Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Robot flow, clogging and jamming in confined spaces DARIA MONAENKOVA, VADIM LINEVICH, MICHAEL A.D. GOODISMAN, DANIEL I. GOLDMAN, Georgia Institute of Technology — We hypothesized that when a collection of robots operate in confined space, maximization of individual effort could negatively affect the collective performance by impeding the mobility of the individuals. To test our hypothesis, we built and programmed groups of 1-4 autonomous robotic diggers to construct a tunnel in a model cohesive soil. The robots' mobility, defined in terms of the residence time (T) required for a robot to move one body-length within the tunnel, was compared between groups of maximally active robots (mode 1), groups with different levels of activity between individuals (mode 2), and maximally active robots with a "giving up" behavior (mode 3), in which the robot ceased the attempt to excavate in a crowded tunnel. In small groups of two robots, T was $\sim$3 sec and did not depend on the mode of operation. However, an increase in the number of robots caused an increase in T which depended upon mode. The residence time in groups of four robots in mode 1 ($\sim$9 sec) significantly exceeded the residence time in mode 2 and 3 ($\sim$4 sec), indicating that crowding was causing slower movement of individuals, particularly under maximum effort (mode 1). We will use our robophysical studies to discover principles of collective construction in subterranean social animals.

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Date submitted: 07 Nov 2015 Electronic form version 1.4