

Supplementary Information

Speed Over Strategy: Why Agent Velocity Dominates Aggregation Method in Crowd-Sourced Continuous Control

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Supplementary Table S1. Optimal speed v^* across adversarial conditions.

Full numerical values of optimal speed v^* for circle and square trajectories across adversarial ratios. For circular trajectories, $v^* = 2.03 \pm 0.03$ m/s is effectively constant across all tested conditions (troll-invariant). Square trajectories show $v^* \leq 1.0$ m/s, reflecting the lower optimal speed required for sharp 90° corners under delayed inputs.

Trajectory	Troll (%)	v^* (m/s)	R^2	RMSE at v^*
Circle	5	2.01	.993	0.241
Circle	10	2.03	.988	0.244
Circle	15	2.02	.985	0.247
Circle	20	2.08	.977	0.249
Circle	30	2.05	.969	0.258
Circle	40	2.04	.962	0.263
Square	all	≤ 1.0	—	0.063–0.102

Supplementary Table S2. Ceiling effect parameters by trajectory (30% adversarial ratio).

Asymptotic fit parameters and ceiling strength classification for four trajectory types at 30% adversarial ratio ($v = 5.0$ m/s). Δ RMSE indicates percentage improvement from $N=5$ to $N=200$ participants. R^2 is from fitting $RMSE(N) = a + b/\sqrt{N}$. Ceiling strength inversely correlates with trajectory complexity.

Trajectory	R^2 (30% troll)	Δ RMSE (N=5→200)	Ceiling strength
Circle	0.82	28.5%	Strong
Square	0.86	13.4%	Strong
Lemniscate	0.81	10.1%	Moderate
Zigzag	0.14	2.6%	Weak

Supplementary Table S3. Model comparison: additive vs. multiplicative.

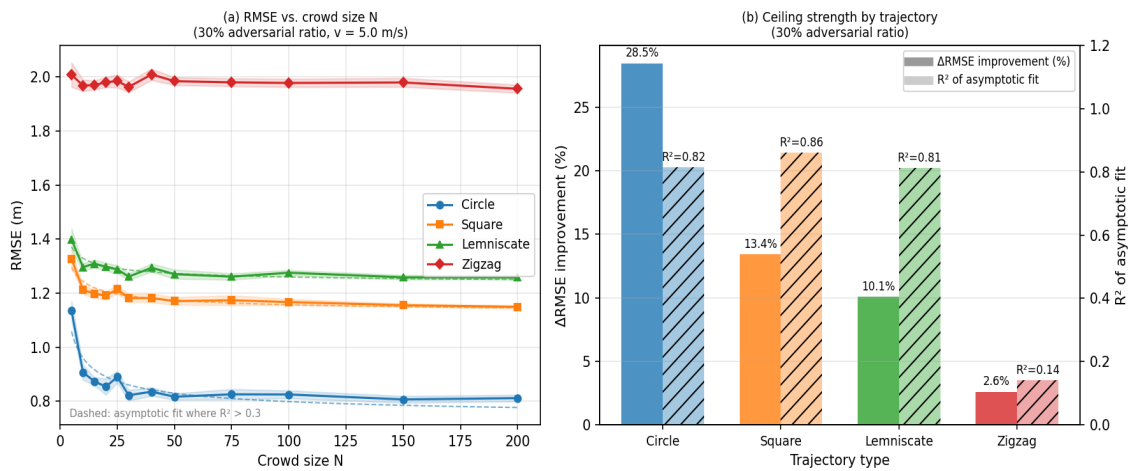
Performance comparison on training and out-of-sample (E5) data. The multiplicative model was selected for superior out-of-sample generalization despite marginally lower training R^2 .

Metric	Additive	Multiplicative
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R^2 (full data)	0.9863	0.9844
5-fold CV R^2	0.982 ± 0.010	0.978 ± 0.010
E5 mean error	8.3%	4.6%
E5 within 15%	5/6	6/6
Parameters	4	4

Supplementary Figure S1. Trajectory-dependent ceiling effect.

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(a) RMSE as a function of crowd size N for four trajectory types at 30% adversarial ratio ($v = 5.0$ m/s, $MC = 15$). Solid lines: mean RMSE; shaded regions: 95% CI. Dashed lines: fitted asymptotic models $RMSE(N) = a + b/\sqrt{N}$ where $R^2 > 0.3$. (b) Ceiling strength (Δ RMSE from $N=5$ to $N=200$) and R^2 of asymptotic fit by trajectory. Zigzag shows negligible benefit (Δ RMSE = 2.6%, $R^2 = 0.14$), indicating system delay as the binding constraint. Circle and Square show strong ceiling effects (Δ RMSE = 28.5% and 13.4%; $R^2 = 0.82$ and 0.86).

Simulation code and raw data: <https://github.com/betasbk/Thesis> (Zenodo DOI: 10.5281/zenodo.19413803).