As part of the submission process please include a short statement of no more than 80 words summarising the contributions made by the paper including the reasons your paper is novel and of specific relevance to *IJRR*’s [Aims and Scope](http://www.sagepub.com/journals/Journal201324/title#tabview=aimsAndScope).

[It is the policy of *The International Journal of Robotics Research* to encourage the application of theoretical advances to real problems and data. Results should represent a significant rather than incremental advance, and should be verified appropriately according to the topic. Experimental results are strongly encouraged. There should be an up to date literature review, and meaningful comparisons with previous work to demonstrate any proposed advance.]

Microrobots can be produced in large numbers. Small size limits their autonomy, onboard power, and individual strength, and makes them difficult to track. Microrobots are usually powered and controlled by external forces. We examine swarm control challenges using an online game with thousands of human-user experiments. These experiments inspire automatic controllers on the swarm’s mean and variance to perform an object manipulation task in a maze, through simulations and hardware experiments with 100 robots steered by a global light source.

Microrobots’ small size limits autonomy and onboard power so external forces usually control them. Small size also means small payloads, so large numbers are required, but are difficult to track. To learn how to control swarms with global forces and limited feedback we conducted thousands of human-swarm experiments online. These inspired automatic controllers using swarm mean and variance as input for object manipulation in a maze, through simulations and hardware experiments with 100 robots steered by a global light source.

1. Introduces an online experiment framework for human-swarm interaction and 15,000+ user experiments
2. Demonstrate significance of user interface and control design (validated through ANOVA)
3. Prove controllability results of swarm mean and variance controlled by a global input
4. Hysteresis-based controller of swarm mean and variance
5. Parameter sweeps on object shape, object weight, number of robots, external disturbances
6. Hardware studies with 100 kilobot robots performing object manipulation with varying object shapes