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# PBS Update

## NEW FINDINGS ON ANIMAL MEMORY OPEN DOORS TO FUTURE RESEARCH ON MEMORY IMPAIRMENT DISEASES

In "Charlie and the Chocolate Factory," Roald Dahl's unforgettable tale of greed, one character meets his just "desserts," so to speak, in the shameless pursuit of chocolate. In an equally inventive set of experiments, participants meet a much better ending, with the memory of how they reached it intact. Yet in this case, the memory in question is their own, and the tale is -- well, more like a tail.

If you ask a rat whether it knows how it came to acquire a certain coveted piece of chocolate, IU neuroscientists conclude, the answer is a resounding, "Yes."

A study newly published in the journal *Current Biology* presents an innovative series of experiments designed to determine whether rats possess "source memory," a form of memory in which an individual remembers not just a particular piece of information but the means by which they attained it.

The findings have "fascinating implications," said principal investigator Jonathon Crystal, both in evolutionary terms and for future research into the biological underpinnings of memory, as well as the treatment of diseases marked by memory failure such as Alzheimer's, Parkinson's and Huntington's, or disorders such as schizophrenia, PTSD and depression.

The study further opens up the possibility of creating animal models of memory disorders.

"Researchers can now study in animals what was once thought an exclusively human domain," said Crystal, professor in the Department of Psychological and Brain Sciences in the College of Arts and Sciences. "If you can export types of behaviors such as source memory failures to transgenic animal models, you have the ability to produce preclinical models for the treatment of diseases such as Alzheimer's."

Of the various forms of memory identified by scientists, some have long been considered distinctively human. Among these is source memory. When someone retells a joke to the person who told it to him, it is an everyday example of source memory failure. The person telling the joke forgot the source of the information -- how he acquired it -- though not the information he was told. People combine source information to construct memories of discrete events and to distinguish one event or episode from another.

Nonhuman animals, by contrast, have been thought to have limited forms of memory, acquired through conditioning and repetition, habits rather than conscious memories. The kind of memory failures most devastating to those directly affected by Alzheimer's have typically been considered beyond the scope of nonhuman minds.



Department of Psychological and Brain Sciences

The study owes much to another quality these rodents share with humans: They love chocolate. "There's no amount of chocolate you can give to a rat which will stop it from eating more chocolate," Crystal said.

Using chocolate as bait in an eight-arm radial maze, the study was made up of a series of five experiments that together provide converging evidence. In the first two, in order to obtain the chocolate, the rats needed to remember the source by which they acquired it, whether they were placed near the trough containing the chocolate or had to run on their own to get there. Using different mazes helped rule out the possibility that overlearned cues from a particular maze led to the positive results.

A third experiment showed that the rats' source memory, the means by which it retrieved the

chocolate, lasted for a week rather than the one day other, more ordinary forms of memory last. This provided converging evidence, said Crystal, that the rats were relying on source memory in that source memories decay more slowly than other memory systems.

In the fourth experiment, the rats could obtain the chocolate when the researcher placed them at the trough. The rats remembered this rule, too. Finally, in the fifth experiment, researchers temporarily disabled the rats' hippocampus, the brain region thought to be crucial for accurate source memory. If the task requires source memory, inactivating that area would impair the ability to remember source information, which it did.

"What we're trying to do is to develop behavioral approaches with rodents that tap into those types of memory systems," Crystal said. "This study is the demonstration, the proof of the concept that source memory exists in animals. But the mechanism that supports it is open. We're now interested in working out the

sub-areas of the hippocampus that are involved in episodic memory, testing hypotheses about different regions being involved in short-term and long-term episodic memory, working out the neuroanatomical pathways."

This study is the latest breakthrough in Crystal's Comparative Cognition Laboratory, which seeks to develop animal models of memory types that are impaired in human diseases. Past experiments have similarly uncovered evidence of other presumably human forms of memory and cognition in rats.

Other researchers include Wesley T. Alford, Visiting Scholar; graduate student Wenyi Zhou; and Andrea G. Hohmann, Linda and Jack Gill Chair of Neuroscience and Professor in the IU Department of Psychological and Brain Sciences.

The study "Source Memory in the Rat" was published in *Current Biology* and is available online.

## PBS Quasiquicentennial

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"Poor Bart, always picks Rock." So Lisa Simpson sums up Bart's aptitude for what seems to most like a simple game of chance.

But rock-paper-scissors has a few tricks up its sleeve. In the past, scientists have used the game to study how we cooperate, to show that we are bad randomizers and to build robots that can beat us at our own game.

Now as Indiana University cognitive scientists demonstrate, rock-paper-scissors also tells us something about the group dynamics of situations as varied as the cycles of fashion, fluctuations of financial markets, eBay bidding wars and political campaign strategies.

In a study written about this week in the online journal PLOS ONE and picked up by NBC news and other sources, the researchers analyzed what happens in a group when each person's decision depends on what they think other people will decide -- how, in other words, we solve the riddle of 'what you think I think you think I think.'

What they found, said Seth Frey, doctoral candidate in the Department of Psychological and Brain Sciences in the IU College of Arts and Sciences, is that "people playing this kind of game subtly influence each other, converging on similar ways of reasoning over time. The natural analogy for the process is to a flock of birds veering in concert."

"Anticipation may be the motor that keeps fads running in circles," Frey said.

"It could be a source of the violent swings that we see in financial markets. And if you've ever been in a bidding war on eBay, you may have been caught in this dynamic yourself. If every bidder is tweaking their increasing bids based on the tweaks of others, then the whole group may converge in price and determine how those prices rise. The process isn't governed by the intrinsic value of that mint-condition Star Wars lunch box you're fighting for, but on the collective dynamics of people trying to reason through each other's thoughts."

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Department of Psychological and Brain Sciences



Seth Frey

As Robert Goldstone, professor in the Department of Psychological and Brain Sciences, explained, “What we wanted was an elegant parable in a laboratory context of the kind of real-world situations when people are trying to assess what other people are deciding. We’re interested in what the entire group looks like when everybody is trying to second guess everybody else.”

“At a core level, people’s guesses do converge, and that’s interesting because dominant models suggest otherwise,” Goldstone said.

Nash equilibrium, for example, the influential theory of John Nash, a mathematician portrayed in several films and the book “A Beautiful Mind,” would predict that everyone will end up at random places with equal probability for each round. It’s a theory, Goldstone said, “that assumes full rationality, full ability to reason about what you know I know you know I know.”

Instead, “we are getting this systematic behavior, which is not random. Even though people are trying to beat each other out, they end up in synchrony.”

Whether looking at benign social habits or mass panics, social theorists have always treated group behavior as though it resulted from a kind of mindlessness. But this lesson from rock-paper-scissors suggests that the most sophisticated reasoning can be caught up in the subtleties of social interaction.

### ROCK-PAPER-SCISSORS REVISITED

In the experiment, Frey and Goldstone introduce a version of rock-paper-scissors they call “the mod game.” In each round, they gave groups of five or six IU psychology undergraduates a choice between the numbers 1 through 24. Participants earned money for picking a number exactly one greater than a number chosen by someone else, with the choices wrapped around in a circle so that 1 beat 24.

Each student had to anticipate what others were going to pick, and pick the next number up, keeping in mind that everyone else was thinking the same thing. In this game of one-upmanship, the best performers aren’t the ones who think the most steps ahead, but the ones who think just the right number of steps ahead -- about two, as it turned out in the experiment.

Experimental economists predict that sufficiently experienced people will continually increase the number of steps by which they think ahead. But this isn’t what happened in the mod game. Instead, when participants were shown each previous round’s results, they tended to cluster in one part of the circle of choices and start bounding around it in sync.

Groups produced a compelling periodic orbit around the choices, reminiscent of the cultural pendulum swinging back and forth, bringing, say, mustaches in and out of fashion.

Interestingly, the cycling behavior consistently got faster with time. With more experience, people learned to think further ahead, so the economic prediction was partly correct.

But the increase was much less dramatic than economists might have thought: After 200 rounds of the mod game, the average number of thinking steps increased by only half a step, from 2 to 2.5. Moreover, the synchrony which occurs in this game turned out to benefit everyone; a tighter grouping of choices meant a higher density of money to be earned in each round.

The study, “Cyclic Game Dynamics Driven by Iterated Reasoning,” is available online at PLOS ONE. This three-minute video explains the concept.

Robert Goldstone, Chancellor’s Professor of Psychological and Brain Sciences, directs the Percepts and Concepts Laboratory in the Department of Psychological and Brain Sciences at IU Bloomington. Seth Frey is a graduate student in the lab.

## IU’S BRIAN D’ONOFRIO AND MARY MURPHY HONORED BY ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Two Indiana University Bloomington faculty members in the Department of Psychological and Brain Sciences have won major awards in recent weeks for early career contributions to their fields.

Brian D’Onofrio, an associate professor of clinical science, has won the 2013 Janet Taylor Spence Award for Transformative Early Career Contributions from the Association for Psychological Science.

Mary Murphy, assistant professor of social psychology who directs the Mind and Identity in Context Lab at IU, was named a 2013 Association for Psychological Science Rising Star.

The Association for Psychological Science is the premier international organization in its field

dedicated to the advancement of psychological science and promotion of psychological research and science-based psychology in the development of public policy. Each year, it honors the accomplishments of members who have made outstanding contributions to the advancement of psychological science.

D’Onofrio, who came to IU in 2005, studies behavioral problems, depression and anxiety, substance abuse and other psychological problems in childhood and adolescence. He explores the influence of such factors as divorce, parents’ mental disorders, poverty, substance abuse and prenatal conditions on children’s development. D’Onofrio is frequently credited for his methodological ingenuity -- for his ability to tease out difficult-to-discern causal connections among environmental and genetic factors.

According to Kenneth Kendler, director of the Virginia Institute for Psychiatric and Behavioral Genetics, D’Onofrio is “one of the

small handful of working behavior geneticists who have been able to move far beyond the traditional nature-nurture debate to developing novel techniques to provide a plausible method to resolve these controversies.”

Benjamin Lahey, professor of epidemiology, psychiatry and behavioral neuroscience in the School of Public Health at the University of Chicago, said D’Onofrio’s work makes it possible for “studies of the environmental origins of mental disorder to move from the stagnating ‘correlate’ stage of research to studies that support strong causal inferences and become the basis for innovative new prevention trials.” He is, Lahey said, “changing how the field does research by raising the bar and showing others how to surpass it.”

Murphy, who earned a Ph.D. at Stanford University in 2007, has been gaining steady recognition for her studies of “stereotype threat” with respect to race and gender,



designing approaches -- described as bold and methodologically adventurous -- for understanding how people's social identities and group memberships interact with the contexts they encounter to affect their thoughts, feelings, behaviors, physiology and motivation.

"Mary Murphy is truly a rising star in social psychology," says Greg Walton, a social psychology professor at Stanford. "Her research provides profound insight into the causes of the continued underrepresentation of women in male-dominated science, technology, engineering and mathematical (STEM) fields, and suggests potential psychological solutions."

Jennifer Richeson, professor of social psychology at Northwestern University with whom Murphy collaborated in her postdoctoral research, notes that in their work together, "Dr. Murphy spearheaded a methodologically intense study exploring the effects of exposure to subtle, compared with

more blatant, forms of racial discrimination. The results of this project are the first to demonstrate the differential impact of blatant racial bias, compared with subtle bias and no racial bias, on racial minorities' nonverbal behavior during, and cognitive functioning after, live interracial interactions."

Richeson also said, "The level of success Dr. Murphy has enjoyed in obtaining both government and foundation support for her work is truly remarkable for a scholar at such a relatively early stage. It is a credit to the quality of her work and her ideas that she has been able to attract so much research funding."

Other Psychological and Brain Sciences faculty members to receive the Association of Psychological Science Rising Star Award in recent years are D'Onofrio in 2012 and Robert "B.J." Rydell in 2011. The Department of Psychological and Brain Sciences is in the College of Arts and Sciences at IU Bloomington.

# Alumna Profile

## SUSAN RINNE, BA '87, MPA '97



Like many undergraduates before her and no doubt many since, Susan Rinne graduated from Indiana University in 1987 not knowing what she wanted to do when she got out.

As a psychology major, she says she "enjoyed learning. There wasn't a class I didn't thoroughly enjoy. But I wasn't sure what I was going to do with it."

Before long, however, the answer became increasingly clear: Her psychology degree would provide key components of a demanding, influential and highly visible career in an organization that gives vital support in the Bloomington community to individuals whose problems might well have been the focus of the psychology courses she had taken.

At first such a direction was not clear. Working after college as a bank teller in Greencastle, Indiana, does not seem like the way back to psychology. Yet, the woman in the teller's cage next to her proved to be a source of inspiration, telling Rinne stories about her husband's work in an organization in Greencastle that provided services for people with disabilities and mental illness.

The more she heard about this work, the more intrigued Rinne became, and soon she got a job with this agency. "I fell in love with the idea of helping people become part of a community, who have been excluded for so many years." The work, she says, "combined my sense of social justice with interests in psychology and helping people move forward."

Deciding this was the field she wanted to be in, she went back to IU, where she pursued a Master of Public Affairs at the School of Public and Environmental Affairs.

Now the CEO of LifeDesigns, a Bloomington organization with a \$10 million budget and staff of 370 that provides in-home services and support for close to 400 people with intellectual and developmental disabilities, brain injuries or mental illness, Rinne sees herself drawing daily on her undergraduate training in the department.

"A lot of what I do goes back to that early training," she observes. Looking back, she realizes how much she relies now on the empirical methods of research and scientific investigation she learned then. "One of the things you have to do in an organization is evaluate what you are doing based on

empirical information. You can't just rely on intuition. I see managers who don't have that background who struggle."

Likewise the focus on behavior instilled as an undergraduate resonates with her current work in which she sees daily "the impact that behavior supports and behavior management can have on those with learning or developmental disabilities." As a student of Professor James Dinsmoor, himself a student of former PBS chair B.F. Skinner, she believes she has inherited traces of that behaviorist past.

As a PBS board member, Rinne "enjoyed being part of discussions to get people more involved with the department, how to get students more involved, and help them to understand that there is life after graduation. While that may not be a career in psychology, there are all kinds of opportunities with what they've learned." "My big advice to students," she says, is "Find out what your passion is. Spend time volunteering in the community at different nonprofits. That's the one thing that really helped drive me at a certain point in time. I discovered what my passion was."

## TARLISE TOWNSEND, A 2012 GRADUATE WITH A DUAL DEGREE IN NEUROSCIENCE AND GERMANIC STUDIES, WAS NAMED A LUCE SCHOLAR

Tarlise Townsend, a 2012 graduate of Indiana University Bloomington, has been named a Luce Scholar, one of 18 recipients of a nationally competitive award designed to enhance understanding of Asia for future leaders.

She is the first person to be named a Luce Scholar after receiving an undergraduate degree from Indiana University. IU is one of 75 colleges and universities eligible to make nominations for the program.



Tarlise Townsend

Townsend graduated Phi Beta Kappa and with highest honors, with a dual degree in neuroscience and Germanic studies. She was a Wells Scholar and a member of the Board of Acons, conducted research in an IU neuroscience lab and studied for a year in Freiburg, Germany. She interned at the Environmental Protection Agency through the Washington Leadership Program in the School of Public and Environmental Affairs. She grew up in Bloomington, Ind., and graduated from Edgewood High School in Ellettsville, Ind.

She is currently a visiting researcher at the Max Planck Institute for Human Development in Berlin, where she is studying environmental decision-making and the role of psychology in policy-making. She plans to pursue a career in global and environmental health.

As a Luce Scholar, Townsend anticipates working at a research institute or think tank that examines issues at the intersection of health, the environment and policy. She also hopes to be involved in local education, possibly as an English tutor. She is looking at placement opportunities in Southeast Asia.

"I'm deeply honored by and grateful for this opportunity," she said. "It's an awesome chance to learn from experts about public health concerns in Asia, and to gain insight into a region of growing global relevance. I have to shout out a 'thank you' to my many mentors at IU -- without their guidance and support, I would be far less prepared for the coming year's challenges."

Ben Robinson, associate professor of Germanic studies in the College of Arts and Sciences, served as Townsend's mentor for an honors thesis on inequality in the German education system, for which she received the 2011-12 Provost's Award for Undergraduate Research and Creative Activity.

"It's of course terrific news that Tarlie has been named a Luce Scholar," Robinson said. "She will bring distinction to the program, and no doubt her experiences in Asia will contribute to the development of a singularly promising young professional in the field of global environmental health."

"Not to put undue pressure on her, but I am terrifically excited to follow Tarlie's achievements in research and policy development," he said. "In

the Germanic Studies Department at IU she is already a legend for the intelligence, insight and inspiration she brought to her work and shared with faculty and peers, as well as for the distinction she lent to our honors program. I can't imagine a better ambassador for the humane aspirations of U.S. environmental policy."

The Luce Scholars program, launched in 1974 by the Henry Luce Foundation, provides stipends, language training and individualized professional placements. Applicants may be college seniors, graduate students and young professionals. The program is unique in that it is intended for young leaders who have limited experience of Asia through previous schooling, work and travel.

Scholars may be placed in Cambodia, China, Hong Kong, India, Indonesia, Japan, Laos, Malaysia, Mongolia, Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam. They meet for orientation in June, engage in intensive language study in Asia in July and August, and work as scholars from September until the following summer. The program is administered by the Asia Foundation.

In other Indiana University connections to the program, Ron Benioff was a Luce Scholar in Indonesia after earning a master's degree from IU and Lauren "Ming" Holden, recipient of the 2012-13 Wells Graduate Fellowship, was a Luce Scholar in Mongolia before enrolling at IU.

## GEORGE KACHERGIS, PHD'12, WINS THE COGNITIVE SCIENCE SOCIETY'S 2013 ROBERT J. GLUSHKO DISSERTATION PRIZE



George Kachergis (on left) with Professor Rich Shiffrin at 2012 Indiana University Commencement Ceremony.

George Kachergis, who graduated from IU with a PhD in 2012, has just received the Cognitive Science Society's 2013 Robert J. Glushko Dissertation Prize. A student of PBS Distinguished Professor and Luther Dana Waterman Professor Richard Shiffrin and Associate Professor Chen Yu, Kachergis wrote his dissertation on statistical learning. He studied the way that travelers—both infant and adult—learn the nouns of a new language by noticing which words and objects co-occur most often. He developed a mathematical model of such learning. The prize is accompanied by a \$10,000 award and is given to groundbreaking work that addresses issues of interest to the multiple fields that comprise cognitive science. Kachergis is now a post-doctoral fellow at the University of Leiden in the lab of Bernhard Hommel.

Tell us what you do, so we can better serve undergraduates

What can one do with a degree in psychological and brain sciences? To answer the question, we'd love to hear from you. Send us an email to let us know what you are doing in your careers: [pbschair@indiana.edu](mailto:pbschair@indiana.edu).



## KEN HELLER'S DIVERSITY FUND MATCHES GIFTS FOR THE SAKE OF EQUITY AND PSYCHOLOGICAL KNOWLEDGE

Ken Heller's diversity fund matches gifts for the sake of equity and psychological knowledge. Increasing the diversity of students in the field of psychological and brain sciences is more than a matter of fairness. It is essential to the future of the field itself.

So suggests Ken Heller, who has created a fund to support the training of ethnic minority students and others from groups under-represented in the field of psychology. Heller, who retired in 1998 as a professor of clinical psychology, has had a strong interest throughout his career on how setting and situation influence the way people see the world. Increasing diversity, he believes, "increases what psychologists study."

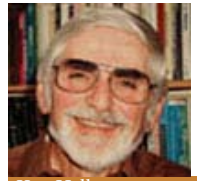
"It used to be said that the principles of psychology are universal, and to some extent

that is true. But in 1960, when we had an all-male faculty, there were no courses on the psychology of women. Now that we have women, we have people teaching and doing research on the topic."

The same occurs with respect to other minorities, he believes. As more African-American, Hispanic, Native Americans, and others enter the field, they expand the scope of our knowledge. They improve our understanding of how specific social and cultural circumstances influence behavior.

Begun soon after his retirement, he designated that the fund can be used to recruit graduate students from under-represented groups, to top off graduate fellowships, cover travel expenses for research and conferences, and summer

stipends. And so strongly does Ken Heller believe in its purpose that he is willing to match, dollar for dollar, all gifts up to \$5,000 each year.



Ken Heller

It's a powerful statement with far-reaching goals, which makes a single gift, multiplied by two, the vehicle for both equity and knowledge.

Donate now to the Ken Heller Fund for Diversity. Under "Additional Comments" please write Heller Fund.

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