Identifying the behavioural cues of collective flow perception

van Assen, J.J.R.; Pont, S.C.

DOI
10.1167/jov.22.14.3985

Publication date
2022

Document Version
Final published version

Published in
Journal of vision

Journal of Vision
December 2022
Volume 22, Issue 14

Identifying the behavioural cues of collective flow perception

- Jan Jaap R. van Assen
  Perceptual Intelligence Lab, Delft University of Technology
- Sylvia C. Pont
  Perceptual Intelligence Lab, Delft University of Technology

Footnotes
Acknowledgements This work was supported by a Marie-Skłodowska-Curie Actions Individual Fellowship (H2020-MSCA-IF-2019-FLOW, Project ID: 896434) and a Marie-Skłodowska-Curie Actions Innovative Training Network (MSCA-ITN-ETN, grant number 765121, 2017) DyViTo.

In this study we investigate the visual perception of collective flow. Collective flow depicts agents that show both individual and group behaviour following a relatively simple set of rules (e.g., swarms of insects, flocks of sheep, cyclists in traffic). These collective patterns occur all around us in animate and inanimate systems and on microscopic and macroscopic scales. Ecologically, it can be argued that the human visual system must have developed certain sensitivities for these collective patterns. Even from very low-level depictions we can identify high-level behaviours (e.g., stress, cooperation, leadership), associate these patterns with specific animal groups, and predict future states of these complex patterns. These are skills that potentially generalize to many cognitively demanding tasks. To investigate this, we developed an online engine that simulates biological collective behaviour using six parameters. Here, we concentrate on zone of alignment, zone of attraction, and turning rate. We collected two types of data: 1. A triplet similarity task i.e., which pair of stimuli is more similar, 2. Rating tasks for ten behavioural attributes selected using online experiments and brainstorm sessions. The triplet task was not easy where 38% of the trials can be considered hard (high intraobserver variability). Using Soft Ordinal Embeddings (SOE) we found that the similarity space is two-dimensional. One of these dimensions is highly correlated with the turning rate, and with nine of the ten behavioural attributes e.g., grouping, cooperation, focus. However, with the attributes explored here we were not able to clearly identify the second dimension of the similarity space. The dominant correlations with the turning rate seem to overshadow intriguing, more subtle non-linear tendencies of the behavioural ratings. In this study we applied a range of methods that allowed us to increase understanding and identify behavioural cues we employ to perceive the versatile space of collective flow.