



June
'12

RESEARCH TRACKS

A publication of the Office of the Vice Provost for Research
Volume IX, Issue 4

Engineering research seeks to replicate natural behaviors

Dr. Robert Marks, Distinguished Professor of Electrical and Computer Engineering, recently received a grant from the Office of Naval Research to support his work on the behavior of swarms.

Swarm behavior is commonly observed in the natural world, where insects like ants, bees and termites are able to build intricate structures without any central control or supervision. While it might seem that the tiny creatures are exhibiting highly intelligent behavior, Dr. Marks says the behavior is actually driven by simple rules governing the action of individual insects. Taken together, these rules result in emergent, and often unexpected behaviors.

To illustrate the way simple rules can influence swarm behavior, Dr. Marks asks students in his classes to look around the room and randomly choose two other students, then challenges the class to predict what will happen when everyone stands up and takes slow steps to position themselves between the two others. The answer, that students end up clustered in the center of the room, isn't readily apparent.

While this example shows the challenge of predicting behaviors based on rules, Dr. Marks says the inverse

problem — beginning with a desired swarm behavior and crafting rules that will produce it — is even more difficult.

“We use computer simulations to devise swarms and set them in motion,” he said, “then see which rules get closest to the behavior we want. Then we can repopulate the swarms that work best and make slight modifications so the fitness of the behavior gets better and better.”

Swarm behavior has implications in a variety of areas, from logistics to communication to military applications.

In his current project, Dr. Marks will work with graduate student Jon Roach and Dr. Benjamin Thompson, a Baylor alumnus (B.S. '00) currently working as a research associate and heading a department in the Applied Research Lab at Penn State University. They'll seek to design swarms that mimic another behavior found in nature — agents' changing roles in response to outside stimuli.

“If an ant colony is attacked, worker ants become soldier ants,” he said. “When a bee finds flowers, it returns to the hive and does a dance to recruit other bees to accompany it back to harvest the flowers. We are looking at ways to use this property in the design of swarms.”

Baylor professor earns fellowship for ethics research

Dr. Robert Roberts, Distinguished Professor of Ethics, has been awarded the Alvin Plantinga Fellowship to pursue research and writing at the Center for Philosophy of Religion at the University of Notre Dame.

The Plantinga Fellowship, one of four fellowships awarded annually by the center, provides time for writing and reflection to individuals working on the forefront of Christian philosophy and the philosophy of religion.

Fellows at the center participate in discussion groups, seminars and conferences on the Notre Dame campus, as

well as lectures and debates for both scholarly and popular audiences.

Dr. Roberts' fellowship will support his research on ethics, virtue and emotions, including his current project, *Emotions and Virtues: An Essay in Moral Psychology*.

The Center for Philosophy of Religion promotes scholarship on philosophical theology and encourages the development and exploration of Christian and theistic philosophy.

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