**Reviewer 1**

- Lack of Sensitivity Analyses for some Key Methodological Decisions: Certain methodological choices in this manuscript diverge from approaches used in previous works. In these cases, I recommend the following: (i) The authors could provide a clear and detailed justification for these deviations from established methods, and (ii) supplementary sensitivity analyses could be included to ensure the robustness of the findings, demonstrating that the results are not driven primarily by these methodological changes. Below, I outline the main areas where such evaluations are needed:

> Use of Communicability Matrices for Structural Connectivity Gradients: The authors chose to construct structural connectivity gradients using communicability matrices, arguing that diffusion map embedding "requires a smooth, fully connected matrix." However, by definition, the creation of the affinity matrix already involves smoothing and ensures full connectedness. I recommend that the authors include an analysis of

what happens when the communicability matrix step is omitted. This sensitivity test is crucial, as it would help determine whether the main findings hold under a simpler construction of the affinity matrix. If the results significantly change, it could indicate that the observations are sensitive to this design choice, thereby raising concerns about the robustness of the conclusions. Additionally, if the concern is related to the large range of weights in the raw structural connectivity (SC) matrix, a more conventional approach is to apply a log-transformation to the SC weights (e.g., log(1+**𝑆𝐶𝑖𝑗**)), which may yield a more reliable affinity matrix without the need for communicability measures.