Dear Dr. Qin,    
    
Thank you for submitting your manuscript to iScience. I am including the comments that reviewers made on your paper. The referees expressed interest in the study, but they also have a number of criticisms and suggestions. We would be interested in considering a revised version of the manuscript that addresses these concerns in detail.    
    
We have currently set the due date for this revision to be Apr 23, 2025. We are flexible about this schedule if more time is needed to complete important experiments. Please let us know if you require additional time. We understand that changes to your circumstances or those of your colleagues can lead to challenges in completing revisions. If that for you and it has an impact on your ability to revise your manuscript, please let us know, and we will be happy to work with you on a plan that works for you to keep your paper moving forward.

* **STAR Methods:**Please keep in mind that should we publish your paper, it will need to comply with our publication guidelines. This includes the STAR Methods format, which Cell Press introduced to improve the rigor in reporting methods and resources for reproducibility. At this stage, we strongly encourage you to use the STAR Methods format so that both the editors and the reviewers can review the details of the experimental procedures and consider a version of the manuscript that closely reflects what would be published. This section replaces the Transparent Methods section. For detailed instructions on STAR Methods and a template for the Key Resources Table, see our [STAR Methods webpage](https://urldefense.proofpoint.com/v2/url?u=https-3A__track.editorialmanager.com_CL0_https-3A-252F-252Fwww.cell.com-252Fstar-2Dauthors-2Dguide_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_RDN3exau7dKy4SJK0vwjCM0t-5FYDQbS7w64BqXNk2hBE-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=nNdfBP9UX03A_D6k2-2mdk70bNbJynX2gccnLbb8u0M&e=). You may also create the Key Resources Table using [this interactive webform](https://urldefense.proofpoint.com/v2/url?u=https-3A__track.editorialmanager.com_CL0_https-3A-252F-252Fstar-2Dmethods.com_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_S8x8C1P1-5F1uf7hju1CgC6o9uGJ30rcKCS9SJXFRQZ8Q-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=YC-Skl2qK7yjsTvJgxtDPM-KdutYwYuC3XVqeZjv6iY&e=). Please contact me if you have any questions about restructuring your manuscript using the **STAR Methods** format.
* Please refer to our online guide for information about how to organize the Supplemental Information of your paper. Please note that, in particular, ALL the methods related to the manuscript should be placed in the STAR Methods section of the main document. However, the STAR Methods should not contain figures (aside from chemical reaction schemes) or tables that are complex or numbered. Additional characterization (such as NMR spectra) should be included as supplemental figures in the Supplemental PDF.
* Cell Press journals include two unique features in the online Summary section of articles:**Graphical Abstracts and Highlights**. These features are optional at this stage but would be required before your paper could be formally accepted. Details about preparing these items are available on the [Information for Authors](https://urldefense.proofpoint.com/v2/url?u=http-3A__track.editorialmanager.com_CL0_http-3A-252F-252Fwww.cell.com-252Fiscience-252Fauthors_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_AF-2DaSrPXO74XjWc9Kt7YyGsAtfS-5FxHRLPwA2PGUjYBE-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=FYE7nLnN1v6cbUed04Ip_qV2vdXMtbPUB5E1s8LobKg&e=) page. A graphical abstract allows readers to quickly gain an understanding of the main take-home message of the paper. Please visit our [Graphical Abstract guide](https://urldefense.proofpoint.com/v2/url?u=http-3A__track.editorialmanager.com_CL0_http-3A-252F-252Fwww.cell.com-252Fpb-252Fassets-252Fraw-252Fshared-252Ffigureguidelines-252FGA-5Fguide.pdf_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_TJ6GJbIuD7uE3pIxMpoNSHqh-2Dw-2Dby3KjBNv3DqCegvE-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=fqy-4J9Qp6b9ghihZ6ZQ_mv8wSl271k9n6Efwe9ZIyw&e=) for specifications and examples. On the EM page where you are asked to upload your files, please choose "Graphical Abstract" to upload your file. We encourage you to avoid abbreviations in the graphical abstract, as they may impair readability.
* Should your manuscript be accepted for publication in the future, we’ll encourage you to contribute any of these optional features:
* **Figure360 video:**You can create a narrated, animated version of your figure that helps the reader zoom in on the most important take-home message in a matter of minutes. For guidelines and examples, please click [here](https://urldefense.proofpoint.com/v2/url?u=http-3A__track.editorialmanager.com_CL0_http-3A-252F-252Fwww.cell.com-252Ffigure360_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_8cktTtEV8HMGFik-2Dr3jhelwxPcmb0Sz8iJ1vFKwOU80-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=UB_ZGUwcsfNzqdIe5z_mgfHBh_M97smBci9OHpMfKQE&e=).
* **Mendeley Data:** Publish your original, unprocessed data through [Mendeley Data](https://urldefense.proofpoint.com/v2/url?u=http-3A__track.editorialmanager.com_CL0_http-3A-252F-252Fdata.mendeley.com-252F_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_ak4Y2XUf-2D0MFicwivtuSTJXmJyo-5FC3-2D23dsj86xL2UU-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=06LFeYubP7a5PMAw_0LQjHegSvQosCkv9shAO_fclWw&e=). We will link your published paper and the dataset to each other. For more information, please click [here](https://urldefense.proofpoint.com/v2/url?u=http-3A__track.editorialmanager.com_CL0_http-3A-252F-252Fwww.cell.com-252Fpb-2Dassets-252Fshared-252Fguidelines-252Fmendeley-2Ddata-2Dinstructions.pdf_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_3z7H9tYq4roNAMxl0wKhvO8qKwycoqRD5cLApnmCqL8-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=HUUkchnn6ROGbRCHUUsYOAwBRgbTIHT-Q5YYlnmRQmw&e=).

When your revisions are complete, please submit your revised paper online at: [https://www.editorialmanager.com/iscience/](https://urldefense.proofpoint.com/v2/url?u=https-3A__www.editorialmanager.com_iscience_&d=DwQFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=IZ7MapZ_E2oY1cEpPDNUa5hLlOz3JNsZWyPUi7UNMuQ&e=) and include a point-by-point list of the revisions made to address the reviewers' comments. For future reference, please note that papers cannot be accepted until any necessary accession numbers are provided.     
   
​Also, we recently updated our reviewer questionnaire to help reviewers and authors get the most out of the peer review process. We would appreciate your feedback. Please visit the survey [here](https://urldefense.proofpoint.com/v2/url?u=https-3A__track.editorialmanager.com_CL0_https-3A-252F-252Fwww.surveymonkey.com-252Fr-252FSPSVBFD_1_010f01952f37f616-2D95b1eb07-2Db682-2D429a-2Da6b2-2D4e945571b666-2D000000_58PBKQ6S4sKqlBe7QdPb-5FMKuxyEyyj4up9TJPOHOy98-3D199&d=DwMFaQ&c=009klHSCxuh5AI1vNQzSO0KGjl4nbi2Q0M1QLJX9BeE&r=0dz1O6V0EqiEFi8BbSupFHH25QQfSbuI8xZzzQCX7yI&m=85lU57KMtO8BbZus5_xSVxuC51mEfnGhslJlY8134-PTwVeCRk0YDvuI8FkYjaMM&s=S_l1SuIFfXJpJbBYZNEMqWoJNVJRvHAENDpX2uOtNTs&e=).

Thanks again for submitting your work to iScience. I look forward to reading your revised manuscript.    
    
Sincerely,    
    
Michelle Muzzio  
Deputy Editor, iScience    
    
Reviewers' comments:    
Reviewer's Responses to Questions

**Main findings** *(seen by authors, reviewers, and editors)*  
What are the main findings/advancements the paper makes with respect to literature?  Your thoughts on the importance/interest of the manuscript to a specific or interdisciplinary community would be helpful.

Reviewer #1: This paper examines the dynamics of human teams, with a particular focus on the relationship between behavioral and physiological markers and their combined impact on team performance. The authors conduct VR experiments and propose a multi-modal biomarker that assesses the predictability of a team member’s behavior. This biomarker integrates physiological and behavioral aspects, offering a novel perspective on team dynamics.  
  
At the same time, the authors challenge the prevailing assumption that synchrony is a reliable indicator of high-performing teams, providing a valuable contribution to the field. The research is inherently interdisciplinary, and its findings are relevant to a broad, cross-disciplinary audience.

Reviewer #2: The authors developed the Apollo Distributed Control Task (ADCT), a virtual team task requiring sustained attention and cooperation among team members as they navigate a spacecraft on a controlled (albeit unplanned) descent to Earth. The task provides an opportunity to synchronize subject behavior and physiology with the task environment. VR provides immersion and strict environmental control, and this approach is particularly novel because it supports teams in VR. During each of the team's three experimental sessions (45 trials each), each of the three team members provided EEG, pupillometry, eye gaze, speech, and controller input data.  
Results indicate steady improvement in team performance over time. Over the three sessions, self-reports of one's helpfulness decline while familiarity rises, suggesting a more nuanced understanding of one's contribution and also providing support of the authors' contention that self-report data may reveal biases in respondents' perceptions (thus justifying the need for multimodal measures). Over sessions, no synchronization emerged within team measures of pupil dynamics, EEG, controller inputs, and speech events.  
Synchrony among more than two team members remains understudied, and results showed that speech event synchrony positively predicted team performance while controller synchrony was marginally and negatively associated with team performance; physiological synchrony showed no relation, highlighting behavioral synchrony's predictive power for team performance.  
A multi-head attention model found that predictability of team member behavior (measured as controller input of a team member in the 0.5 seconds prior to passing through a ring and modeled as a function of the other two teammates' EEG, pupil size, and controller inputs during the 1.5 seconds prior to passing through a ring) did not vary across sessions; however, predictability was positively associated with team performance. This is a particularly novel finding given the lack of prior studies modeling performance as a function of behavioral and psychological synchrony. This stands out as a particularly important finding in the context of teams with interdependent roles whose success relies on each team member simultaneously executing their task responsibilities in order for the team to meet its goal.

**Revisions required for publication** *(seen by authors, reviewers, and editors)*  
For each of the main points of the paper indicated above, please discuss whether the data sufficiently support the conclusions. If the point is not sufficiently supported, please indicate the kind of evidence you feel is required for that specific point, include any suggestions for specific additional work, and the reason for this additional work. Please assess any critical flaws with reported research design and data robustness.

Reviewer #1: I believe the authors provide sufficient evidence to support the main results highlighted above. The paper includes a visual representation of the findings (which is, per se, ok); however, I would encourage the authors to make their dataset publicly available to align with best practices and enhance the replicability of their results.

Reviewer #2: The measure of team performance needs to be clarified for the GLMM results  
p. 5, line 193 "Team performance was quantitatively evaluated by the team's total number of ring obstacles successfully navigated" Based on this description I was expecting the team performance variable to by modeled with a linear mixed-effect model. Instead, a GLMM was chosen. What exactly was the dependent variable in the results and as described in 4.12? Was performance dichotomized using a median split to fit within a binary GLMM? Or was the distribution a better for for a Poisson GLMM? Additional details and justification of the chosen modeling approach would be helpful for understanding the choice of a GLMM modeling procedure rather than a LMM.

**Optional and minor work recommended to authors** *(seen by authors, reviewers, and editors)*  
Please list additional work which would strengthen the paper, but is not strictly necessary to prove its main claims.

Reviewer #1: The paper is generally very well-prepared, and despite addressing the topic from an interdisciplinary perspective, the authors have done an excellent job of making it accessible to a broad audience. I have a few minor comments that I believe could further enhance the quality of the paper:  
  
(1) Did the authors consider whether the task might be perceived as too complex, potentially hindering participants from taking appropriate action? For instance, research by Dietrich Dörner has explored how complexity can affect decision-making and problem-solving.  
  
(2) It is somewhat unconventional to present results in Section 2 (or to label it Results). While this did not disrupt the reading flow, the authors might reconsider the section’s title, as it not only presents results but also provides an outline of the experimental setup, with further details elaborated later in the paper.  
  
(3) Lines 379–400 are densely formulated. The authors may want to consider rephrasing these paragraphs to improve readability and accessibility for a wider audience.  
  
(4) Line 411: Please specify what the positive correlation refers to (i.e., the correlation of X with Y).  
  
(5) Some sections, such as Section 2.5, are quite brief. By expanding on the main messages, the authors could make these parts more informative and accessible to a diverse readership.

Reviewer #2: p. 3, l 120: please provide a brief definition of Boundary Avoidance Task (i.e. briefly, what are teams trying to do?)  
  
p. 4, l 184: The wording of the last line in the caption is awkward. I recommend changing it to something clearer like "Asterisks indicate statistically significant differences, defined as p < .001 while ns indicates the difference is not significant"  
  
p. 7, section 2.3: Say more about how to interpret speech event synchrony. Based on how it's described here and in the Methods section, it sounds like this captures overlapping speech events. I am not convinced this captures "verbal coordination" as described in the text, unless some time-lag was applied to capture sequential speech events.

**Transparency of reporting** *(seen by authors, reviewers, and editors)*  
Does the paper adequately report the methods, statistics, data, and code? Are data and code availability sufficient to evaluate the manuscript? If not, please elaborate.

Reviewer #1: The paper adequatly reports the results. I would encourage the authors to make their dataset publicly available to align with best practices and enhance the replicability of their results.

Reviewer #2: Other than the performance measure mentioned in the previous section, the description is sufficient for proper evaluation of the manuscript. The Methods section and supplementary materials provide extensive detail of sampling, data collection procedures, data processing, and modeling; this is all sufficiently transparent.

   
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(5) Some sections, such as Section 2.5, are quite brief. By expanding on the main messages, the authors could make these parts more informative and accessible to a diverse readership.  
  
  
Reviewer #2: No additional comments