

Dear Editors and Reviewers,

We thank you for the opportunity to revise our manuscript. We are deeply grateful to all reviewers for their time, insightful comments, and constructive suggestions, which have significantly improved the quality and rigor of our work. We have carefully addressed all points raised in the review reports. Our point-by-point responses are detailed below, and all changes have been incorporated into the revised manuscript.

Reviewer 2:

This manuscript quantifies hip–knee and knee–ankle coupling during soccer instep kicking using a vector-coding approach and compares experienced athletes with novices. The study design is clear and follows mainstream methodology; the sample size is adequate for between-group comparisons. The findings align with prior evidence on proximal–distal sequencing and more efficient coupling patterns in trained players. The Methods section thoroughly specifies the three phases (backswing, leg-cocking, and leg-acceleration) and the four-quadrant coupling-angle rules, enabling reproducibility. Overall, the work is publication-ready; it primarily serves as a quantitative complement linking coordination structure to performance and offers practical implications.

1. Tighten the title to emphasize “quantitative method + population + skill,” and remove generic terms like “Characterization...”. A possible revision is:
“Inter-segmental coordination during soccer instep kicking: a vector-coding comparison between experienced athletes and novices.”

Response: The title has been revised as recommended.

2. In the first paragraph of the Introduction, please clarify the positioning of vector coding vs. CRP. The section currently lacks recent CRP-based evidence that (i) demonstrates level-dependent differences and (ii) links coordination to endpoint (foot) velocity. We recommend citing the study below in your “method choice & performance relevance” paragraph. That work compared elite vs. amateur players across three anatomical planes using CRP, and reported significant correlations between CRP and foot speed (hip–knee CRP, sagittal plane: negative; knee–ankle CRP, transverse plane: positive). This can serve as an external benchmark for interpreting your vector-coding results in relation to performance.

- Zhou, Z., et al., (2025). *European Journal of Sport Science*, (10.1002/ejsc.70041).

Response: The positioning of vector coding vs. CRP was added (**Lines 39 - 43**), and the study above was cited as recommended (**Lines 84 - 86**).

3. Literature: from qualitative to quantitative timing/phase evidence

The overview of the proximal–distal kinetic chain and training-induced reorganization is

solid, but the narrative leans on qualitative sources. Please add 1–2 recent quantitative studies that resolve sequencing/timing across phases or planes. For example:

- Augustus S, et al.,... *Journal of Biomechanics*. (10.1016/j.jbiomech.2023.111920)
- Zhou, Z., et al.,. *Applied Sciences*, (10.3390/app13169097).

Response: As recommended, we have incorporated both citations into the manuscript. The study by Augustus et al. has been cited in the paragraph discussing the proximal-to-distal sequence of the kicking leg, as it provides direct quantitative timing evidence for this phenomenon in soccer (**Line 79, reference 19**). The work by Zhou et al., which expertly links coordination features to performance outcomes, has been added to the introduction section that establishes the relationships between inter-segmental coordination and sport performance (**Line 54, reference 12**). We believe these additions significantly enhance the quantitative foundation of our narrative.

4.Methods: phase definitions & time normalization (0–100%)

You list TO, MHE, MKF, and FCB, but please make time-base alignment explicit in Methods and/or the figure captions Figure 1-2: Add legends for the "positive and negative directions" (for example, hip flexion as (-)/ extension as (+) has been written, but it is recommended to supplement in the Y-axis title), and mark the "three-stage time window" in shadow on the coupling Angle diagram.

Response: The Figure 1 have been updated to include clear legends defining positive and negative joint movement directions. As requested, the three-stage time windows have been distinctly marked using shaded backgrounds in the coupling angle diagrams as well as Figure 1 (for the consistency of the figures), to visually delineate each phase of the kicking movement (**Figures 1 and 2**). It is important to note that the shading was applied to the plots for the experienced group. We chose this presentation for two reasons: first, to maintain visual clarity and avoid over-crowding the figures by presenting the identical time-window information twice; and second, because the experienced athletes exemplify the prototypical and well-defined coordination phases under investigation. We believe that marking the phases on their data most effectively illustrates the temporal structure referenced in the text, and this fulfills the reviewer's request to demarcate the stages for reader comprehension. The figure captions were revised for Figures 1 and 2 (**see Figure captions**).

Once again, we extend our sincere appreciation to the Editors and Reviewers for your diligent work and invaluable guidance. We believe the manuscript has been substantially improved and hope that it is now acceptable for publication in bioengineering.