

WICKED PROBLEM SOLVING WINS PRIZE

BEACONites win coveted Wiley Practice Prize

BEACON Director Erik Goodman and Prof. Kalyanmoy Deb, MSU Chair of Electrical & Computer Engineering, won the prestigious Wiley Practice Prize (with collaborator Oliver Chikumbo of New Zealand, receiving the prize below center) from the International Society on Multi-Criterion Decision Making (MCDM).



These BEACONites developed an optimization program, affectionately dubbed “WISDOM” (Wicked Problem Solutions Through Transparent Decision-Making), to tackle the difficult problem of how to best use land in a given area.

To optimize land use, the program works by using a series of algorithms, or ‘rules,’ that factor in multiple variables. These variables can be things like how the land could be used for farming, housing, or industry, and the environmental and social issues for many stakeholders that accompany how the land is potentially used.

These algorithms work toward optimality by incorporating these various factors and devising potential solutions. Such solutions are ‘bred’ repeatedly and selected and ranked for best performance based on the values and preferences of stakeholders. The award-winning element here is their unique combination of biomimetic (biology-inspired) and MCDM processes.

Read more here: Goodman ED, Deb K, Chikumbo O, “Triple bottomline, hyper-radial-visualisation-based ‘decision-making by shopping’ for a land use management problem using evolutionary multi-objective optimisation”, *Journal of Multi-Criteria Decision Making* 2013. In Press.

A ‘TAIL’ OF HOPPING BEHAVIOR

Organisms use a variety of methods to navigate the world. Some swim, some fly, some run, and some even hop. Those ‘hoppers’ fall into several classes, yet those that hop on two legs (bipedal) seem to have similar body structures and movement patterns. Still, bipedal hopping is physically unstable, so how and why could it evolve?

In a recent paper, MSU graduate student Jared Moore and colleagues set out to better understand how body structures, specifically the tail, influence bipedal hopping characteristics. Exploring hopping through digital simulation of real-world physics, Moore found that a light tail can also be effective for hopping, which is not seen in hopping biological organisms, like kangaroos and wallabies.

Evolving solutions requires lots and lots of simulations, but eventually good solutions do arise. Initially, many of the digital animals are slow and awkward, but with time, these organisms develop a very fast, powerful hopping motion as the optimum for this environment.



Want to read more? See Moore J, Gutmann AK, McGowan C, McKinley P, “Exploring the Role of the Tail in Bipedal Hopping through Computational Evolution”, Proceedings of the 12th European Conference on Artificial Life.

Want to see hoppers in action? View a video of their results here: <http://www.youtube.com/watch?v=M1BWxwVUAEM>

EVOLUTION DOESN'T FAVOR MEANIES

Finally, a break for the good guys! In a highly publicized paper, two MSU BEACONites, Christoph Adami and Arend Hintze, have provided some evidence that evolution doesn't favor selfish behavior.

Contrary to recent, previous studies which show selfish behavior as beneficial, Adami and Hintze "found evolution will punish you if you're selfish and mean." It appears that selfishness may be a good short-term strategy in a select few cases, but is difficult to maintain over time: "For a short time and against a specific set of opponents, some selfish organisms may come out ahead. But selfishness isn't evolutionarily sustainable."

The paper, published in *Nature Communications*, uses game theory as its foundation. Game theory is used not just in biology, but in a variety of disciplines including economics, political science, and even music composition. At its most basic, game theoretic models try to understand strategic decision making, or when to cooperate and when to be selfish, and under what conditions. Within biology, research over the last 30 years has investigated how and why organisms cooperate, as cooperation is found in a variety of life forms.

In 2012, a scientific paper announced a so-called new "zero-determinant" (ZD) strategy, which when implemented guaranteed selfish players would beat those that were cooperative. These results appeared novel, and created "quite a stir," yet Adami and Hintze doubted whether following a ZD strategy would work. If followed, ZD would essentially eliminate cooperators and create a world solely inhabited by selfish beings.

To investigate the possible evolution of a selfish world, Adami and Hintze ran hundreds of thousands of games using high-powered computing. They found simply that ZD strategies can never be

the product of evolution. Although ZD strategies work well against non-ZD opponents, they don't work well against other selfish, ZD opponents.

Selfish, ZD strategies were effective only if players knew whether they were playing a selfish or cooperative competitor. "The only way ZD strategists could survive would be if they could recognize their opponents," Hintze said. "And even if ZD strategists kept winning so that only ZD strategists were left, in the long run they would have to evolve away from being ZD and become more cooperative. So they wouldn't be ZD strategists anymore."

So, in the end, being selfish only gets you so far. It's teamwork and communication that win out evolutionarily.

This 'nice' article has led to tons of press, and has set sharing records of MSUToday's website on Facebook, Twitter, Linked In, and was found trending on Reddit. Want more? See the articles in Discovery and other popular media, or consult the article itself: Christoph Adami and Arend Hintze. Evolutionary instability of zero-determinant strategies demonstrate that winning is not everything. *Nature Communications* Volume 4, August 2013, doi:10.1038/ncomms3193. Photo of Adami courtesy of MSU



DEB RECEIVES HONORARY DOCTORATE



BEACON's Kalyanmoy Deb receives honorary doctorate in the above photo, complete with full regalia and a sword!

On August 24, 2013, Kalyanmoy Deb, a BEACON researcher and the Koenig Endowed Chair of Electrical and Computer Engineering at Michigan State University, received an Honorary Doctoral Degree from the Faculty of Information Technology at the University of Jyväskylä in Finland.

Prof. Deb received this recognition along with 14 other honorary degree recipients, including the President of Finland, Mr. Sauli

Niinisto (Sport and Health Sciences) and three other professors from the USA: Prof. Kristine Munoz from the University of Iowa (Humanities), Prof. Thomas McKenzie, San Diego State University (Sports and Health Sciences) and Prof. Michael Lambert, Brigham Young University (Social Sciences).

Although the University of Jyväskylä organizes the degree ceremony once every five years, this year's ceremony was exceptionally special: it marked the 150-year jubilee of the University of Jyväskylä. The ceremony lasted for two and a half days, with a very formal ceremony mostly spoken in Latin, and followed a 350-year old conferment tradition, a walk-in procession from Jyväskylä city center to a local church, a gala dinner with traditional folk dancing, and ended with a boat ride on a bright sunny day to an island for traditional Finnish food and music.

Since 1999, Prof. Deb has been in collaboration with the University of Jyväskylä. He and his collaborators within the Faculty of Information Technology work on various projects in the area of multi-criterion optimization and decision making, delivering short courses to their international summer school courses, and co-supervising PhD students.

More about Prof. Deb's research interests can be found at <http://www.egr.msu.edu/~kdeb>.

SMELLS LIKE 'PREEN' SPIRIT

Bird scent use in evaluating mates

Does your sweetheart smell sexy? It might not be only their looks that make them hot... or not.

Scent is one of the most basic ways animals exchange information, but many animals are thought to primarily use other modes of communication, like acoustic or visual signals, to indicate their status and quality as a mate. Birds have been dismissed in this way, however, from a first-of-its-kind study, we now have evidence that birds not only communicate via scent, but also use it to evaluate mates.

Birds' scent, or preen, glands are located near their tails, and using their beaks, birds extract this gland oil and rub it along their feathers and legs. Although it was thought that rubbing the oil just bolstered the strength of feathers, this new research shows that this scent also signals reproductive health.



"This study shows a strong connection between the way birds smell near the beginning of the breeding season – when birds are choosing mates

– and their reproductive success for the entire season," lead author Danielle Whittaker said. It appears that the more 'male' a male's scent, and the more 'female' a female's scent, the more offspring those birds will have.

Because birds were assumed to communicate and select mates primarily through visual and acoustic cues, the researchers studied a species of bird, dark-eyed juncos, to compare which were more effective – chemical scent signals or size and attractiveness of feathers.

Although size and feather attractiveness were useful in predicting reproductive success, the study's results showed that individual bird odor was better! The study also revealed that females were mak-

ing multiple decisions based on how their potential mates smelled.

"Based on odor, females seemed to be not only choosing with which males to mate, but many times they also were selecting different males to raise their nestlings," Whittaker said. "Interestingly enough, the cuckolded males had higher levels of a 'female-like' odor."

From the data, it appears that odors may also serve as beacons for hormone levels, current condition and overall health, and genetic background of a potential mate.

The study, authored by Danielle Whittaker, managing director of MSU's BEACON Center for the Study of Evolution in Action, and her collaborators at Indiana University, appears in the current issue of *Animal Behaviour*. Read more here: Whittaker, D.J., Gerlach, N.M., Soini, H.A., Novotny, N.M, and Ketterson E. D. (2013). "Bird Odor Predicts Reproductive Success", *Animal Behaviour* 86(4): 697-703.



Photos courtesy of Danielle Whittaker and Nicole Gerlach

RESPONSIBLE CONDUCT IN RESEARCH JUST GOT EASIER

Simplified Processes for Reporting

Reporting your responsible conduct in research (RCR) efforts, although important, can be a time-consuming process added to the time it takes to complete such requirements. This can lead to underreporting of efforts and inaccurate assessments for additional training needs.

Because BEACON recognizes that each of its participating universities has different RCR training requirements, and the fact that departments/colleges/universities are tracking RCR training differently, BEACON has instituted a simplified process for tracking RCR training within BEACON.

When researchers log into the BEACON intranet, they need now only to certify, rather than reenter, the information on efforts made to meet their institution's training and reporting requirements. As an additional feature, as the date approaches when current training expires, researchers will

receive an automated email informing them that it is time to update their RCR training.

Should one choose to still keep track of RCR efforts through BEACON, the RCR event reporting system is still in place and documentation of participation in BEACON-sponsored RCR activities will still be entered into the system.

If you are a researcher and have not certified your RCR through BEACON, please visit here: <https://secure.beacon-center.org/rcr/event.php>

If you have not yet met your institution's requirements, be sure to do that ASAP and keep current on your renewable trainings.

If you have questions, contact Danielle Whittaker (djwhitta@msu.edu).

EVOLVING...SUDOKUS?

Charles Ofria (MSU) has been working on a project to evolve Sudoku puzzles like the one on the right here.

Sudoku puzzles originated in Japan and are logic-based, combinatorial puzzles. The objective is to fill a 9x9 grid with digits so that each row, column, and 3x3 section contains all of the digits from 1 to 9 only once. The puzzle maker provides a few completed spaces, and the solver works to find the unique solution.

The evolved Sudoku puzzle project is still underway, but it will have a website viewable to the public soon. The Sudoku puzzles are created using genetic algorithms, and unlike traditional Sudoku puzzles which use numbers, these evolved puzzles use letters.

If you have any feedback or questions on this fun project and how you can help, please contact Charles at ofria@msu.edu.

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CONGRATULATIONS, BEACONITES!

Celebrating recent efforts around BEACON

Awards:

April Wright (UT Austin) won an award for the Best Teaching Assistant in Natural Science for her work as a TA in the upper-division evolution course.

Chris Waters (MSU) won a Young Investigator Award sponsored by the Center for Biofilm Engineering, Montana State University.

Grants:

Risto Miiikkulainen (UT Austin) & Kay Holekamp (MSU) have just been awarded a NIH Grant for a proposal that was a spin-off from BEACON-funded pilot work done during years 2 & 3 of BEACON's existence. The title of the new grant, which will run from August 2013 through July, 2016 is "The

Role of Emotion and Communication in Cooperative Behavior."

Invited Talks:

Zachary Blount (MSU) gave an invited talk on "The evolution of aerobic citrate utilization in an experimental population of *E. coli*: A case study in evolutionary contingency" in Oxford, England.

Education and Outreach:

Karen Matsumoto, Bryan Bartley, Louise Mead, Lauren Vandepas, Emma Timmins-Schiffman, and Billie J. Swalla held a "Think Evolution" Teacher Workshop in Forks, WA. Guest speakers, including UW academics and professional scientists, provided exercises

and spoke about about connections between the effects of climate change and "Evolution in Action", especially as it relates to the Pacific Northwest.

Paul Hohenlohe (U Idaho) gave a lecture and workshop as a part of weeklong course in conservation genetics and genomics at University of Montana's Flathead Lake Biological Station. The international course on RAD sequencing for conservation and population genomics included graduate students, postdocs, and professional conservation biologists.

And of course, special congrats to our recent graduates! Best of luck!

CURIOUS ABOUT SUBMITTING CONTENT?



New to BEACON? Veteran BEACONite? Here's how to submit possible content to the newsletter:

1. Do what you're already doing: Log into the BEACON Intranet (accessible through the BEACON site: <http://beacon-center.org>, at the "For Current Members" tab.) Then go to the "Outputs and Activities" tab at the top banner, and fill in information about

your papers published, grants received, etc. New entries will be flagged automatically.

2. Tweet about it. Tweet about what you'd like to cover as it happens to @BEACON_Center with the hashtag #news. We'll see it, and so will others!

3. Email content directly. Please email weigelem@msu.edu if you've got content you'd like to highlight that doesn't fit into the website categories.