

I have now read the latest revision of the recommended-in-principle manuscript entitled “Behavioral flexibility is manipulable and it improves flexibility and problem solving in a new context” by Logan et al.

On the substance of the manuscript, I pretty much have nothing left to say. The authors have consistently taken into account my comments about the limitations of their data, and about conveying definitions to a broader audience, resulting in a significantly better manuscript.

I do have however some comments left about some stylistic, syntax and organisation choices and/or mistakes. Some are continuations of previous comments about how to integrate preregistered and post-registration material in a way that is stylistically consistent and easy-to follow by the reader. Some are more about internal inconsistencies in style/syntax within the manuscript itself, especially around equation syntax. I acknowledge that some of these stem directly from the methods used to layout the text of the manuscript (I reviewed, again, the EcoEvoRxiv pdf version); nonetheless, please be very careful and proofread the entire manuscript against the comments I detail below, not just the specific lines where I point these issues. In my opinion, once these stylistic issues are thoroughly ironed out, I think the manuscript is ready to recommend.

## Minor comments

**Line 23:** please remove “in species” to avoid unnecessary repetition with “species” later in the same sentence

**Line 108:** Maybe the header should be “Preregistered hypotheses” rather than simply “hypotheses” to really hammer the point home

**Line 148:** should be “(some of which ARE tested in McCune et al 2023)”, not “will be”. Please be careful with both tense and year when referencing the companion preprints to this one.

**On the Methods:** It should be made unambiguously clear whether everything under the “Methods” header (lines 181-342) is a summary of the preregistered methods or of the actually used methods. Current wording and styling obfuscates this; for instance, the header “deviations from preregistrations” line 343 is of the same style as the main “Methods” header, implying it is something different from it. I suggest bringing the deviations under the general methods header, and being extremely clear with subheaders or within the text what is a summary of the preregistered methods, and what is not.

**Line 261:** “following methods by Hartig” can be deleted, since the DHARMa package is already cited.

**Lines 264 vs 196,** and others: in some places of the Methods (L196), text after a colon is treated as part of the same sentence with the text immediately before, and therefore not capitalised. In others (L264) text immediately after a colon is capitalized, indicating it is considered a separate sentence. This inconsistency make it difficult to read the text, and in some cases results in verb-less sentences where there should really be a verb. Please check thoroughly the manuscript, especially the methods, for this. Similarly, variables descriptions are treated in many (but not all) places as verb-less lists, yet are including inline as normal sentences would be. E.g. Line 265 “Explanatory variable: reversal number. Random variables: batch (batch is a test cohort, consisting of 8 birds being tested simultaneously and there were multiple batches included in the analysis) and ID (random effect because there were repeated measures on the same individuals).” (see also L284-285). This hurts readability; please convert that either to actual lists (e.g. bullet points) or rewrite to full sentences.

**Across the methods and supplementary:** There are several issues around the writing of equations. I suggest the authors use (Edwards & Auger-Méthé, 2019) as one example of recommended practices. Among these issues (again, I am only pointing representative examples, the authors should check carefully the entire manuscript):

- Equations are supposed to be parts of sentences. The phrase starting L287 should include a comma after the first equation, and a comma, semi-colon or a period after the second equation, depending on whether the authors consider line 290 to start a new sentence or not.
- More importantly, there are major inconsistencies in indexing – If a variable is indexed by individual in one equation (e.g.  $\lambda_i$ , the individual rate by bird in equation line 295), then all individual-level variables/elements should also be indexed similarly across the manuscript unless explicitly noted. For

instance, this should be *at least*  $\text{latency}_i$  and not latency line 295, and individual indexing should also be added in the equation lines 288-289, among others. Since there are multiple observation per individual, the notation should most likely be at least:

$$\begin{aligned}\text{latency}_{i,j} &\sim \text{gamma} - \text{Poisson}(\lambda_{i,j}, \phi), \\ \log(\lambda_{i,j}) &\sim \alpha + \beta \text{trials}_{i,j},\end{aligned}$$

where  $i$  is the individual and  $j$  the observation. Please be also careful about whether or not coefficients ( $\alpha$  and  $\beta$ ) should be individual-indexed ( $\alpha_i$ ,  $\beta_i$ ) or not, depending on the presence or not of individual-level random effects, and what that says about the way priors should then be written.

**Line 451:** just to check, when you say you removed the observer random effect because inter-observer reliability was virtually 1, can you confirm you also removed/merged together the different observer replicates? To avoid artificially inflate the sample size.

**Line 507:** I would suggest to start the caption by “In the manipulated birds, the number(…)” Figure 4: I am still not sure why the authors do not add the predicted trend line from table 2 to this plot. This would be helpful.

**Figure 6:** it might be interesting to also add the unmanipulated birds to that plot, on a second row for instance, to create a contrast. As far as I can tell the relevant posteriors exist \_ from the same models table 1 & 3 used to extract the predictions from the manipulated birds.

**Line 726:** there is a missing period between “shapes” and “Shapes”

**Line 895:** “parameter”, not “paramter”

**Reference list:** the main text and the supplementary material should have separate reference lists. Please ignore this comment if this was already on the to-do list for the final version, and the current state just reflects the way the document was knitted for submission

## References

Edwards, A. M., & Auger-Méthé, M. (2019). Some guidance on using mathematical notation in ecology. *Methods in Ecology and Evolution*, 10(1). <https://doi.org/10.1111/2041-210X.13105>