

Supplementary Material

for

A Hierarchical Bayesian Analysis of Memory Load Effects on Visual Working Memory Precision

Erfan Jaripour 

Independent Researcher

erfanjaripour@gmail.com

July 2026

This document provides supplementary tables and figures supporting the analyses reported in the main manuscript. These materials include robustness analyses, model diagnostics, and additional visualizations that complement the primary results. All supplementary materials were generated using the same reproducible analysis pipeline described in the main manuscript.

Supplementary Tables

Table S1: Posterior summaries of the population-level memory-load effect (β) estimated separately for each experiment.

Experiment	Mean	SD	95% HDI	ESS (bulk)	$\hat{R}$
Exp1	-0.287	0.006	[-0.299, -0.277]	8252	1.00
Exp2	-0.377	0.007	[-0.389, -0.364]	6949	1.00
ExpS3	-0.354	0.008	[-0.368, -0.340]	6691	1.00

Table S2: Posterior summaries for the nonlinear hierarchical model, including population-level parameters and set-size effects.

Parameter	Mean	SD	95% HDI	ESS (bulk)	$\hat{R}$
α	0.864	0.102	[0.684, 1.067]	983	1.01
σ_α	0.354	0.084	[0.220, 0.507]	979	1.00
$\beta_{\text{setsize},1}$	1.364	0.019	[1.327, 1.398]	10189	1.00
$\beta_{\text{setsize},2}$	0.823	0.018	[0.789, 0.857]	9930	1.00
$\beta_{\text{setsize},3}$	0.378	0.017	[0.346, 0.410]	9861	1.00
$\beta_{\text{setsize},4}$	-0.031	0.017	[-0.063, 0.003]	8924	1.00
$\beta_{\text{setsize},5}$	-0.244	0.018	[-0.277, -0.210]	9385	1.00
$\beta_{\text{setsize},6}$	-0.578	0.020	[-0.615, -0.542]	9713	1.00
$\beta_{\text{setsize},7}$	-0.779	0.021	[-0.819, -0.740]	10321	1.00
$\beta_{\text{setsize},8}$	-0.933	0.023	[-0.975, -0.891]	9836	1.00

Table S3: Posterior summaries under different random seeds.

Seed	Parameter	Mean	95% HDI
42	α	0.826	[0.625, 1.009]
42	β	-0.336	[-0.343, -0.328]
42	σ_α	0.366	[0.225, 0.525]
123	α	0.830	[0.645, 1.035]
123	β	-0.335	[-0.343, -0.329]
123	σ_α	0.363	[0.235, 0.518]
456	α	0.828	[0.637, 1.036]
456	β	-0.336	[-0.342, -0.329]
456	σ_α	0.367	[0.226, 0.525]

Table S4: Posterior summaries under alternative prior specifications.

Prior	Parameter	Mean	95% HDI
Primary	α	0.827	[0.619, 1.017]
Primary	β	-0.336	[-0.343, -0.329]
Primary	σ_α	0.368	[0.236, 0.529]
Weak	α	0.828	[0.642, 1.031]
Weak	β	-0.336	[-0.343, -0.329]
Weak	σ_α	0.368	[0.225, 0.521]
Strong	α	0.819	[0.616, 0.998]
Strong	β	-0.336	[-0.343, -0.329]
Strong	σ_α	0.357	[0.230, 0.499]

Table S5: Posterior summaries under alternative sampling configurations.

Configuration	Parameter	Mean	95% HDI
Primary	α	0.827	[0.620, 1.019]
Primary	β	-0.336	[-0.343, -0.329]
Primary	σ_α	0.367	[0.231, 0.528]
LongTune	α	0.826	[0.630, 1.022]
LongTune	β	-0.336	[-0.342, -0.328]
LongTune	σ_α	0.368	[0.226, 0.531]
HighAccept	α	0.827	[0.640, 1.033]
HighAccept	β	-0.336	[-0.342, -0.328]
HighAccept	σ_α	0.368	[0.233, 0.530]

Table S6: Pareto- k diagnostic summaries for leave-one-out cross-validation.

Model	Maximum Pareto- k	No. Pareto- $k > 0.7$	No. Pareto- $k > 1.0$
Null	0.199	0	0
Hierarchical	0.185	0	0
Nonlinear	0.264	0	0

Supplementary Figures

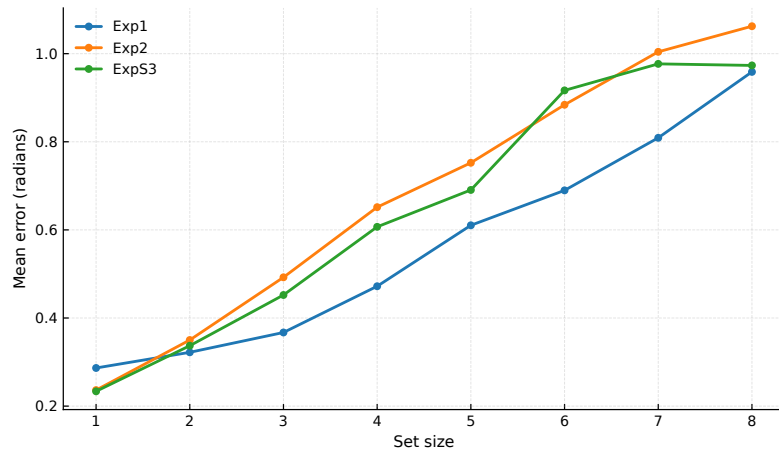


Figure S1: Mean angular error across memory set sizes for each experiment.

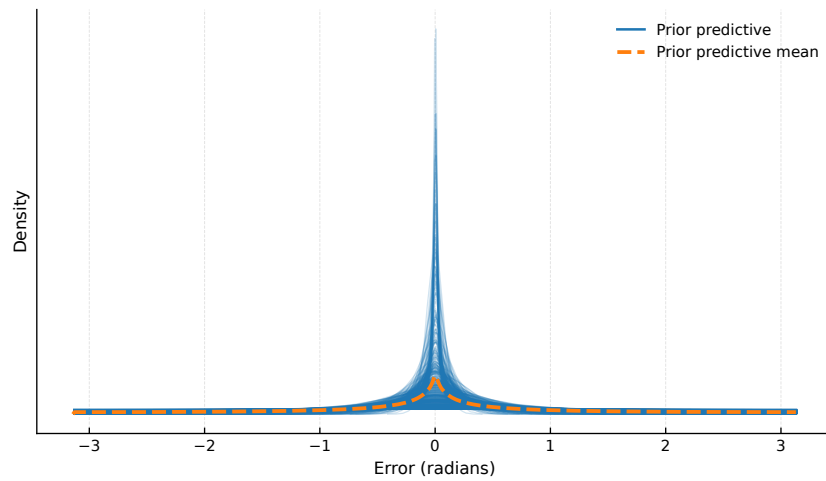


Figure S2: Prior predictive check for the hierarchical Bayesian model.

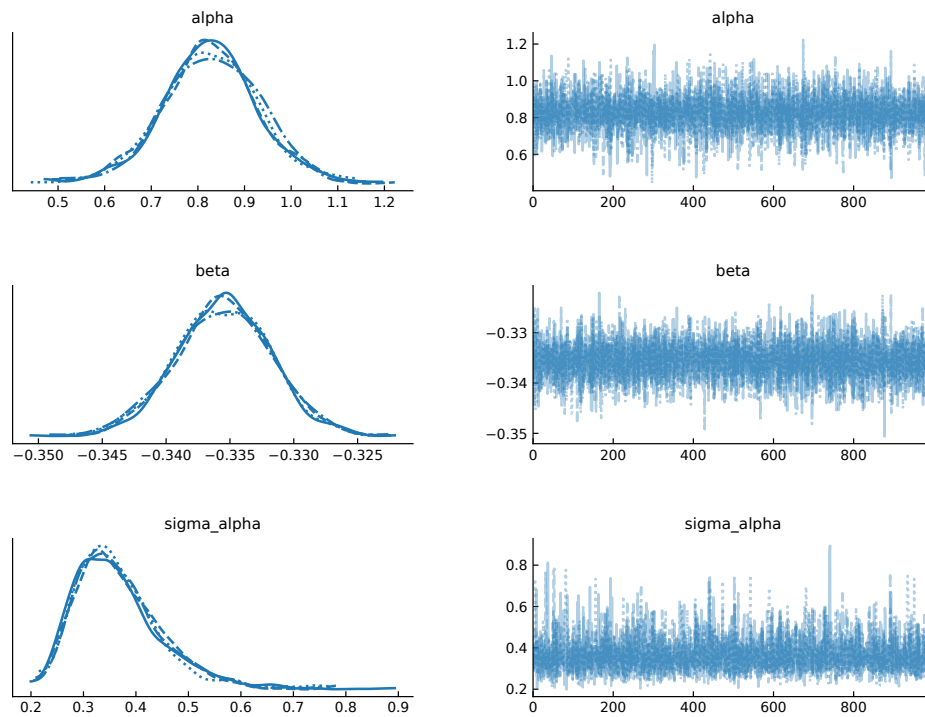


Figure S3: Trace plots for selected parameters from the hierarchical Bayesian model.

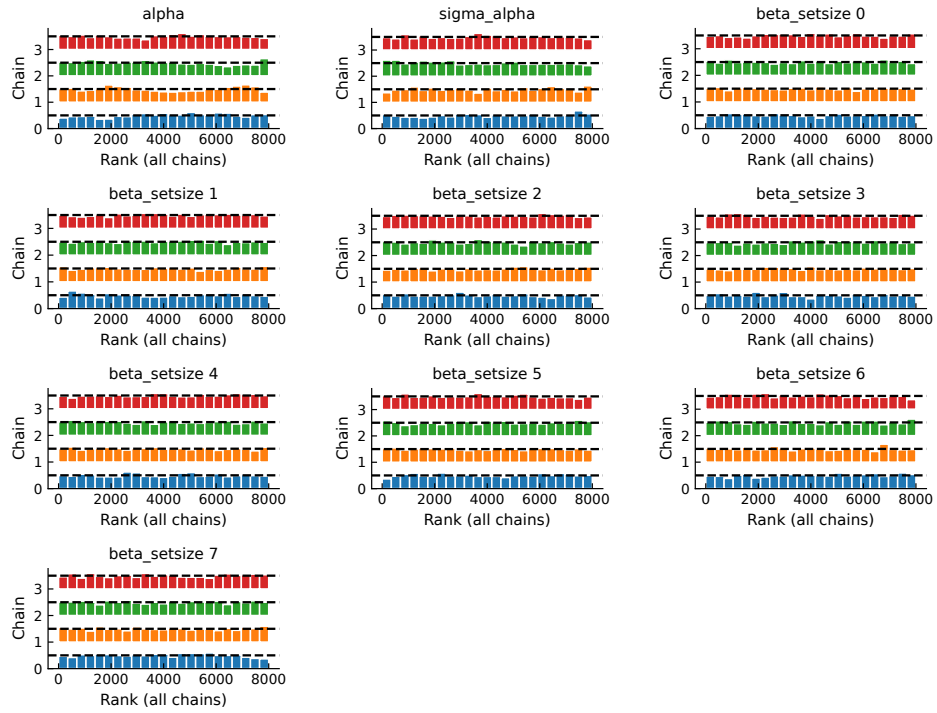


Figure S4: Rank plots for posterior samples of the nonlinear hierarchical model.

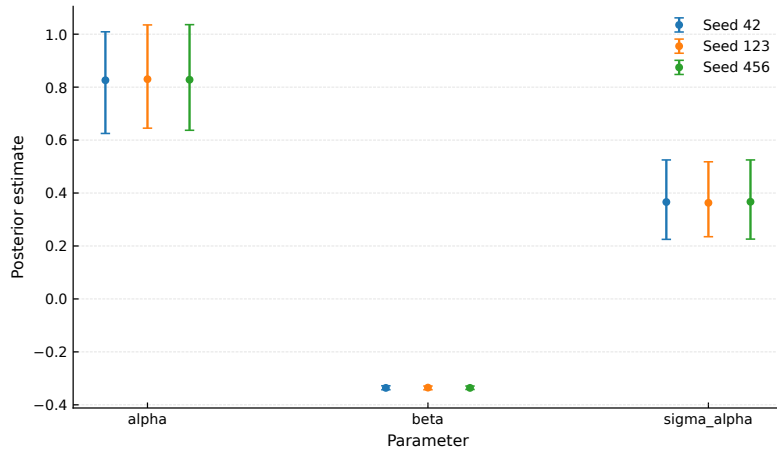


Figure S5: Stability of posterior estimates across independent random seeds.

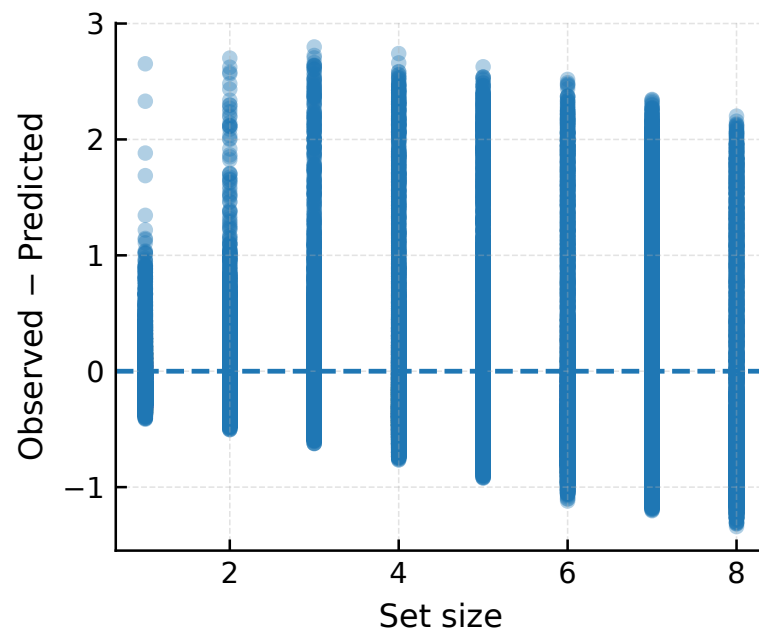


Figure S6: Residual diagnostics across memory set sizes for the hierarchical Bayesian model.