**Supplemental materials**

This document contains the supplemental materials for the paper “Error accumulation when steering toward curves”. This document contains the distributional model equations and AICs values used for model selection for each steering metric.

**Reaction times**

Three candidate distributions were specified within the multilevel models: Gamma, Inverse Gaussian, and Gaussian distributions. Table S1 highlights the AIC values of these models.

*Table S1: AIC summaries from the fitted reaction time models*

|  |  |  |
| --- | --- | --- |
| Model | Distribution family | AIC |
| LMM | Gaussian | 1899.15 |
| GLMM | Gamma | 3.37 |
| **GLMM** | **Inverse Gaussian** | **-334.32** |

The model specifying the Gamma distribution was the most parsimonious of the candidates. However the model produced a singular estimate within the random effects structure. Singmann & Kellen (2019) propose that when the random effects structure is singular, it should be simplified by first removing the random correlations. With an experimental design with two or more factors, the random correlation parameters make up the largest number of random effects within the model. This was done for the reaction time model and produce a model with no singular estimates. This final model was used to investigate the effects of radius and starting position on reaction times, and is specified below:

Where subscript indicates the condition, subscript indicates the participant, represents the identity link function on the mean of the response, and is a matrix expressing the variance and covariance parameters. Because the random correlation parameters have been removed from the model, they are replaced by 0s in the distributional model equation.

**Lateral position errors**

Three candidate models were attempted to be fitted for the lateral position error model. However, the model specifying the Inverse Gaussian distribution repeatedly failed to converge. This can sometimes occur because the identity link function can generate numerical instability when modelling non-zero positively skewed responses due to the linear predictor not being constrained to only produce non-zero values. Hence when the dependent variable has very small positive values, the model can value to converge as negative values are predicted which cannot be supported by the Inverse Gaussian distribution. As such, the model containing this distribution was removed from consideration. The AICs of the remaining models are highlighted in Table S2. The model specifying the Gamma distribution appears to provide the most parsimonious fit.

*Table S2: AIC summaries from the fitted lateral position error models*

|  |  |  |
| --- | --- | --- |
| Model | Distribution family | AIC |
| LMM | Gaussian | -10566.53 |
| **GLMM** | **Gamma** | **-12765.18** |

Once again, the Gamma model produced singularity estimates. Therefore, the correlations were removed from the random effects model structure to simplify the model. The distributional model was specified as follows:

Where subscript indicates the condition, subscript indicates the participant, represents the identity link function on the mean of the response, and is a matrix expressing the variance and covariance parameters. Because the random correlation parameters have been removed from the model, they are replaced by 0s in the distributional model equation.

**Steering rate**

Finally, three candidate models were fitted for the steering rate metric. The AICs of the candidate models can be found in Table S3. The model specifying the Gamma distribution was the most parsimonious.

*Table S3: AIC summaries from the fitted steering rate models*

|  |  |  |
| --- | --- | --- |
| Model | Distribution family | AIC |
| LMM | Gaussian | -1206.74 |
| **GLMM** | **Gamma** | **-2827.99** |
| GLMM | Inverse Gaussian | -2667.03 |

Because the mode was singular, the correlations were once again removed. The remaining model structure used to assess the effect of radius and starting position on steering it highlighted as follows:

Where subscript indicates the condition, subscript indicates the participant, represents the identity link function on the mean of the response, and is a matrix expressing the variance and covariance parameters. Because the random correlation parameters have been removed from the model, they are replaced by 0s in the distributional model equation.