

Ordinal Mixed-Effects Analysis of Truth-Value Judgments

1 Statistical analysis: Ordinal mixed-effects model

1.1 Design and data

We analyzed trial-level truth-value judgments from $N = 42$ participants. Each participant responded to 30 items, crossing two within-participant factors: (i) DISPLAY with three levels (0, 2, 4) and (ii) PROMPT with two levels (ALL, AND). Responses were recorded on a three-level ordered scale: *Completely false* < *Neither completely true nor completely false* < *Completely true*. Participants were assigned to one of six questionnaire versions (“lists”), indexed by **Group**. The dataset comprised 1260 observations ($42 \text{ participants} \times 30 \text{ trials}$).

1.2 Model

We fit a Bayesian cumulative-link (ordinal) mixed-effects model with a logit link. The ordered response was modeled as a function of PROMPT, DISPLAY, and their interaction, with random intercepts for participants and for questionnaire version (**Group**):

$$\text{Response}_{ord} \sim \text{PROMPT} \times \text{DISPLAY} + (1 \mid \text{participant}) + (1 \mid \text{Group}). \quad (1)$$

Inference is reported in terms of posterior means and 95% credible intervals (CrI). Convergence diagnostics indicated good mixing and convergence (all $\hat{R} \approx 1.00$; effective sample sizes were large). Posterior predictive checks based on marginal category frequencies indicated that the model reproduces the observed response distribution well.

1.3 Condition-wise predicted probabilities

To aid interpretability, we summarize the fitted model using population-level predicted probabilities (random effects marginalized out) for each PROMPT×DISPLAY cell. Table 1 reports posterior means and 95% CrIs.

PROMPT	DISPLAY	$P(\text{False})$	$P(\text{Neither})$	$P(\text{True})$
ALL	0	0.991 [0.978, 0.998]	0.0085 [0.0023, 0.0211]	0.00014 [0.00003, 0.00043]
AND	0	0.991 [0.976, 0.998]	0.0093 [0.0024, 0.0234]	0.00016 [0.00003, 0.00047]
ALL	2	0.983 [0.963, 0.995]	0.0162 [0.0052, 0.0365]	0.00028 [0.00006, 0.00079]
AND	2	0.511 [0.340, 0.676]	0.473 [0.316, 0.633]	0.0159 [0.0050, 0.0357]
ALL	4	0.00025 [0.00005, 0.00073]	0.0148 [0.0043, 0.0337]	0.985 [0.966, 0.996]
AND	4	0.00003 [0.00000, 0.00013]	0.0019 [0.00013, 0.0071]	0.998 [0.993, 1.000]

Table 1: Population-level predicted response probabilities from the ordinal mixed-effects model (posterior mean with 95% CrI).

1.4 Key posterior contrasts

The fitted model implies strong floor and ceiling effects driven by DISPLAY, together with a pronounced PROMPT×DISPLAY interaction at DISPLAY=2.

(i) Prompt effect at DISPLAY=2. At DISPLAY=2, switching from ALL to AND substantially increases intermediate (“Neither”) responses while decreasing “Completely false” responses:

$$\Delta P(\text{Neither} \mid \text{DISPLAY} = 2; \text{AND} - \text{ALL}) = 0.457 \quad [0.307, 0.606], \quad (2)$$

$$\Delta P(\text{False} \mid \text{DISPLAY} = 2; \text{AND} - \text{ALL}) = -0.473 \quad [-0.633, -0.314]. \quad (3)$$

Thus, at DISPLAY=2, AND shifts roughly 46–47 percentage points of posterior mass away from “Completely false” and into the intermediate category.

(ii) Display effect on “Completely true” (0 → 4). The manipulation of DISPLAY induces a large change in the probability of “Completely true” responses in both prompts:

$$\Delta P(\text{True} \mid \text{ALL}; \text{DISPLAY} = 4 - 0) = 0.985 \quad [0.966, 0.995], \quad (4)$$

$$\Delta P(\text{True} \mid \text{AND}; \text{DISPLAY} = 4 - 0) = 0.998 \quad [0.993, 1.000]. \quad (5)$$

This reflects near-ceiling “True” responding at DISPLAY=4 and near-floor “True” responding at DISPLAY=0.

1.5 Summary

In sum, the ordinal mixed-effects analysis shows that DISPLAY overwhelmingly controls the direction of truth-value judgments (floor at DISPLAY=0; ceiling at DISPLAY=4), while PROMPT matters primarily at the intermediate DISPLAY=2 level. At DISPLAY=2, AND markedly increases intermediate “Neither” judgments relative to ALL, consistent with a strong PROMPT×DISPLAY interaction.