Dynamic response and hydrodynamics of polarized crowds

Nicolas Bain[a*],Denis Bartolo,[b]

a. Department of Materials, ETH Zürich, 8093 Zürich, Switzerland.
b. Univ Lyon, Ens de Lyon, Univ Claude Bernard, CNRS, Laboratoire de Physique, F-69342 Lyon, France

* nicolas.bain@mat.ethz.ch

Modeling crowd motion is central to situations as diverse as risk prevention in mass events and visual effects rendering in the motion picture industry. The difficulty of performing quantitative measurements in model experiments has limited our ability to model pedestrian flows. We use tens of thousands of road-race participants in starting corrals to elucidate the flowing behavior of polarized crowds by probing its response to boundary motion. We establish that speed information propagates over system-spanning scales through polarized crowds, whereas orientational fluctuations are locally suppressed. Building on these observations, we lay out a hydrodynamic theory of polarized crowds and demonstrate its predictive power.

Figure 1: Starting line of the 2017 Bank of America Chicago Marathon