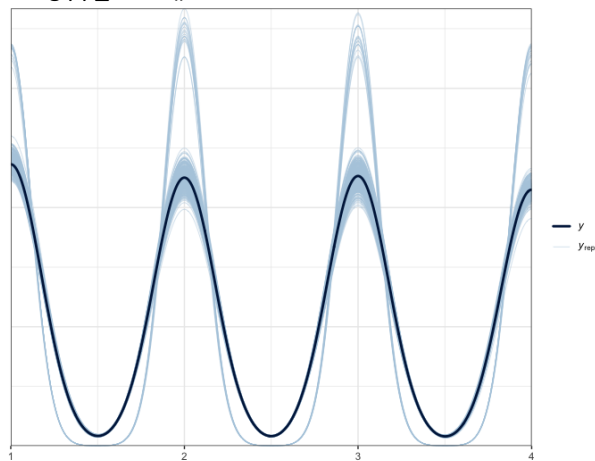


1.3 Full output of selected model

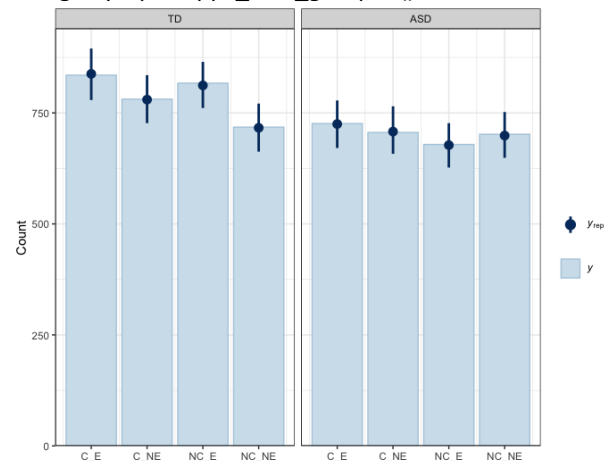
```
## Family: categorical
## Links: muCNE = logit; muNCE = logit; muNCNE = logit
## Formula: choice ~ group + (1 | id)
## Data: synch (Number of observations: 5964)
## Draws: 4 chains, each with iter = 3000; warmup = 1500; thin = 1;
##         total post-warmup draws = 6000
##
## Multilevel Hyperparameters:
## ~id (Number of levels: 116)
##           Estimate Est.Error l-95% CI u-95% CI  Rhat Bulk_ESS
## sd(muCNE_Intercept)    0.035    0.027   0.001   0.100 1.000    3331
## sd(muNCE_Intercept)    0.038    0.028   0.001   0.106 1.001    2955
## sd(muNCNE_Intercept)   0.035    0.026   0.001   0.097 1.001    3399
##           Tail_ESS
## sd(muCNE_Intercept)    2515
## sd(muNCE_Intercept)    1850
## sd(muNCNE_Intercept)   2742
##
## Regression Coefficients:
##           Estimate Est.Error l-95% CI u-95% CI  Rhat Bulk_ESS Tail_ESS
## muCNE_Intercept    -0.067    0.051  -0.168   0.032 1.001    5521    4954
## muNCE_Intercept    -0.022    0.049  -0.118   0.077 1.000    5322    4597
## muNCNE_Intercept   -0.151    0.052  -0.252  -0.048 1.001    5113    4596
## muCNE_groupASD      0.039    0.073  -0.101   0.185 1.000    5471    4607
## muNCE_groupASD     -0.046    0.072  -0.185   0.094 1.000    5013    4939
## muNCNE_groupASD     0.117    0.074  -0.029   0.264 1.001    5226    4522
##
## Draws were sampled using sampling(NUTS). For each parameter, Bulk_ESS
## and Tail_ESS are effective sample size measures, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

1.4 Posterior predictive checks

Using `pp_check()`



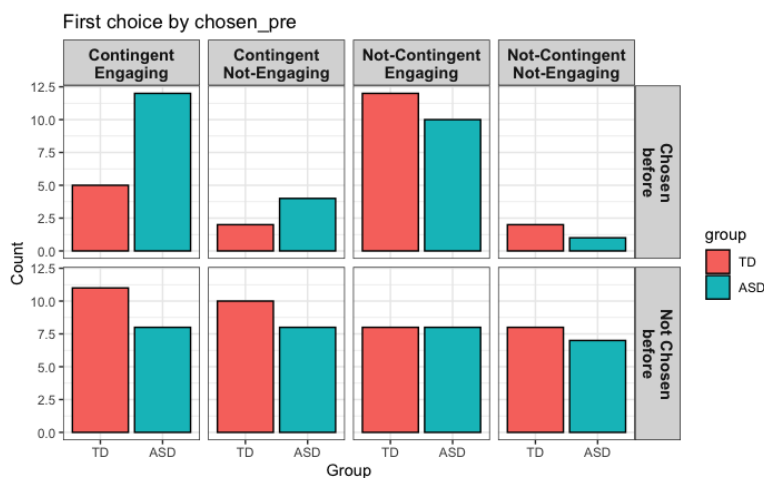
Using `bayesplot::ppc_bars_grouped()`



Posterior predictive checks (PPC) on `m1` for choices during interaction were conducted using 500 draws. In the plot on the right side, PPC were stratified by group (TD vs. ASD) and show that the model generally captures the observed distribution of response categories well in both groups. Specifically looking at the stratified plot, the observed counts (light-blue bars) are compared with the model's posterior predictions (dark-blue points $\pm$ 90 % intervals) separately for the TD and ASD groups. In both ASD and TD, the bars fall well within the predictive intervals for every category, indicating that the model provides an adequate fit to the data at the group level.

2. PREFERENCES AFTER INTERACTION

2.1 Descriptive plots



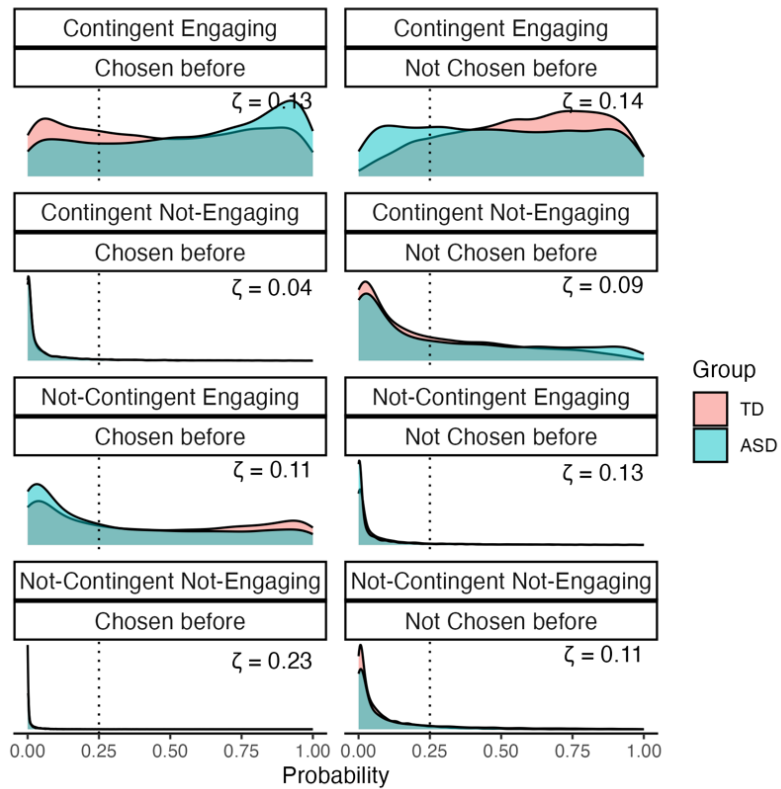
2.2 Overlap of posterior distributions within categories, across groups

Table

Category	chosen_pre	η (overlapping)	ζ (non-overlapping)
C_E	chosen	0.873	0.127
	not chosen	0.855	0.145
C_NE	chosen	0.962	0.038
	not chosen	0.911	0.089
NC_E	chosen	0.892	0.108
	not chosen	0.867	0.133
NC_NE	chosen	0.769	0.231
	not chosen	0.886	0.114

`Chosen_pre` has been included here as its interaction with group was what we added to the previous model in model comparison, which suggest the improvement in performance might be driven by this effect. However, distributions are highly overlapping across the two groups.

Plot



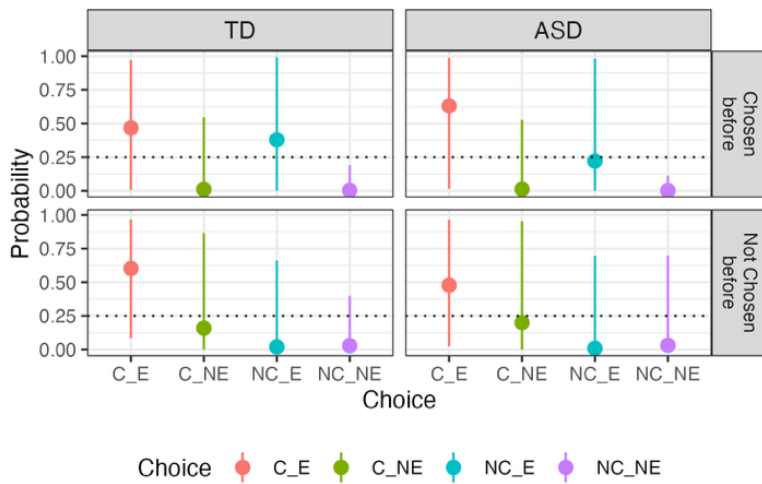
2.3 Tables with probabilities and chance level

Group	Category	Chosen_pre	MAP	HPDI_low	HPDI_high	P_gt_025	P_lt_025
TD	C_E	chosen	0.063	2.93E-06	0.898	0.690	0.310
		not chosen	0.745	0.194	0.967	0.868	0.132
	C_NE	chosen	0.002	4.02E-14	0.197	0.086	0.914
		not chosen	0.024	4.62E-12	0.665	0.403	0.597
	NC_E	chosen	0.039	9.44E-09	0.923	0.589	0.411
		not chosen	0.005	9.37E-10	0.270	0.118	0.882
	NC_NE	chosen	0.001	5.78E-12	0.060	0.017	0.983
		not chosen	0.007	3.18E-08	0.194	0.074	0.927
ASD	C_E	chosen	0.924	0.119	1.000	0.793	0.208
		not chosen	0.107	0.027	0.906	0.733	0.267
	C_NE	chosen	0.003	1.76E-13	0.205	0.088	0.912
		not chosen	0.027	9.94E-11	0.807	0.460	0.540
	NC_E	chosen	0.033	1.76E-08	0.855	0.475	0.525
		not chosen	0.003	5.20E-10	0.249	0.110	0.890
	NC_NE	chosen	2.96E-05	9.85E-12	0.031	0.006	0.994
		not chosen	0.008	1.75E-09	0.344	0.158	0.842

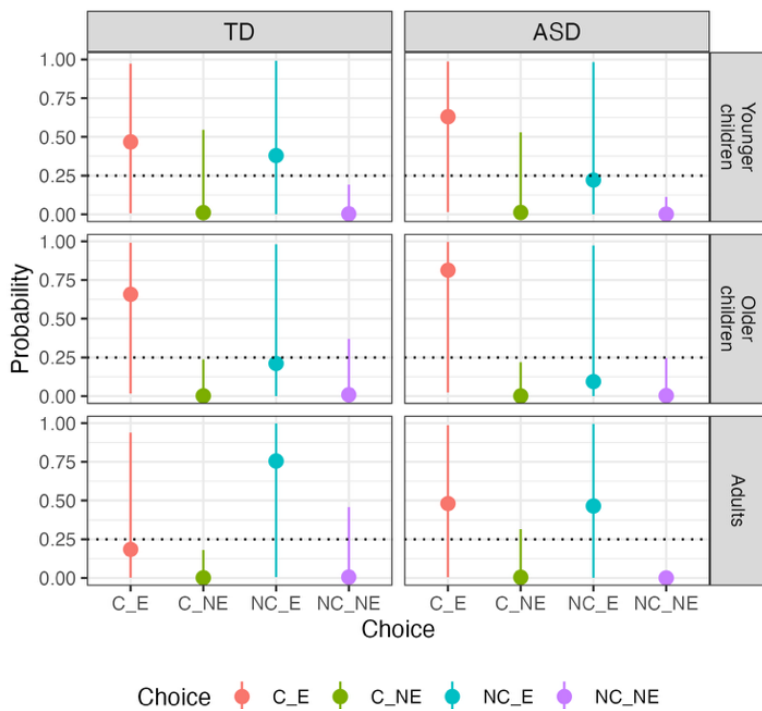
2.4 Plots

The following plots have been created using `brms::conditional_effects(categorical = TRUE)`. Full code available on OSF.

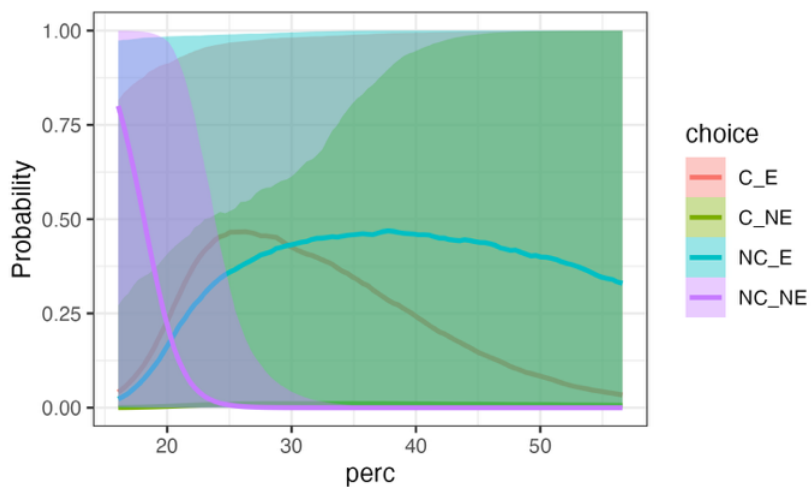
1. group * chosen_pre



2. group * age_group



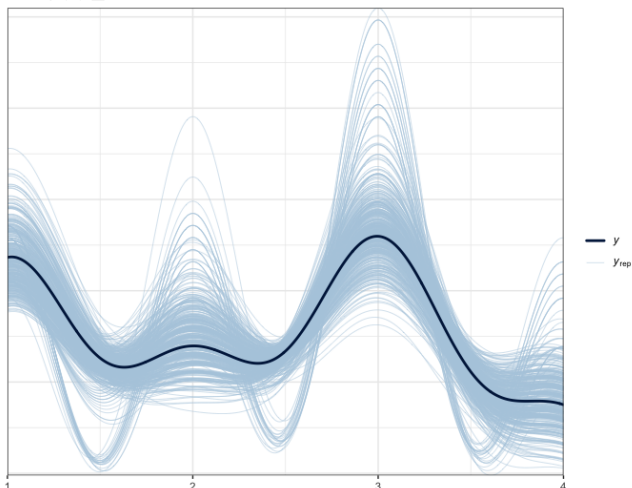
3. percentage of choice during interaction



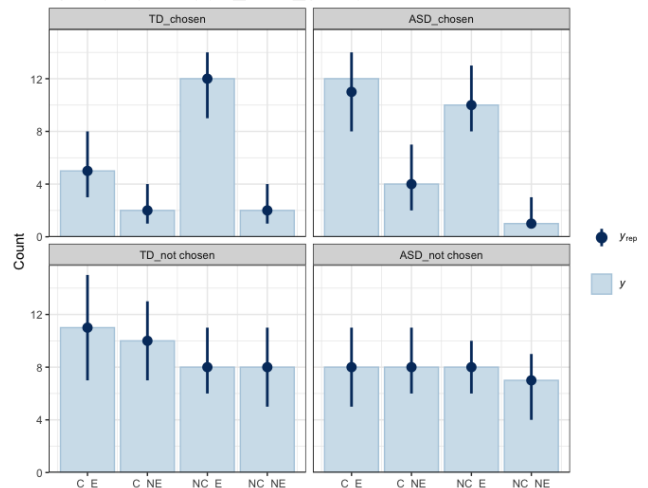
```
## Family: categorical
## Links: muCNE = logit; muNCE = logit; muNCNE = logit
## Formula: choice ~ group * age_group + group * chosen_pre + perc + (1 | id)
## Data: df_first (Number of observations: 116)
## Draws: 4 chains, each with iter = 3000; warmup = 1500; thin = 1;
##         total post-warmup draws = 6000
##
## Multilevel Hyperparameters:
## ~id (Number of levels: 116)
##
##               Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS
## sd(muCNE_Intercept)    7.739    4.100    2.504    17.851 1.005    1413
## sd(muNCE_Intercept)   11.694    6.057    3.887    26.856 1.001    1692
## sd(muNCNE_Intercept)  4.637    2.536    0.759    10.845 1.006    1208
##
##               Tail_ESS
## sd(muCNE_Intercept)   1878
## sd(muNCE_Intercept)   2196
## sd(muNCNE_Intercept)  1327
##
## Regression Coefficients:
##
##               Estimate Est.Error l-95% CI u-95% CI
## muCNE_Intercept    -6.047    7.765   -23.804    6.056 1
## muNCE_Intercept     -2.071    8.488   -20.833   12.811 1
## muNCNE_Intercept    15.150    8.893    1.826   36.541 1
## muCNE_groupASD       0.192    2.025   -4.197    3.813 1
## muCNE_age_group2     -2.019    2.201   -6.905    1.883 1
## muCNE_age_group3     -1.154    2.019   -5.331    2.621 1
## muCNE_chosen_prenotchosen 2.115    2.118   -1.584    6.920 1
## muCNE_perc           0.076    0.246   -0.370    0.593 1
## muCNE_groupASD:age_group2 -0.425    2.431   -5.598    4.303 1
## muCNE_groupASD:age_group3  0.545    2.272   -3.879    5.121 1
## muCNE_groupASD:chosen_prenotchosen 0.691    2.124   -3.384    5.291 1
## muNCE_groupASD      -0.798    2.261   -5.605    3.464 1
## muNCE_age_group2     -0.995    2.347   -6.227    3.316 1
## muNCE_age_group3      1.662    2.374   -2.621    6.891 1
## muNCE_chosen_prenotchosen -3.196    2.707   -9.578    1.214 1
## muNCE_perc           0.061    0.303   -0.512    0.712 1
## muNCE_groupASD:age_group2 -0.163    2.568   -5.403    4.844 1
## muNCE_groupASD:age_group3 -0.553    2.346   -5.380    4.191 1
## muNCE_groupASD:chosen_prenotchosen 0.294    2.464   -4.807    5.183 1
## muNCNE_groupASD     -1.300    2.050   -5.794    2.372 1
## muNCNE_age_group2     0.667    1.747   -2.611    4.434 1
## muNCNE_age_group3      1.463    1.902   -2.196    5.397 1
## muNCNE_chosen_prenotchosen 1.850    2.008   -1.422    6.425 1
## muNCNE_perc          -0.776    0.390   -1.735   -0.225 1
## muNCNE_groupASD:age_group2  0.210    2.121   -3.817    4.712 1
## muNCNE_groupASD:age_group3 -3.592    2.860   -10.287    1.097 1
## muNCNE_groupASD:chosen_prenotchosen 1.615    2.094   -2.237    6.032 1
##
## Draws were sampled using sampling(NUTS). For each parameter, Bulk_ESS
## and Tail_ESS are effective sample size measures, and Rhat is the potential
## scale reduction factor on split chains (at convergence, Rhat = 1).
```

2.6 Posterior predictive checks

Using pp_check()



Using `bayesplot::ppc` `bars` `grouped()`



Posterior predictive checks (PPCs) on m_6 for preferences after interaction were conducted using 500 draws, stratified by group (TD vs ASD) and prior choice (chosen vs not chosen). The PPC bar plots indicate that the model generally captures the observed response distributions well across conditions.