Speed-mediated properties of schooling

Maud I. A. Kent, Ryan Lukeman, Joseph T. Lizier and Ashley J. W. Ward

Review History

RSOS-181482.R0 (Original submission)

Review form: Reviewer 1 (Mate Nagy)

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Is it clear how to access all supporting data?
Yes

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No

Recommendation?
Accept with minor revision (please list in comments)

Comments to the Author(s)
This paper reports experiments on schooling of groups of 5 fish belonging to 5 closely related species and studies the effect of speed, polarization and elongated shape of the shoal in relation to the information transfer between the individuals. The manuscript is interesting and generally well written. The description of the experiment and the analysis are sound and the results fit well into the existing literature, and on the other hand, aiming to fill a gap in an important but yet not so much explored area. It is also a strength of the manuscript that the authors have done the experiments on multiple (although closely related) species rather than a single selected model. I have only minor comments to be addressed.

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Max Planck Institute for Ornithology, Department of Collective Behaviour &
Department of Biology, Konstanz University, Konstanz, Germany
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B. Pettit, Z. Akos, T. Vicsek, D. Bior (2015) Speed Determines Leadership and Leadership Determines Learning during Pigeon Flocking, Current Biology 25 (23), 3134-4147

Review form: Reviewer 2

Is the manuscript scientifically sound in its present form?
No

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Is it clear how to access all supporting data?
Yes

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
I do not feel qualified to assess the statistics

Recommendation?
Major revision is needed (please make suggestions in comments)

Comments to the Author(s)
Review of the paper RSOS-181482:

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By Kent, Lukeman, Lizier, Ward

Summary:

This paper reports on an experimental study on the collective dynamics of swimming fish, using 5 species of rainbowfish from the Melanoteaenia family. The experiments consist of free swimming trials of groups of 5 fish in an annular swimming arena. The authors use video recordings to discuss the fish school morphology and the information transfer within the group as a function of the swimming speed.

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Decision letter (RSOS-181482.R0)

19-Nov-2018

Dear Dr Kent,

The editors assigned to your paper ("Speed-mediated properties of schooling") have now received comments from reviewers. We would like you to revise your paper in accordance with the referee and Associate Editor suggestions which can be found below (not including confidential reports to the Editor). Please note this decision does not guarantee eventual acceptance.

Please submit a copy of your revised paper before 12-Dec-2018. Please note that the revision deadline will expire at 00.00am on this date. If we do not hear from you within this time then it will be assumed that the paper has been withdrawn. In exceptional circumstances, extensions may be possible if agreed with the Editorial Office in advance. We do not allow multiple rounds of revision so we urge you to make every effort to fully address all of the comments at this stage. If deemed necessary by the Editors, your manuscript will be sent back to one or more of the original reviewers for assessment. If the original reviewers are not available, we may invite new reviewers.

To revise your manuscript, log into http://mc.manuscriptcentral.com/rsos and enter your Author Centre, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision. Revise your manuscript and upload a new version through your Author Centre.

When submitting your revised manuscript, you must respond to the comments made by the referees and upload a file "Response to Referees" in "Section 6 - File Upload". Please use this to document how you have responded to the comments, and the adjustments you have made. In order to expedite the processing of the revised manuscript, please be as specific as possible in your response.

In addition to addressing all of the reviewers' and editor's comments please also ensure that your revised manuscript contains the following sections as appropriate before the reference list:

• Ethics statement (if applicable)
If your study uses humans or animals please include details of the ethical approval received, including the name of the committee that granted approval. For human studies please also detail whether informed consent was obtained. For field studies on animals please include details of all permissions, licences and/or approvals granted to carry out the fieldwork.

• Data accessibility
It is a condition of publication that all supporting data are made available either as supplementary information or preferably in a suitable permanent repository. The data accessibility section should state where the article's supporting data can be accessed. This section should also include details, where possible of where to access other relevant research materials such as statistical tools, protocols, software etc can be accessed. If the data have been deposited in an external repository this section should list the database, accession number and link to the DOI for all data from the article that have been made publicly available. Data sets that have been deposited in an external repository and have a DOI should also be appropriately cited in the manuscript and included in the reference list.

If you wish to submit your supporting data or code to Dryad (http://datadryad.org/), or modify your current submission to dryad, please use the following link:
http://datadryad.org/submit?journalID=RSOS&manu=RSOS-181482

• Competing interests
Please declare any financial or non-financial competing interests, or state that you have no competing interests.

• Authors' contributions
All submissions, other than those with a single author, must include an Authors' Contributions section which individually lists the specific contribution of each author. The list of Authors

should meet all of the following criteria; 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published.

All contributors who do not meet all of these criteria should be included in the acknowledgements.

We suggest the following format:
AB carried out the molecular lab work, participated in data analysis, carried out sequence alignments, participated in the design of the study and drafted the manuscript; CD carried out the statistical analyses; EF collected field data; GH conceived of the study, designed the study, coordinated the study and helped draft the manuscript. All authors gave final approval for publication.

• Acknowledgements
Please acknowledge anyone who contributed to the study but did not meet the authorship criteria.

• Funding statement
Please list the source of funding for each author.

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Once again, thank you for submitting your manuscript to Royal Society Open Science and I look forward to receiving your revision. If you have any questions at all, please do not hesitate to get in touch.

Kind regards,
Royal Society Open Science Editorial Office
Royal Society Open Science
openscience@royalsociety.org

on behalf of Professor Brooke Flammang (Associate Editor) and Professor Kevin Padian (Subject Editor)
openscience@royalsociety.org

Associate Editor's comments (Professor Brooke Flammang):
Dear Authors,
Both reviewers find the paper to be interesting and scientifically strong, yet lacking in a number of important details. Please see both reviewers comments for specific suggestions to improve your manuscript.

Comments to Author:

Reviewers' Comments to Author:
Reviewer: 1

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Author's Response to Decision Letter for (RSOS-181482.R0)

See Appendix A.

Decision letter (RSOS-181482.R1)

23-Jan-2019

Dear Dr Kent,

I am pleased to inform you that your manuscript entitled "Speed-mediated properties of schooling" is now accepted for publication in Royal Society Open Science.

You can expect to receive a proof of your article in the near future. Please contact the editorial office (openscience_proofs@royalsociety.org and openscience@royalsociety.org) to let us know if you are likely to be away from e-mail contact. Due to rapid publication and an extremely tight schedule, if comments are not received, your paper may experience a delay in publication.

Royal Society Open Science operates under a continuous publication model (http://bit.ly/cpFAQ). Your article will be published straight into the next open issue and this will be the final version of the paper. As such, it can be cited immediately by other researchers. As the issue version of your paper will be the only version to be published I would advise you to check your proofs thoroughly as changes cannot be made once the paper is published.

On behalf of the Editors of Royal Society Open Science, we look forward to your continued contributions to the Journal.

Kind regards,
Royal Society Open Science Editorial Office
Royal Society Open Science
openscience@royalsociety.org

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Follow Royal Society Publishing on Facebook:
https://www.facebook.com/RoyalSocietyPublishing.FanPage/
Read Royal Society Publishing's blog: https://blogs.royalsociety.org/publishing/

Appendix A

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Responses to Reviewer 1

The referee makes a good point that the abstract could be pared down to better reflect the rest of the paper. Accordingly, we have rewritten lines 19-20 to reflect our use of fish in this experiment.

As Reviewer 1 points out, the relationship between speed and collective motion is currently a hot topic and we agree that our manuscript would benefit from the inclusion of recent work by Pettit et al. and Jolles et al. that discuss the importance of speed in mediating leadership and various group dynamics. We have added these references to the manuscript on lines 41-42. We believe, as the referee suggested, that the inclusion of these papers serves to underscore the importance of the current manuscript and the research presented. As also suggested, we added references to other works that measured TE in animal models and rewrote lines 83-88 to highlight the specific application of information theory in the current study and the ways in which our application differs slightly from previous work.

To clarify the methods, we have reworded lines 157-158 and provided more explicit information pertaining to the sample sizes on lines 162-164.

While we have not made the raw trajectories available through the online repository site Dryad, we have added a sentence to the data availability section specifying that the full trajectory files will be available upon request. Each trial is a separate .mat or .txt file consisting of 15 columns and 15,000 rows.

Reviewer: 2
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Responses to Reviewer 2

As Reviewer 2 suggested, we have made short excerpts of tracked video from each species available through the online repository site Dryad. This will be helpful in demonstrating our methods to any interested readers. We have also included a table of species names, abbreviations, SLs and speed/alignment cut-offs in the SI, with an in-text reference to Table S1 on line 100.

We appreciate reviewer 2's enquiries regarding transfer entropy and agree that our methods could be more specific. As suggested, we have significantly expanded our presentation of how we calculated transfer entropy and have provided the specific equation rather than simply referring the reader to Crosato et al. (see the new transfer entropy section in the methods on lines 166-191). Furthermore, at the end of this expanded section we have included a brief comment on "local transfer entropies" being positive or negative as the reviewer suggests. We have deferred the reader to Crosato for full details on this particular point because the local transfer entropy values within each segment are not dealt with in this paper (only the averages are). We note that the reader may confuse negative local transfer entropies with the negative average transfer entropies for some trajectory segments visible in Figure 4 and 5, and so we have added further clarification at this point in the manuscript on why such negative average values may occur and what they mean.

The referee makes a good point regarding our explanation of mixed effect models. We have therefore added greater explanation on lines 194-196 and provided an in-text reference to our R code, which is available through the online repository site Dryad (line 196).

Reviewer 2 also makes a good point about the need to discuss the specific quadratic relationship reported between linear neighbour positioning and speed. On lines 282-288 in the discussion, we have provided greater interpretation of our quadratic fit as well as discussed this in the context of the work done by Ashraf et al. Regarding the quadratic relationship between alignment and speed, there is a hard limit at 0 degrees because that is the point at which individuals are perfectly aligned. Therefore, the trend naturally plateaus as individuals approach near perfect alignment with neighbours.