Row, row, row your bots: But are they synchronized?

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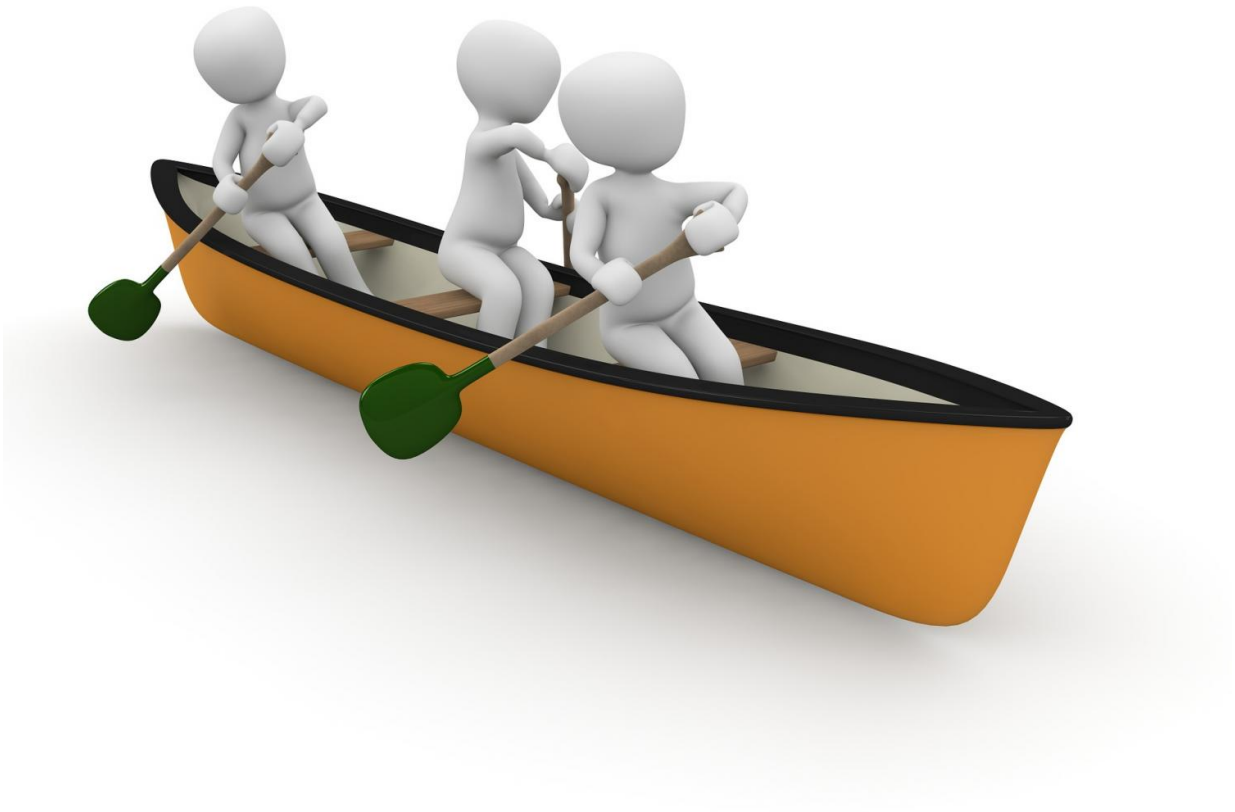

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To get maximum propulsion, should a boat's team of rowers set their strokes to the same rhythm? Or should the rowers stagger the dropping and pulling of the oars through the water? Athletes and scientists have looked at the question, offering illuminating but inconclusive observations. But this month's Physics Today features a special article by fluid mechanic researchers at the Paris École Polytechnique laboratory of hydrodynamics (LadHyX), who provide data and fundamental physics approaches for coaches, sportspersons and scientists to keep in mind the next time they observe or get into a crew boat.

For their study, conducted in the pool of the École Polytechnique, the LadHyX researchers built a 2-m-long boat with eight robotic rowers and controlled the speed and phasing of the strokes; *Physics Today* has posted two of their runs online.

In "Row bots," Jean-Philippe Boucher, Romain Labbé and Christophe Clanet first offer some of the fascinating sports and scientific background for their experimentation. In the early 1980s, Soviet women's teams that participated in the World Rowing Championship placed the coxswain (the steerer) in the middle of rowing pairs, to facilitate out-of-phase strokes. (On race days, they played it safe and rowed in sync.)

Scientists, too, have been intrigued in various ways. In a 2010 study of shrimp krill movement, a Georgia Tech team found that this migratory marine denizen maximized its per exertion velocity by staggering the rhythmical flexing of its five pairs of legs.

History aside, these researchers wanted to come up with a clear sense of

whether rowing in sync, or not, is better for speed. Their experimental boat is one-tenth the scale of a competitive race boat with a realistically shaped fiberglass hull. They compared the synchronous rowing run with trials in which they varied the stroke speed and phase relation of the eight robotic rowers. In addition to measuring the overall speed, the LadHyX researchers determined velocity fluctuations.

Read "Row bots" for free in this month's *Physics Today* to find out what the LadHyX found about synchronous and krill-like desynchronized rowing for raceboat competitions.

More information: Jean-Philippe Boucher et al. Row bots, *Physics Today* (2017). DOI: 10.1063/PT.3.3606

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