APS Division of Fluid Dynamics 71st Annual Meeting
Georgia World Congress Center in Atlanta, Nov. 18-20

Swarmlike Collective Behavior in Bicycling

Study of large-scale collective behavior of bicycle racers in pelotons gives clues to cognition and crowd dynamics

EMBARGOED FOR RELEASE until Sunday, Nov. 18, 2018, 6:00 p.m. ET

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WASHINGTON, D.C., November 18, 2018 -- Whether it's the acrobatics of a flock of starlings or the synchronized swimming of a school of fish, nature is full of examples of large-scale collective behavior. Humans also exhibit this behavior, most notably in pelotons, the mass of riders in bicycle races.

During the American Physical Society's Division of Fluid Dynamics 71st Annual Meeting, which will take place Nov. 18-20 at the Georgia World Congress Center in Atlanta, Georgia, Jesse Belden, a researcher at the Naval Undersea Warfare Center, will describe the research he and his colleagues have been conducting on collective behavior in pelotons.

Using aerial video footage of bicycle races, Belden and colleagues analyzed peloton motion to determine what causes changes in the group's large-scale collective behavior. They found that riders move through the peloton in a manner similar to circulation in a fluid and observed two types of propagating waves within pelotons. "You see all these patterns and motion behaviors emerge," said Belden.

The researchers found two types of waves affect the structure of a peloton. First, the researchers found a wave that moves back and forth along the peloton, usually due to a rider suddenly hitting the brakes and others slowing to avoid a collision. The other type of wave is a transverse wave caused when riders move to the left or right to avoid an obstacle or to gain an advantageous position.

Pelotons maintain a persistent structure, and researchers previously thought this form was driven by individual riders seeking an aerodynamic advantage. However, aerodynamics only come into play at the outside edges of the peloton. Instead, the researchers found that peloton dynamics are likely driven by rider vision, with each rider keeping other riders within a range of peripheral vision that is most sensitive to motion. Additionally, wave propagation speeds were consistent with human reaction time rather than conscious cognitive decisions like improving aerodynamics.

These findings shed new light on large-scale collective behavior in humans and could apply to varied topics including traffic and crowd management. Additionally, understanding the role of sensory input in collective behavior is important to building better autonomous vehicles like self-driving cars. This research has also given insights into the cognitive processes involved with individual rider actions and their effects on broader peloton dynamics. “Unlike birds or fish, you can talk to the cyclists,” Belden said.

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Presentation E17.5, “Continuum behavior in cycling pelotons” by Jesse Belden, Mohammad Mansoor, Aren Hellum, Andrew R. Meyer, Rafid Rahman, Christopher Pease, Scott Koziol and Tadd T. Truscott, will be Sunday, Nov. 18, 6:02 p.m. in Room B304 of the Georgia World Congress Center in Atlanta. Abstract: http://meetings.aps.org/Meeting/DFD18/Session/E17.5

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---------- MORE MEETING INFORMATION ----------

USEFUL LINKS

Main meeting website: https://www.apsdfd2018.org/
Meeting technical program: http://meetings.aps.org/Meeting/DFD18/SessionIndex2
Invited talks: http://meetings.aps.org/Meeting/DFD18/APS_Invited
Hotel information: https://www.apsdfd2018.org/hotels/

GALLERY OF FLUID DYNAMICS

At the Annual Meeting, The Gallery of Fluid Motion will consist of posters and videos submitted by attendees illustrating the science and beauty of fluid motion. More information can be found here: https://gfm.aps.org/.

PRESS REGISTRATION

We will grant free registration to credentialed journalists and professional freelance journalists. If you are a reporter and would like to attend, contact Rhys Leahy or the AIP Media Line (media@aip.org, 301-209-3090). We can also help with setting up interviews and obtaining images, sound clips or background information.

LIVE MEDIA WEBCAST

A press briefing featuring a selection of newsworthy research will be webcast live from the conference Monday, Nov. 19. Times and topics to be announced. Members of the media should register in advance at http://apswebcasting.com/webcast/registration/aps1118.php.

ABOUT DFD

The Division of Fluid Dynamics of the American Physical Society, established in 1947, exists for the advancement and diffusion of knowledge of the physics of fluids with special emphasis on the dynamical theories of the liquid, plastic and gaseous states of matter under all conditions of temperature and pressure. For more information about DFD, visit https://www.aps.org/units/dfd/.

ABOUT APS

The American Physical Society (APS) is a nonprofit membership organization working to advance and diffuse the knowledge of physics through its outstanding research journals, scientific meetings, and education, outreach, advocacy, and international activities. APS represents over 55,000 members, including physicists in academia, national laboratories, and industry in the United States and throughout the world. For more information about APS, visit https://www.aps.org/.

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