APS to Launch New Research Methodologies and Practices Journal

Observer

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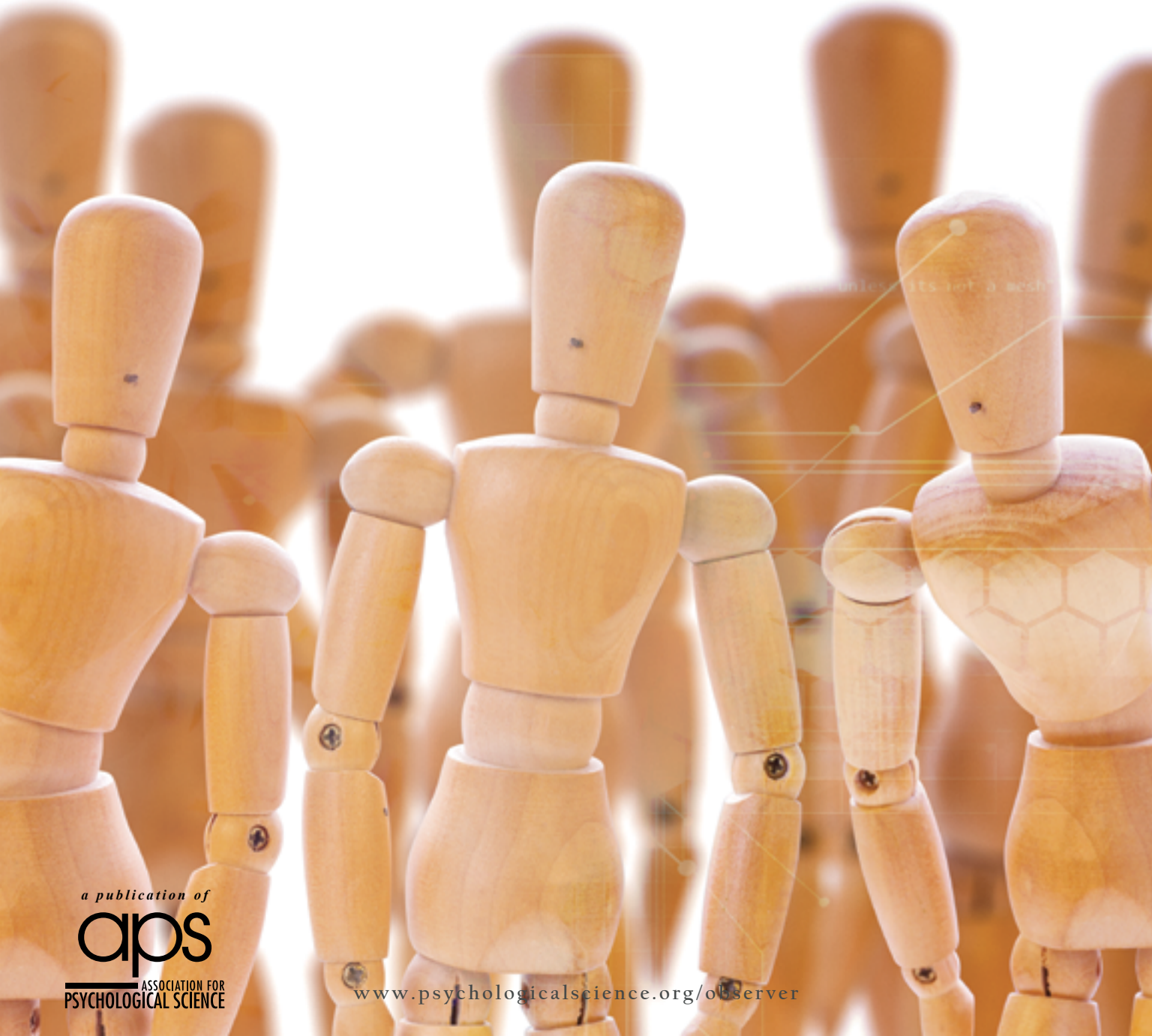
The Science of Sameness

THE NEURAL MECHANICS OF CONFORMITY



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Integrative Science Symposia

Our Social Brain: Neurobiology of Human Interactions

Patricia S. Churchland, *Department of Philosophy, University of California, San Diego, USA*

Christian Keysers, *Department of Psychology and Neuroscience, Netherlands Institute for Neuroscience of the Royal Netherlands Academy of Arts and Sciences*

Brian D. Knutson, *Department of Psychology and Neuroscience, Stanford University, USA*

Rebecca Saxe, *Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, USA*

Who's In, Who's Out? Loneliness, Exclusion, and Integration

Jennifer Cole, *Department of Comparative Human Development, The University of Chicago, USA*

Steve Cole, *Department of Medicine and Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, USA*

Taciano L. Milfont, *School of Psychology Victoria University of Wellington, New Zealand*

Frosso Motti-Stefanidi, *Department of Psychology, National and Kapodistrian University of Athens, Greece*

Alan Teo, *Department of Psychiatry and School of Public Health, Oregon Health & Science University, USA*

Better Minds: Understanding Cognitive Enhancement

Daphne Bavelier, *Department of Psychology, University of Geneva, Switzerland*

Arthur F. Kramer, *Department of Psychology, University of Illinois at Urbana-Champaign, USA*

E. Glenn Schellenberg, *Department of Psychology, University of Toronto, Canada*

Ilina Singh, *Department of Psychiatry University of Oxford, United Kingdom*

The Science of Successful Aging

Monica Fabiani, *Department of Psychology, University of Illinois at Urbana-Champaign, USA*

Denise C. Park, *Center for Vital Longevity The University of Texas at Dallas, USA*

Karl A. Pillemer, *Department of Human Development, Cornell University, USA*

Lorraine K. Tyler, *Department of Psychology, University of Cambridge, United Kingdom*

Emotions in Context

Ralph Adolphs, *Division of the Humanities and Social Sciences, California Institute of Technology, USA*

Iris M. Engelhard, *Department of Psychology, Utrecht University, The Netherlands*

Klaus R. Scherer, *Department of Psychology, University of Geneva, Switzerland*

Jeanne L. Tsai, *Department of Psychology, Stanford University, USA*

Frank H. Wilhelm, *Department of Clinical Psychology and Psychotherapy, University of Salzburg, Austria*

The Push and Pull of Values and Behavior

Scott Atran, *School of Anthropology and Museum Ethnography, University of Oxford, United Kingdom*

Chi-yue Chiu, *Department of Psychology, The Chinese University of Hong Kong, China*

Hazel R. Markus, *Department of Psychology, Stanford University, USA*

Heidi Keller, *Department of Psychology, Osnabrück University, Germany*

Walter Mischel, *Department of Psychology, Columbia University, USA (Discussant)*

Bridging the Lab and the Real World

Karen E. Adolph, *Department of Psychology, New York University, USA*

Rick Dale, *Department of Cognition & Information Sciences, University of California, Merced, USA*

Susan Goldin-Meadow, *Department of Comparative Human Development, The University of Chicago, USA*

Emiliano Macaluso, *Neuroimaging Laboratory, Lyon Neuroscience Research Center, Italy*

Hugo Spiers, *Department of Experimental Psychology, University College London, United Kingdom*

In Sync: The Dynamics of Social Coordination

Nick Chater, *Department of Psychology, University of Warwick, United Kingdom*

Shaun Gallagher, *Department of Philosophy, University of Memphis, USA*

Marco Iacoboni, *Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, USA*

Andrzej Nowak, *Department of Psychology, University of Warsaw, Poland and Florida Atlantic University, USA*

Natalie Sebanz, *Department of Cognitive Science, Central European University, Hungary*

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Cognitive Evolution: People Are Animals Too

W. Tecumseh Fitch

Department of Cognitive Biology
University of Vienna, Austria

How Infants Break Into Language

Linda B. Smith

Department of Psychological and Brain Sciences
Indiana University Bloomington, USA

Genetic and Brain Diversity in AutismS

Thomas Bourgeron

Department of Human Genetics and Cognitive Functions
Pasteur Institute, France

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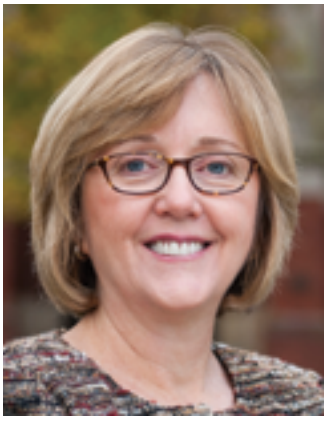
December 2016 Volume 29, Number 10

Contents

FEATURES

Departments

Women's Colleges and the STEM Gender Gap



Guest Columnist
Kathleen McCartney
President, Smith College

Smith College gave me the opportunity to attend the University of Geneva, Switzerland, as a 20-year-old and study with Jean Piaget, Barbel Inhelder, and Hermine Sinclair — an incredible introduction to the field of psychology, which got me hooked. Today, Smith is providing opportunities for many young women to study and practice science and is thus playing a crucial role in diversifying who conducts science. Kathleen McCartney, a developmental psychological scientist and president of Smith College, describes the college's goals with respect to women and science, including, of course, psychological science.

-APS President Susan Goldin-Meadow

Numerous studies have identified a gender gap in science, technology, engineering, and mathematics (STEM) in the United States — a gap that threatens the country's leadership position and competitive advantage in the global economy. According to the US Department of Commerce, women hold fewer than 25% of STEM jobs in the US.[1] In engineering, the disparity is even greater; although women earn 20% of engineering degrees, they represent only 13% of employed engineers.[2] Degree attainment among women in computer science has fallen from its peak of 35% in 1985 to 17% today.[3]

Three factors contribute to the lack of women's representation in STEM. First, the comparatively small proportion of women working in STEM fields, and therefore ascending to leadership positions in STEM, results in a dearth of female role models and mentors at all stages of the STEM pipeline. Second, implicit and explicit biases contribute to women concluding that a career in the sciences is not for them. Finally, for women who do pursue careers in STEM, the lack of institutionalized family supports may inhibit career aspirations, especially because these are fields that often require long hours in the workplace. This, of course, contributes to a loss of talent.

Women's colleges are uniquely positioned to address the gender gap in STEM fields. For example, Smith College, where I serve as president, established the first engineering program at a women's college in 1999. Today, 40% of Smith students major in one of the STEM fields — double the national average for undergraduate women. We have identified a number of principles that have advanced our work.

Principle One: Mentor via Cohorts

Research demonstrates that people learn better when they gain a sense of mutual support and accountability from active, meaningful learning communities. Smith College psychology professor Patricia M. DiBartolo served as lead author on a recent paper about successful intervention initiatives that promote persistence for students in STEM fields, particularly students from underrepresented populations.[4] In a study of 11 colleges and universities, the researchers found four common elements: cohort and mentoring programs, research- and inquiry-based experiences, attention to quantitative skills, and outreach programs that broaden the pool of future scientists.

Among these interventions, mentoring and cohort programs have proven extremely successful at Smith. One example is our Achieving Excellence in Mathematics, Engineering, and Science (AEMES) program, launched in 2007. AEMES connects underrepresented students with faculty and peer mentors, engages students in faculty-supervised research, and creates a network of academic and social support and encouragement. Institutional research has shown that AEMES improves the bonds between students and faculty, peer-to-peer connections among students, and student outcomes:

- Students in our AEMES Scholars program no longer evidence a gap in gateway-course GPA relative to well-represented (White, non-first-generation-, non-Pell Grant-recipient) peers.

APS Fellow **Kathleen McCartney** *was installed as president of Smith College in 2013. Her research has focused on early experience and development, particularly with respect to child care, education, and poverty. She can be contacted via apsobserver@psychologicalscience.org.*

- AEMES Scholars who enter Smith interested in STEM persist in the natural sciences at higher rates than their well-represented peers.
- AEMES Scholars participate in natural science honors and independent research at rates equivalent to their well-represented peers.

Principle Two: Make the Invisible Visible

APS Past President Mahzarin R. Banaji of Harvard University has done groundbreaking work in the study of implicit bias. Her research focuses on "unconscious thinking and feeling as they unfold in social context."[5] Banaji and her collaborator, APS William James Fellow Anthony G. Greenwald, call these stereotypical thought patterns (based, for example, on race, gender, ethnicity, or ability) "blindspots." Consider, for example, the tendency to favor a résumé with a male name versus a female name when candidates present equivalent qualifications, a well-documented finding in social science. In their book, *Blindspot: Hidden Biases of Good People*, Banaji and Greenwald suggest that the first step to overcoming such biases is to develop a heightened awareness of them and to bring this awareness to the surface, where it can be considered and confronted.

"Because many biases are not ones of which we are even aware," they note, "the act of becoming aware of them is a key first step."[6]

Beyond awareness, interventions that help to mitigate the effects of implicit bias include participating in diversity training and professional development; seeking active feedback about one's own unconscious biases from mentors and peers; and reviewing hiring criteria to ensure they do not privilege or disadvantage candidates on the basis of race, gender, or other characteristics.

Principle Three: Support Employed Parents

Cultural assumptions about the sexes limit the aspirations of men and women alike. In a column for CNN, I argued that "the narrative in our culture is consistent and unyielding … omnipresent in our lives: Raising children is mothers' work, not parents' work."[7]

Our country needs to do more to support employed parents, beginning with parental leave. Presently, the United States ranks 33rd among countries in the Organisation for Economic Co-operation and Development in support for early care and education; only Slovakia, Cyprus, and Estonia are ranked lower. For example, England guarantees 1 year of maternity or shared parental leave, including 39 weeks of paid leave. Although cities such as New York and San Francisco have mandated leave policies, they remain outliers in this country. Affordable, high-quality child care is another obstacle for women as well as men pursuing careers in STEM.

There is much more to do to promote equity and to expand the STEM talent pool. Barriers to women's success in STEM limit innovation, prosperity, and economic growth. If we draw from only half the population, we leave capacity on the table. While women's colleges are well positioned to advance women in STEM, the interventions that work are replicable across classrooms, universities, and workplaces around the world. ●

Notes

1 http://2010-2014.commerce.gov/blog/2011/08/03/women-stem-opportunity-and-imperative.html

2 https://www.goodcall.com/news/40-women-engineering-students-earning-degrees-quit-never-enter-field-mit-study-finds-08493

3 http://www.aauw.org/research/solving-the-equation/

4 http://www.lifescied.org/content/15/3/ar44.full.pdf+html

5 http://www.iq.harvard.edu/people/mahzarin-banaji

6 http://spottheblindspot.com/the-book/a-talk-with-the-authors-of-blindspot/

7 http://www.cnn.com/2013/03/15/opinion/mccartney-working-parents-issues

Bringing Together Cultural Evolution and Cultural Learning

Psychology generally has begun to recognize the importance of integrating and unifying its many diverse interests and accomplishments.

As APS Fellow **David G. Myers** so valuably indicates in "Simulating Cultural Evolution" (*Observer*, October 2016), it has been illustrated that cultural evolution is cumulative (Caldwell, Atkinson, & Renner, 2016). Moreover, researchers have experimentally shown cumulative microcultures in action. Myers has projected additional experimental studies of cumulative cultural evolution.

In terms of integration, it would be productive to add that Staats (2012) has developed another cumulative explanation of cultural change based on humans' cumulative learning. "Take religion as another example … A book entitled *Man and His Gods* by Homer W. Smith (1952) provides a historical description of how aspects of the religious beliefs of a people are drawn upon by a later people creating their new religion" (2012, pp. 285–287).

The two approaches have much in common that should be brought together, but they arise within different theoretical and empirical frameworks. Bringing that separated knowledge together would inform each framework greatly.

-**Arthur W. Staats**
APS Fellow
Professor Emeritus of Psychology
University of Hawaii, Honolulu

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Smith, H. W. (1952). *Man and his gods*. New York: Universal Library.

Staats, A. W. (2012). *The marvelous learning animal: What makes human nature unique*. New York: Prometheus/Random House.

Effect of Facial Expression on Emotional State Not Replicated in Multilab Study

A coordinated replication effort conducted across 17 labs found no evidence that surreptitiously inducing people to smile or frown affects their emotional state. The findings of the replication project have been published as part of a Registered Replication Report (RRR) in *Perspectives on Psychological Science*.

The RRR project, proposed by University of Amsterdam psychology researchers **Eric-Jan Wagenmakers**, **Titia Beek**, **Laura Dijkhoff**, and **Quentin Gronau**, aimed to replicate a 1988 study conducted by psychological scientists APS Fellow **Fritz Strack**, APS Fellow **Leonard L. Martin**, and **Sabine Stepper**.

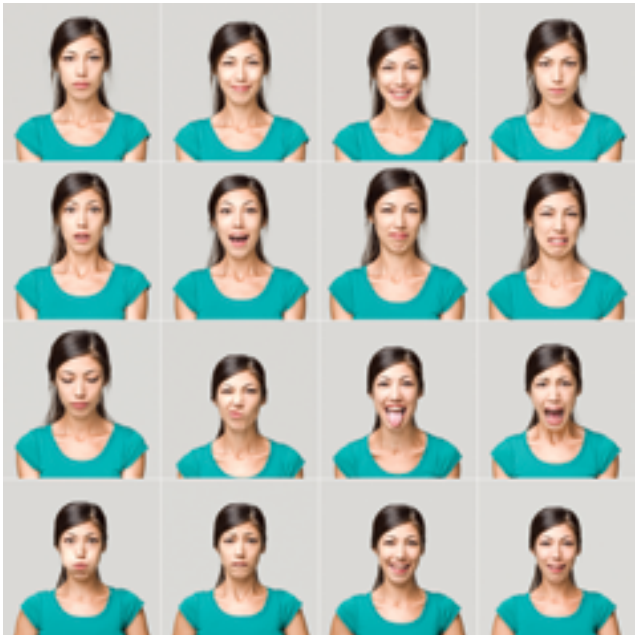
In the 1988 paper, Strack, Martin, and Stepper reported two studies in which they surreptitiously changed participants' facial expressions. Their goal was to test the idea that our facial expressions can trigger emotional reactions — the so-called "facial feedback hypothesis" — even when people are unaware that they are making that expression. Participants who held a pen between their teeth, inducing a smile, rated cartoons as funnier than did those who held a pen between their lips, inducing a frown.

The study is cited frequently in the scientific literature and in introductory psychology courses and textbooks. Although other studies have tested the facial feedback hypothesis using different methods, this influential study had not been directly replicated with the same design and outcome measure. The RRR paper describes a rigorous, multilab replication of that study, with each lab following a vetted protocol that was registered online prior to data collection.

The aim was to replicate the original study as closely as possible, but the RRR differed in several ways from the original. Strack provided the materials from the original study, including the original Far Side cartoons. The RRR study also used a set of Far Side cartoons after first conducting a study to ensure that they were moderately funny by today's standards. The RRR protocol also standardized the instructions to participants and stipulated that they be delivered via computer in order to minimize interactions with the experimenter. Based on guidance from an expert reviewer during the protocol vetting process, participants were recorded on video during the experiment to ensure that they were holding the pen correctly on each trial.

All of the materials, the protocol, the data, and the analysis scripts are publicly available on the Open Science Framework.

As in the original study, participants were told they would be completing different tasks with parts of the body not normally used for those tasks. Per the instructions provided, they held the pen in their mouth (between their teeth or between their lips) and completed the tasks presented in a booklet, which included drawing lines between various numbers, underlining vowels, and indicating how amused they were by cartoons.



The combined results from 1,894 participants were inconsistent with the findings reported in the original study. The data provided no evidence that inducing participants to have particular facial expressions led them to rate the cartoons differently.

"This RRR did not replicate the [Strack, Martin, Stepper] results and failed to do so in a statistically compelling fashion," the contributing researchers write in their report.

"Nevertheless, it should be stressed that the RRR results do not invalidate the more general facial feedback hypothesis," they conclude.

In a commentary accompanying the RRR report, Strack commends the efforts of those involved in the RRR. He notes his surprise that the original finding was not replicated, especially given that his and colleagues' labs have confirmed the results in "numerous operational and conceptual replications." Strack speculates about some possible reasons for the different outcomes, including that the presence of a camera in the RRR experiments might have affected how participants reacted to the cartoons.

APS Fellow **Daniel J. Simons**, the acting editor for this RRR project, commended the care taken by the proposing authors: "This team's exceptional rigor and care in developing the study protocol, teaching other researchers how to follow it, and fully documenting every step of the process set a standard that I hope future large-scale studies like this one will emulate."

Eric-Jan Wagenmakers will speak at the 2017 APS Annual Convention, May 25–28, 2017, in Boston, Massachusetts.

Bourgeron to Share Groundbreaking Autism Research at ICPS

Bourgeron

One of the most significant examples of integrative science will be spotlighted at the 2017 International Convention of Psychological Science (ICPS), to be held March 23–25 in Vienna, Austria. **Thomas Bourgeron**, the French geneticist who is credited with transforming autism research, will deliver the closing keynote address at the event. Bourgeron, who was elected to the French Academy of Science in 2015, is director of the Human Genetics and Cognitive Functions Unit of the Institut Pasteur in Paris. He has titled his address "Genetic and Brain Diversity in AutismS."

Bourgeron gained recognition in 2003 when he and his research team identified the first single-gene mutations linked to autism, pointing to the synapse as a site of autism's pathology. His lab gathers geneticists, neurobiologists, and clinicians to explore the genetic and epigenetic hallmarks of individuals with autism. The research group uses high-throughput genotyping and sequencing-based methods in combination with clinical, neurobiological, and neuroimaging data collected from patients and from cell and animal models.

In his keynote, Bourgeron will discuss how his research is identifying not only the various mutations linked with the disorder, but also the factors that increase risk for (or protection from) comorbidities associated with it.

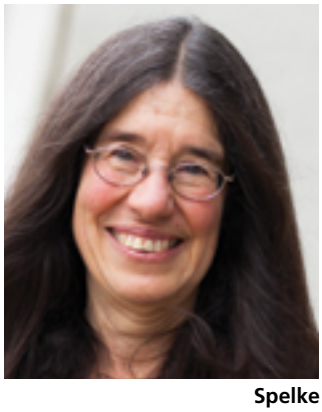
To register for ICPS, visit icps.psychologicalscience.org/registration/.

Spelke Awarded Heineken Prize

APS William James Fellow **Elizabeth S. Spelke**, a Harvard University psychological scientist widely known for her research on the cognitive development of infants, recently received the C. L. de Carvalho-Heineken Prize for Cognitive Science from the Royal Netherlands Academy of Arts and Sciences.

The $200,000 prize will support Spelke's cognitive research. Her pioneering work has demonstrated the remarkable capacity of infants to predict movement and to understand characteristics of objects that could not be derived from their experience in the world. In the process of demonstrating these fundamentally important points about native knowledge, Spelke has developed techniques of studying infants' beliefs that are far more probative than might have been imagined only a short time ago. Past recipients of the award include APS William James Fellows **James L. McClelland** and **John R. Anderson**, as well as APS Fellows **John Duncan**, **Michael Tomasello**, and **Stanislas Dehaene**.

"Sometimes when I am asked what I do, I say that I study human infants and try to figure out what they are thinking about," Spelke said in a video on the award's Web page. "My real goals in studying infants, though, are to understand something about the human mind and the amazing capacities that we have for building rich and varied systems of knowledge from the limited glimpses of the world that we get in our short lives."



Spelke

Spelke also has researched young children's interpersonal habits and delineated how they select social partners. In making sense of how children decide to interact, cooperate, and share with others, she has illuminated the many facets of social exclusion and interpersonal conflict at a young, fundamental level.

Spelke also is a Fellow of the American Academy of Arts and Sciences and received the 2009 Jean Nicod Prize, delivering a series of lectures hosted by the French National Centre for Scientific Research.

NEW BOOK

Introduction to the New Statistics: Estimation, Open Science, and Beyond
by Geoff Cumming and Robert Calin-Jageman; Routledge, October 12, 2016.

To submit a new book, email apsobserver@psychologicalscience.org.

Psychological Science Explores the Minds of Dogs

Dogs are one of the most common household pets in the world, so it's curious that we know relatively little about their cognitive abilities when we know so much about the abilities of other types of animals, from primates to cetaceans. Over the last couple decades, researchers have been aiming to bridge this gap in scientific knowledge, investigating how our canine companions behave and what they know and why.

The October 2016 issue of *Current Directions in Psychological Science* is a special issue dedicated to exploring recent findings by psychological scientists about dog behavior and cognition.

"Although Pavlov's classic work on conditioning was conducted with dogs, since then most research with animals has been done primarily with rats, pigeons, and primates (including humans)," notes special issue editor and APS Fellow **Thomas R. Zentall** of the University of Kentucky in an introduction to the special issue. "The reason for this shift in experimental subjects can be attributed to a number of factors, including the issue of keeping them housed in cages, and although dogs are generally quite available as companion animals, researchers have been reluctant to have to deal with the large range in breed characteristics, experience, and age.

"In the past 20 years, however, researchers have recognized that those sources of variability may not be as great as once imagined, and a wealth of research on the cognitive abilities of dogs has appeared in the literature," Zentall explains.

The special issue offers an overview of the literature, highlighting the kinds of questions scientists have been trying to answer in an effort to understand the mental and social capacities of dogs, he adds.

The collection of articles underscores the unique relationship that dogs have with humans. Accumulated research shows, for example, that dogs are highly attentive to humans' communicative cues — including pointing and eye gaze — and they are able to comprehend and respond to human spoken words. Studies also indicate that dogs can recognize individual humans based on their face and can discriminate between different expressions of emotion, at least to some degree.

But existing research also provides little evidence that dogs have a meaningful understanding of humans' motivations and mental states, or the ability to reflect on their own mental states. Although studies suggest that dogs can solve complex visual tasks and store multisensory representations, dogs appear to have limited spatial memory and numerical discrimination. And data indicate that dogs' sense of object permanence is roughly equivalent to that of a 1- to 2-year-old child.

"There can be little argument that dogs are remarkable beings: Their ability to inveigle a larger, stronger, and surely more intelligent species to support their welfare is itself striking enough," writes APS Fellow **Clive D. L. Wynne** of Arizona State University in his article about dog cognition. But just because dogs are incredibly skilled when it comes to social interactions with humans doesn't necessarily mean that they have more advanced cognitive abilities than other animals do, he adds.

As many contributors to the special issue note, research on dogs' particular capacities and abilities is still in its infancy. Existing studies tend to be small and underpowered, making it difficult to examine individual variability and complex behaviors. Furthermore, integration across multiple levels of analysis — including behavior, neurobiology, and genetics — tends to be rare. But momentum in the field seems to be building.

"Although dogs had not been considered worthy of research for their own sake for many years, the situation has changed dramatically in the past decade," write **Gregory S. Berns**, Emory University, and **Peter F. Cook**, New College of Florida, Sarasota. "There is now a veritable renaissance in canine behavioral research."

The fact that dogs are so socially adept means that they can be trained to participate in studies that employ a variety of investigative approaches, including relatively new technologies like noninvasive neuroimaging techniques. This opens up avenues for exploration that are not available to researchers who study most other animals.

As research methods improve and collaborative partnerships develop, the field stands to gain deeper insight into the mechanisms and processes that underlie dogs' behavior. These insights may, in turn, elucidate important aspects of human behavior.

"Bringing these scientific practices to bear on canine cognition will have huge advantages," researchers **Rosalind E. Arden** (London School of Economics and Politics, United Kingdom), **Miles K. Bensky** (University of Illinois at Urbana–Champaign), and **Mark J. Adams** (University of Edinburgh, Scotland) write in their review of 105 years' worth of canine research. "We have an immense amount to learn from these captivating animals. Let's go to the dogs."

APS to Launch New Research Methodologies and Practices Journal

APS is launching a new journal to serve as the home for dissemination and discussion of new developments in research methodology and practices.

Advances in Methodologies and Practices in Psychological Science will publish new types of empirical work along with articles and tutorials on research practices, methods, and conduct. An APS search committee has begun considering nominations for the Founding Editor.

An explicit part of the journal's mission is to encourage integration of methodological and analytical questions across multiple branches of psychological science. Other types of articles the new journal aims to publish include large-scale studies using new and innovative methodologies, statistical techniques, and modeling; best-practices papers and multilab antagonistic collaborations designed to resolve theoretical disagreements; and multilab studies beyond the scope of single labs. The journal also will become the new center for APS's innovative Registered Replication Reports, currently published in *Perspectives on Psychological Science*.

The search committee intends to select a scientist who can assemble and lead a team of editors covering methodologies and practices across all of psychological science. The Editor will begin work in January 2017 or as soon thereafter as possible and will start soliciting and evaluating manuscripts throughout the year to prepare for the journal's first issue in early 2018.

The search committee includes APS Past President **Henry L. "Roddy" Roediger, III** (Chair) of Washington University in St. Louis; APS Board Members **Dorthe Berntsen** of Aarhus University, Denmark, and **Simine Vazire** of the University of California, Davis; former *Psychological Science* Editor in Chief **Eric Eich** of the University of British Columbia, Canada; APS Fellows **Michael C. Frank** and **Russell A. Poldrack** (both of Stanford University) and **Brian Nosek** of the University of Virginia and the Center for Open Science; **Teresa A. Treat** of the University of Iowa; and APS Executive Director **Sarah Brookhart** (ex officio).

"The APS Publications Committee and the APS Board of Directors are excited about launching this new journal with our partner, SAGE Publishing," Roediger said. "I believe the journal will attract an exciting variety of papers, with its multiple formats for articles, and will serve to improve the methods and standards of psychological science and science in related fields. The search committee is hoping to appoint a visionary and experienced founding editor to launch the journal."

APS President **Susan Goldin-Meadow** added, "This will be a unique publication for our field, one that is designed to make methodological advances accessible to researchers across areas. It reflects APS's leadership in efforts to bolster psychological science through innovation and methodological advances."

NIH-Wide Policy Doubles Down on Scientific Rigor and Reproducibility

The US National Institutes of Health (NIH) is now assessing all research grant submissions based on the rigor and transparency of the proposed research plans.[1] Previously, efforts to strengthen scientific practices had been undertaken by individual institutes, beginning in 2011 with the National Institute on Aging, which partnered with APS and the NIH Office of Behavioral and Social Science Research to begin a conversation about improving reproducibility across science.[2] These early efforts were noted and encouraged by Congress. Now, the entire agency has committed to this important goal: NIH's 2016–2020 strategic plan announces, "NIH will take the lead in promoting new approaches toward enhancing the rigor of experimental design, analysis, and reporting."[3]

"This is another sign that increased attention toward rigor and transparency has become science-wide," says APS Executive Director Sarah Brookhart. "Psychological science has pioneered the development of these practices and continues to be a model in promoting methods and incentives that encourage replication and open science."

Emphasis on Design

The NIH policy highlights four areas central to enhancing rigor and transparency. The first area — attention to rigorous experimental design — may have the widest scope. According to NIH, scientific rigor is "the strict application of the scientific method to ensure robust and unbiased experimental design, methodology, analysis, interpretation, and reporting of results. This includes full transparency in reporting experimental details so that others may reproduce and extend the findings."

NIH acknowledges that what constitutes robust and unbiased methods may vary from discipline to discipline.

"It is important to keep in mind that each scientific field may have its own set of best practices or standards to achieve scientific rigor," wrote Michael Lauer, NIH Deputy Director for Extramural Research, in a blog post.[4]

Given these differences, a practical issue in the months to come will be the interpretation of NIH's new policies and how they will or should guide new regulations. Researchers will have to stay tuned regarding what these policies mean for their own work. In the meantime, psychological scientists may wish to consult the NIH site "Principles and Guidelines for Reporting Preclinical Research" for guidance (in this context, "preclinical" means something roughly similar to "basic," describing the kind of research that many psychological scientists conduct).[5]

The guidelines are comparable to those that authors encounter when preparing submissions to an APS journal. They recommend full reporting of statistical analyses using up-to-date methods, appropriate consideration of good experimental techniques such as randomization and blinding, and inclusion of details about how sample size was determined. Each of NIH's institutes and centers have renewed their emphasis on these matters in different ways. For instance, the National Institute of Mental Health (NIMH) released specifications in a document titled "Enhancing the Reliability of NIMH-Supported Research through Rigorous Study Design and Reporting."[6]

The NIH guidelines also recommend that data and materials be made publicly available online. This coincides with APS's Open Practice Badges program, which recognizes journal authors who make their data or materials available online with an icon that appears on the published paper. (In case you missed it, a recent analysis showed that this program dramatically increased rates of data sharing.)[7]

Another aspect of experimental design now under scrutiny: NIH expects that researchers consider relevant biological variables such as sex when conducting research. The main idea here is that consideration of sex may be critical to the interpretation, validation, and generalizability of research findings. For instance, a study that is conducted on only male human subjects (historically a common practice in animal research) may be limited in generalizability. NIH also recommends consideration of other factors such as age, weight, and underlying health conditions.

(Learn more about NIH's interest in sex as a biological variable on the website of NIH's Office of Research on Women's Health, which led the NIH-wide focus on this issue.)[8]

NIH also specifies that researchers should authenticate key biological and chemical resources when conducting proposed research. This focus comes from notable cases in which researchers believed they were using a particular resource (e.g., chemical compound, strain of mouse, etc.) but actually weren't. This is relevant for many psychological scientists working in a variety of areas, but even those who aren't frequent users of biological or chemical resources still can take a lesson: Consider carefully the different manipulations and methods used in a study and ensure that what's being measured is what is intended.

Solid Grounding

NIH's final point is that the scientific premise forming the basis of research should be sound. This involves the question, "Does the proposed research build on research that you already have reason to believe is rigorous and transparent?" If your research proposal is based on previous research that used improper or unconvincing research practices, this constitutes a questionable foundation and increases the potential for spurious results.

Given that NIH is concerned about rigor and transparency, what can researchers expect when submitting grant applications? Changes have been made throughout the grant application process. The Significance and Approach sections of the Research Strategy portion of applications now ask applicants to detail the scientific premise of the project and describe how the methods proposed will achieve robust and unbiased results. This same section will ask applicants to explain how sex is factored into the research design.

In the grant review process, reviewers will be asked to indicate whether there is a strong scientific premise for the proposed research and whether the investigators have presented strategies to ensure a robust and unbiased approach. And once an application is funded, subsequent progress reports will require investigators to document the rigor of the approaches taken to ensure accurate, reliable results.

According to NIH, the increased emphasis on rigor and transparency reflects NIH's mission to promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science. To further this mission, NIH also has announced that in 2017 it will begin evaluating institutional training grants, institutional career development awards, and individual fellowships using similar criteria.[9] After all, a large part of improving research practices lies in training of early-career researchers.

A Renewed Focus on Replicability

With these changes, NIH joins other organizations in leading a drive toward improved replicability in scientific research. APS has helped focus attention on these issues in psychological science and beyond — for more, read "APS and Open Science: Music to Our Ears" by APS Executive Director Emeritus Alan G. Kraut.[10] In addition, the Social, Behavioral, and Economic Sciences division of the National Science Foundation published a report in 2015 on encouraging robust, reliable science. This report was coauthored by APS Past President John T. Cacioppo, APS Fellow Jon A. Krosnick, and others.[11]

Another initiative from APS is the Registered Replication Report, a type of study developed by past Editor in Chief of *Perspectives on Psychological Science* Barbara A. Spellman and Special Associate Editors Alex O. Holcombe and Daniel J. Simons.[12] These reports are multilab replication attempts of important experiments in psychological science, often paired with comments by the authors of the original studies.

Also supporting the important goals of rigor and reproducibility are APS's journal policies. Past Editor in Chief of *Psychological Science* Eric Eich, in 2014, established a new set of guidelines to ensure that scientific claims made by authors were justified by the methods used.[13] And current Editor in Chief D. Stephen Lindsay has taken new steps to further strengthen scientific practices at that journal, such as building a team of statistical advisors to provide additional statistical and methodological expertise in cases where it is necessary.

"I want to shout from the rooftops that *Psychological Science* is committed to scientific rigor," said Lindsay in an interview.[14]

More recently, incoming editor of *Clinical Psychological Science* Scott O. Lilienfeld has affirmed that journal's commitment to robust scientific practices. "I perceive the fact that psychological science is striving to improve itself by using the very methodological tools that psychological science has helped to create as a most welcome development."[15]

In line with this commitment, *Clinical Psychological Science* has recently begun awarding Open Practice badges to recognize authors for making their data or materials open or preregistering their research.[16]

Additionally, the efforts of the Center for Open Science (COS), cofounded and directed by APS Fellow Brian A. Nosek, have been instrumental in building an infrastructure to support reproducible science.[17] COS's Open Science Framework provides storage for data, materials, and registrations of experiments. COS also has helped develop the Transparency and Openness Promotion Guidelines, of which APS is an original signatory.[18] These guidelines outline ways that academic journals can encourage adherence to good research practices.

Even the US Congress has taken an interest in this critical topic, recognizing the importance of rigor and reproducibility in scientific research. In 2012, the Senate Appropriations subcommittee that funds NIH noted, "The Committee supports NIH's effort to develop a consensus on the issues of false-positive research results."[19] More recently, Congressional language has observed, "The gold standard of good science is the ability of a researcher or research lab to reproduce a published method and finding."[20] And this past July, Congress noted that it expects an update on progress made within the scientific community on reproducibility issues in 2017 and beyond.[21]

NIH's notice and new requirements suggest an extra level of scrutiny will be paid to scientific methodology moving forward. ●

-K. Andrew DeSoto

Further Reading

"Rigor and Reproducibility" http://grants.nih.gov/reproducibility/

"Rigor and Reproducibility in NIH Applications Resource Chart" http://grants.nih.gov/grants/RigorandReproducibilityChart508.pdf

Notes

1 "Implementing Rigor and Transparency in NIH & AHRQ Research Grant Applications" http://grants.nih.gov/grants/guide/notice-files/NOT-OD-16-011.html

2 "A Science We Can Believe In" http://www.psychologicalscience.org/index.php/publications/observer/2011/december-11/a-science-we-can-believe-in.html

3 "NIH-Wide Strategic Plan" https://www.nih.gov/sites/default/files/about-nih/strategic-plan-fy2016-2020-508.pdf; "NIH unveils FY2016-2020 Strategic Plan" https://www.nih.gov/news-events/news-releases/nih-unveils-fy2016-2020-strategic-plan

4 "Scientific Rigor in NIH Grant Applications" https://nexus.od.nih.gov/all/2016/01/28/scientific-rigor-in-nih-grant-applications/

5 "Principles and Guidelines for Reporting Preclinical Research" https://www.nih.gov/research-training/rigor-reproducibility/principles-guidelines-reporting-preclinical-research

6 "Enhancing the Reliability of NIMH-Supported Research through Rigorous Study Design and Reporting" https://www.nimh.nih.gov/research-priorities/policies/enhancing-the-reliability-of-nimh-supported-research-through-rigorous-study-design-and-reporting.shtml

7 "Psychological Science Badge Program Encourages Open Practices, Study Shows" http://www.psychologicalscience.org/index.php/publications/observer/obsonline/psychological-science-badge-program-encourages-open-practices-study-shows.html

8 "Considering Sex as a Biological Variable: In the NIH Guide" http://orwh.od.nih.gov/about/director/messages/nih-guide-biological-variable/

9 Advanced Notice of Coming Requirements for … NIH and AHRQ Institutional Training Grants, Institutional Career Development Awards, and Individual Fellowships" http://grants.nih.gov/grants/guide/notice-files/NOT-OD-16-034.html

10 "APS and Open Science: Music to our Ears" http://www.psychologicalscience.org/index.php/publications/observer/2015/december-15/aps-and-open-science-music-to-our-ears-2.html

11 "Social, Behavioral, and Economic Sciences Perspectives on Robust and Reliable Science" https://www.nsf.gov/sbe/AC_Materials/SBE_Robust_and_Reliable_Research_Report.pdf

12 "An Introduction to Registered Replication Reports at Perspectives on Psychological Science" http://pps.sagepub.com/content/9/5/552.full

13 "Business Not as Usual" http://pss.sagepub.com/content/25/1/3.short

14 "Lindsay Talks Plans for Psychological Science" http://www.psychologicalscience.org/publications/observer/2016/sept-16/lindsay-talks-plans-for-psychological-science.html

15 "Lilienfeld Plans New Features for Clinical Psychological Science" http://www.psychologicalscience.org/publications/observer/2016/oct-16/lilienfeld-plans-new-features-for-clinical-psychological-science.html

16 "Clinical Psychological Science Begins Awarding Open Practices Badges" http://www.psychologicalscience.org/publications/observer/2016/sept-16/clinical-psychological-science-begins-awarding-open-practices-badges.html

17 "Center for Open Science" https://cos.io/

18 "The Transparency and Openness Promotion Guidelines" https://cos.io/top/

19 "Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriation Bill, 2013" https://www.congress.gov/congressional-report/112th-congress/senate-report/176

20 "America COMPETES Reauthorization Act of 2015" https://www.congress.gov/bill/114th-congress/house-bill/1806/text

21 "Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Bill, 2017" https://www.gpo.gov/fdsys/pkg/CRPT-114hrpt699/html/CRPT-114hrpt699.htm

Research Preregistration 101

By D. Stephen Lindsay, Daniel J. Simons, and Scott O. Lilienfeld

APS President Susan Goldin-Meadow recently published an *Observer* column titled "Why Preregistration Makes Me Nervous." We suspect that many psychological scientists share Goldin-Meadow's uncertainties about preregistration. In this article, we attempt to allay those concerns by explaining the rationale for and benefits of preregistration for researchers and for the field of psychology at large.

A Problem: Reporting Flexible, Post hoc Analyses as if They Had Been Planned

Imagine you conduct a study testing whether symmetrical faces are more attractive than asymmetrical ones. Suppose that you find no overall difference in attractiveness, so you test whether the effect differed as a function of the gender of the participant and the gender of the face. Looking at the means, you see that men found symmetry attractive for faces of both genders, whereas women found symmetry attractive in women's faces but asymmetry attractive in men's faces. That interesting interaction pattern was not statistically significant. Examining the data more closely, though, you notice that some faces were rated as maximally attractive by almost everyone, so you drop those faces from the analysis because they might obscure a real effect. Moreover, some participants were older than the rest and their ratings don't seem to fit the pattern, so you exclude their data, too. Now the interaction becomes statistically significant. "Eureka!" you cry.

In the past, results selected from such freewheeling exploratory analyses often were reported as if they were theory-driven and planned. Many researchers generated or changed their hypotheses after looking at the data but reported their research as if those hypotheses had motivated the study in the first place (a practice known as "hypothesizing after the results are known," or *HARKing*; Kerr, 1998). Also, researchers often tweaked their measures or designs while analyzing their data and then selectively reported just those outcomes that best supported the story they wanted to tell. Similarly, they sometimes conducted a series of studies, reporting only the most "successful" ones and treating the others as failed pilot studies. This approach to analyzing data and reporting findings was recommended most famously by Daryl Bem (1987), but we believe it was widespread long before then.

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Researchers taking this approach almost always believe that their selectively reported evidence is also the best evidence — they're choosing results not because they are the prettiest, but because they truly believe those are the "right" analyses. But these flexible, post hoc approaches to data analysis and reporting have come under intense fire in the last 6 years. Different critics have used several terms and highlighted multiple aspects of the problem (in addition to *HARKing*, terms include *researcher degrees of freedom*, Simmons, Nelson, & Simonsohn, 2011; p-*hacking*, Simmons, Nelson, & Simonsohn, 2012; *the garden of forking paths*, Gelman & Loken, 2014; and *questionable research practices*, John, Loewenstein, & Prelec, 2012). What is hard to realize is that our intuitions about which analyses are "right" likely are influenced by the results of those analyses and by how much we want to believe in those results.

The problem is *not* data exploration. Exploration can lead to new ideas and discoveries — it's a generative, creative, fun, and key component of science, and all researchers should fully examine and explore their data. Exploration often helps uncover unexpected patterns that merit further study. It helps researchers avoid overlooking effects (Type II errors). But exploration differs from planned hypothesis testing, and the results of standard inferential hypothesis tests (i.e., *p* values) are valid only when evaluated in the context of the full range of tests that were entertained (Wasserstein & Lazar, 2016).

Flexible analytic practices — exploring your data to decide which hypotheses to test and how to test them — dramatically increase the chances of erroneously rejecting null hypotheses (Type I errors). Even though the interaction between gender of faces and gender of participants was "significant" in the example we've described, the odds that it was just a fluke are high as a result of flexibility in analyzing the data. When several such strategies are combined, the Type I error rate can soar from the ostensible .05 level to a staggering .61 or more (Simmons et al., 2011). Thus, flexibly choosing which statistical tests to conduct after inspecting your data makes it easy to obtain statistical significance when, in reality, there is no effect at all. It also leads to exaggerated estimates of the size of real effects, which increases the likelihood that subsequent replication attempts will be underpowered and at high risk of failure (Button et al., 2013) and renders meta-analytic summaries of the literature less accurate. More generally, in the words of Wasserstein and Lazar (2016) of the American Statistical Association, "proper [statistical] inference requires full reporting and transparency."

Research projects unfold across months or years, so even with the best of intentions, you might not remember which predictions, analyses, exclusions, transformations, covariates, and so on were planned and which were post hoc. When you finally get around to writing a paper, it's easy to forget that you had planned to analyze means rather than medians, that you hadn't planned to drop older subjects, that you meant to treat socioeconomic status as a covariate, or that you intended to analyze men's and women's faces separately. You might even forget that you conducted a couple of studies similar to the one you're reporting — studies that, for some reason, did not yield the predicted effects. Even if you report every analysis and all were planned in advance, how can you demonstrate that to others?

A Solution: Preregistration of Research Plans

Preregistering a research project involves creating a permanent record of your study plans before you look at the data. The plan is stored in a date-stamped, uneditable file in a secure online archive. You can give others (e.g., reviewers) access to the preregistered plan, and you can do so while maintaining your and the reviewers' anonymity. The main purpose of preregistration is to make clear which hypotheses and analyses were specified a priori and which were more exploratory and driven by the data.

Preregistered research plans supplement our malleable, imperfect memories (Nosek, Spies, & Motyl, 2012). Good documentation of your original plan can help ensure that your report accurately represents what you actually planned. If editors or reviewers ask about flexibility in your data-analysis choices or in your predictions, your preregistered research plan will put any concerns to rest. Your preregistered plans also provide a long-term record of your laboratory's workflow — you can return to your plans years later to review your original hypotheses and analysis plans. And, if you upload your materials, plans, and results to the same site as your preregistered plan, you can see the entire research process for a completed study in one place, making it easy for you to share with others.

You can preregister every detail of your study, uploading all of your research scripts, coding schemes, data-collection plans, analysis code, and so on. Alternatively, you can preregister a more minimal plan. You can preregister competing hypotheses, and you can plan tests without having a specific prediction regarding the outcomes. You also can preregister your lab's "standard operating procedures" (e.g., how you define outliers, standard transformations; see http://www.columbia.edu/~wl2513/sop-safety-net.pdf) and refer to that documentation to simplify the process of registering individual studies. Even if you are collecting a set of measures for entirely exploratory purposes, you can preregister that plan. Such a preregistration will remind you and inform reviewers that you conducted the study without specific analyses and predictions in mind. That said, the more detail you provide and the better the documentation that your analyses and predictions were made a priori rather than post hoc, the more confidence readers can have in your interpretation of the results of the inferential statistical tests you report.

Just because you have preregistered a plan does not mean that you must stick to that plan regardless of what happens. In many cases, it makes sense to examine your data in ways that you did not anticipate. Preregistration does not stifle exploration, and it does not preclude changing your mind after you look at your data. It does not prevent you from examining your data fully, testing additional hypotheses inspired by your data, or trying out different analyses. In fact, it may encourage further exploration of your data because you no longer need to pretend that any discoveries were predicted. Any analyses that you preregistered are truly a priori, planned ones. If you deviate from your plan, you can report what you did and why you did it to provide full transparency. You should always report your preregistered

analyses even if you also report other analyses — doing so provides an accurate accounting of the analyses that were planned versus unplanned. Patterns observed in more exploratory analyses can be put to more rigorous tests in subsequent preregistered research. With reference to our face-attractiveness example, you could preregister a follow-up study in which you plan to exclude older subjects and faces with ceiling-level attractiveness and predict the specific interaction that emerged in your exploratory work.

In our own research, we have found that working on a preregistration pushes us to be clear and precise about our study plans, what we expect to find, and what we think our findings will mean. The first time you preregister a detailed analysis plan, you will realize how many flexible decisions you could have made when choosing your analyses after seeing the data and how those decisions could have misled you about the results of your study. Working with students on the preregistration process can be deeply rewarding for all parties. In our own labs, engaging in this thoughtful planning process has enhanced our understanding of projects and has saved us from running some poorly conceived studies. For a terrific (and more extensive) treatment of preregistration, see van 't Veer and Giner-Sorolla (2016).

Neither of APS's empirical journals, *Psychological Science* and *Clinical Psychological Science*, require preregistration, although they encourage it. Of the three authors of this piece, only Simons has already published preregistered research from his laboratory, but we all have begun preregistering our new and ongoing research. In our work as editors and reviewers, we put more stock in submissions that report preregistered studies (all else being equal). In the words of Bob Dylan, "the times, they are a-changin'." In our view, the adoption of preregistration means they're changing for the better. Preregistration is like washing your hands — it is good hygiene and good for the herd, and everyone should do it. ●

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TYPES OF PREREGISTRATION

Preregistration (a.k.a. unreviewed preregistration)

The researcher creates as detailed a description of his or her plans for a study as possible and saves those plans in a time-stamped, uneditable archive. This record can be shared with reviewers, editors, and other researchers.

Registered Reports (a.k.a. reviewed preregistration)

The researcher submits a detailed proposal for a study to a journal before conducting the study. These registered reports have the same virtues as preregistration, but they also address the problem of publication bias because the studies are published regardless of their outcomes. Registered Reports are most useful for well-defined research domains in which reviewers can reasonably assess the likelihood that a proposed study will be informative regardless of its outcome. (See https://cos.io/rr for a list of such journals and for a more extensive discussion.)

Registered Replication Reports (RRR)

A variant of Registered Reports, RRRs are focused on direct replication of one or more original findings. Many labs follow the same preregistered plan, and the results from all of those independent studies are published collectively regardless of the outcomes of individual studies. Variants of such reports include RRRs in *Perspectives on Psychological Science* and the ManyLabs project (https://osf.io/89vqh/), among others.

FAQS ABOUT PREREGISTRATION

Q: Where and how can I preregister my studies?

A: You can preregister your study plans in many ways, all of which are accessible and free. Sites like AsPredicted.org make preregistration quick and easy using a Web form that works well for many simple experimental designs. The Open Science Framework (OSF; osf.io) allows for both simple preregistration and complete specification of all aspects of your study — you can upload files, scripts, images, and so on. The OSF site provides a detailed example of how to do a preregistration (https://osf.io/sgrk6/). That example uses a template (OSF provides a number of those), but you don't have to use one. In fact, you can type your plans in a Word file, upload that to OSF, and preregister it. You can use these tools to create a view-only link or a PDF that allows an anonymous reviewer to see your plans. Other options for preregistration include ClinicalTrials.gov, AEA Registry, Evidence in Government and Politics, and trial registries in the World Health Organization Registry Network. See van 't Veer and Giner-Sorolla (2016) for additional resources related to preregistration.

Q: Doesn't preregistration take a lot of time and effort?

A: It takes some time before you start your study, but it can save you time later. Think of it as writing the core of your method section in advance of conducting the study. Once you have preregistered one study, subsequent preregistration plans for follow-up studies can be completed quickly and easily. If you post all of your materials as part of your preregistration documentation, you also will have a permanent record of what you did that will make it easier for you and others to reproduce your procedure years later.

Q: I can see preregistering laboratory experiments but not field work, archival analyses, longitudinal research, etc. Does it make any sense to preregister those sorts of research?

A: Yes. Any quantitative research should be preregistered if the results are to be analyzed with standard inferential statistical tests. Preregistration just means describing what you plan to do; even field studies are based on plans. You can preregister your plans for archival research, field observations, longitudinal studies, survey research, meta-analyses, and so on. Indeed, preregistration may be especially valuable in correlational research (e.g., large data sets provide vast opportunities for HARKing). For an exploratory study, the preregistration would be brief — perhaps just listing the measures you will collect and the sorts of analyses you might try. For a long-term longitudinal study, you could produce incremental preregistrations (e.g., an initial preregistration might spell out the first phase in detail and leave the second phase more open). For a field study, you might preregister your plans for developing a coding scheme.

Q: Does the preregistration have to be completed before data collection begins?

A: No. As long as you have not examined the data, you can create a preregistration after data collection starts or even after it is complete (in the case of archival data, it might be years later).

Q: Do I have to conduct the study exactly as described in the preregistration?

A: No. A preregistration is not binding, and you are free to change your mind about your plans. When your procedures depart from your preregistered plan, though, you must acknowledge such differences and recognize that your hypothesis tests might not be truly a priori. Reviewers and readers can make informed assessments of the appropriateness of your departures from the plan. The key is to be transparent about which aspects were entirely planned and which were determined at least in part by your knowledge of the data.

Q: Most researchers are honest, so why do we need preregistration?

A: Preregistration does not assume dishonesty. HARKing and similar practices that preregistration cures typically are unintentional rather than deliberate. Preregistration helps us remember (and show others) what we actually planned.

Q: I have always distinguished between exploratory research and planned research in my writing. Why should I bother formally preregistering?

A: Why not? It documents your adherence to best practices and serves as a crucial check on your memory.

Q: In my lab, we check results obtained in exploratory analyses by replicating them in follow-up studies.

A: Terrific (especially if you report all of your follow-up studies, not just those that yielded the prettiest results). But all the more compelling if you can show reviewers your preregistered plans for those replications.

Q: What are the criteria for qualifying for a Preregistration Badge for manuscripts accepted for publication in the APS journals *Psychological Science* and *Clinical Psychological Science*?

A: See http://www.psychologicalscience.org/index.php/publications/journals/badges.

Q: Won't preregistering cramp my style?

A: Only if your style relies on presenting exploratory analyses as though they had been planned.

Q: Couldn't a researcher intent on cheating produce a faux preregistration by collecting and analyzing data first and then "preregistering" that "plan" later?

A: Yes. Preregistration helps honest researchers do good work, but it is not designed to prevent fraud (although it may make it harder).

Q: Are there other advantages to preregistering?

A: Preregistration can make your research more efficient. With preregistration, you can adopt sequential testing procedures that can dramatically reduce the number of participants needed to test a hypothesis (Lakens, 2014). Without preregistration, deciding whether to collect more data after looking at the results (optional stopping) is a form of *p*-hacking that inflates your chances of accidentally obtaining a false-positive result. With preregistration, you can divide your alpha level to account for peeking-and-deciding, keeping your false-positive rate constant while stopping sooner if you find a significant result. But it is valid only with a preregistered plan that specifies when you will peek at your data and how you will adjust your alpha level to keep your error rate constant. (Note, though, that sequential testing even with preregistration will inflate your effect-size estimates, so its value is limited to maintaining a fixed false-positive rate.)

Q: Can I win money by preregistering?

A: Yes! The Center for Open Science will pay 1,000 researchers $1,000 each for publishing projects preregistered on the Open Science Framework. See cos.io/prereg.

The Science of Sameness

THE NEURAL MECHANICS OF CONFORMITY

By Scott Sleek

Let's face it: People rarely make history by fitting in. It takes a Nelson Mandela or an Aung San Suu Kyi to draw attention to a cause, a George Lucas or a Madonna to revolutionize an entertainment genre, and a Donald Trump or a Jon Stewart to change the nature of political discourse.

But for most people, fitting in feels far more comfortable than bucking convention. That human tendency has propagated such common behaviors as recycling, picking up after pets, and tipping wait staff. But conformity also can carry negative consequences — juries may reach a unanimous verdict because one or two people on the panel feared disagreeing with the others; a man may force himself to laugh at a sexist joke because his buddies are chuckling at it; and teens may decide to drink alcohol because "all the cool kids are doing it."

Psychological studies on conformity have come a long way since Solomon Asch developed his famous experiments on social pressure in the 1950s. They're showing that conformity is not just a learned behavior, but one that is innate and much more pronounced in humans than in other primates.

Now scientists are investigating the brain processes that drive conformity as well as deviation from it. The research provides new insights into how people handle disagreement and why they comply with rules, customs, and directives even when they believe them to be objectionable. Moreover, these studies stand to uncover the neuroscience behind social deviation.

The Reward Response

Among scientists studying the links between the brain and conformity is APS Fellow Christopher D. Frith, emeritus professor of neuroscience at the Wellcome Trust Centre for Neuroimaging at University College London, United Kingdom, in collaborations with experimental psychologist Daniel Campbell-Meiklejohn of University of Sussex, United Kingdom. Their work indicates that when other people agree with us, our brains show relatively heightened activity in areas related to reward.

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When other people agree with us, our brains show relatively heightened activity in areas related with reward, research indicates.

In a study several years ago, Campbell-Meiklejohn, Frith, and an international team of researchers recruited 28 volunteers and asked them to make a list of 20 songs they liked but did not own in any format. The participants then rated how much they wanted to own each of the songs on a scale from 1 to 10, with 10 being the highest. They also read profiles of two music reviewers and rated how much they thought each of those individuals could be trusted to pick music they (the participants) would like.

While undergoing functional MRI (fMRI) scans a week later, the subjects viewed a display with the title of a song from their preferred list on one side of the screen and another song title chosen by the experimenter. Participants randomly received a token for one song title on each trial (either their choice or that of the experimenter) and were told that the songs with the most tokens at the end of the task would be given to them on a CD.

Before receiving the token, however, the participants were shown which of the two songs were preferred by each of the reviewers. After the task was over, subjects rated their songs for desirability again.

The fMRI results showed that participants showed relatively greater activity in the ventral striatum, a brain region associated with reward, when their preferred song received a token compared with when the alternative tune got the token. That activity was even stronger when participants' opinions matched those of both of the critics, and this effect was greatest in subjects whose song ratings were influenced by reviewer opinion.

In a later step in that study, Campbell-Meiklejohn, Frith, and colleagues keyed into a specific brain area that seemed to link with our response to consensus. They found that subjects who had more volume in one precise brain region — the lateral orbitofrontal cortex — were more likely than their peers to change their ratings to more closely align with the critics' ratings.

The findings suggest, the researchers note, that the lateral orbitofrontal cortex is particularly sensitive to signs of social conflict or disagreement, which may influence changes of opinion.

"Our results show that social conformation is, at least in part, hardwired in the structure of the brain," Frith said.

The Punishment Threat

Other researchers have explored activation in threat-processing brain structures when we violate social norms. Among them are APS Fellows Manfred Spitzer (University of Ulm, Germany) and Ernst Fehr (University of Zurich, Switzerland). In a study published in 2007, they examined the brain activity that occurs when we're faced with the consequences of deviating from social expectations. Additionally, they set out to explore how personality affected individual responses to punishment for nonconformity.

Spitzer, Fehr, and colleagues recruited 24 men and had the volunteers fill out a questionnaire designed to measure Machiavellian personality traits such as selfishness and opportunism. They then divided the group into pairs to play a game. Each pair was given an initial endowment of 100 virtual money units, which Player A was empowered to split between himself and Player B. They also received a secondary endowment of 25 money units.

The men assigned to be Player A wore fMRI-compatible video goggles and participated in a series of 24 trials, facing a different Player B each time in one of two randomly alternating conditions.

In the control condition, Player B simply received whatever Player A offered from the 100-unit endowment. In the punishment condition, Player B — if he felt he received an unfair amount from the 100-unit endowment — could penalize Player A by spending all or part of the additional 25-unit pot to reduce their earnings. Specifically, every unit that Player B spent resulted in a 5-unit reduction in Player A's earnings. If Player A kept all 100 units from the first pot, for example, Player B could inflict the maximum punishment and spend all 25 units from the second pot. This would leave Player A with nothing.

In analyzing the results, the researchers found that on average, Player A gave approximately 10 units to Player B in the control condition while sharing about 40 units in the punishment condition. In fact, several of the A subjects who gave no money units in the control condition changed their behavior markedly in the punishment condition, the scientists noted. The finding illustrated that participants were induced to be fair when they faced the threat of a punitive response for being selfish. And as expected, the less A players gave in the punishment condition, the more severely the B players treated them in response.

But how did this manifest in the brain imaging? The researchers found that, compared with the control condition, A players in the punishment condition showed significantly higher activation of the lateral orbitofrontal cortex and the right dorsolateral prefrontal cortex (rDLPFC) when deciding how much to share with B players. Given that the rDLPFC is known to be involved in the evaluation of punishment threats, this finding supports the theory that pressure to conform to social expectations activates a brain-based punishment warning system of sorts. (In 2013, Fehr was part of a team that further demonstrated this, using noninvasive stimulation of the rDLPFC to actually change norm compliance.)

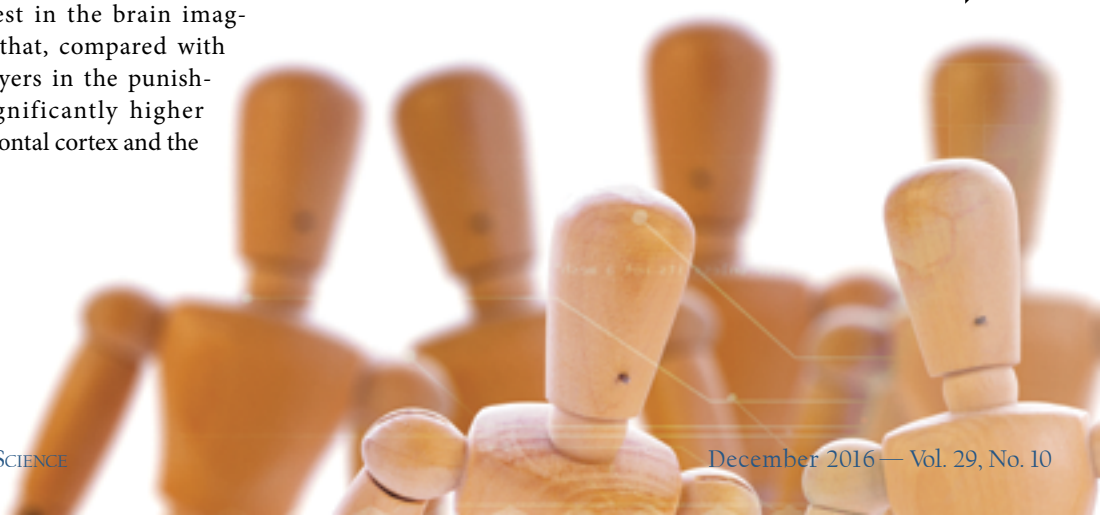
Unsurprisingly, the participants who had scored high on Machiavellian traits transferred less money during the control condition and more in the punishment condition. They also showed heightened activation of key brain areas involved in social-norm compliance. This all fit the typical Machiavellian focus on self-interest.

To compare those brain responses with a condition with a nonsocial punishment, the researchers conducted an additional experiment in which Player A interacted with a preprogrammed computer instead of a human Player B. The researchers found that punishment from the computer produced significantly less activation in the brain areas compared with the human interaction. The psychological scientists suggested their findings could lead to new understanding of psychopathic behavior, since individuals with damage in the prefrontal areas of the brain show an inability to behave in accordance with social norms even when they comprehend them.

Conformity Control

If science can link brain regions with social conformity, can it in turn foster techniques to manipulate our tendency to stick with or break from the pack? Campbell-Meiklejohn and Frith also were on a team of researchers who explored whether Ritalin and other methylphenidates (MPH) used to treat attention-deficit hyperactivity disorder might not increase conformity in behavior, but also in judgment.

The research team gave 38 female adult volunteers a dose of either MPH or a placebo, waited an hour, and then had participants view pictures of 153 faces and rate them for levels of trustworthiness. After rating each face, the volunteers were told the average rating of that face by participants performing the same task at other European universities — in other words, the social norm.



After performing some unrelated tasks for 30 minutes, the volunteers again were unexpectedly asked to rate faces for trustworthiness. They found that, on average, the subjects who received the MPH changed their second rating to twice the extent of the placebo group to conform to the social norm if their original rating moderately deviated from what they were told was average. (This didn't occur when the volunteers had widely divergent opinions compared with the norm.) The researchers thus propose that MPH may amplify brain signals that promote conformity.

In many cases, a person's tendency to conform can have negative consequences — think of people joining a violent protest or buying into political propaganda. Researchers led by psychological scientist Vasily Klucharev of Radboud University in the Netherlands have studied the possibility of controlling the drive to conform. They tested a way to moderate conformity by sending electromagnetic pulses to the posterior medial frontal cortex (pMFC), another part of the frontal cortex implicated in reward processing and behavioral adjustments and believed to play a role in social conformity.

Klucharev and his colleagues recruited 49 female students and randomly assigned them to three groups. One group received transcranial magnetic stimulation (TMS) to the pMFC and another group was given subthreshold TMS to the same brain region (i.e., a sham treatment). The third group received TMS to a different part of the brain — the medial parietal cortex.

The women then viewed more than 220 photographs of female faces in randomized order and rated each face on an 8-point scale, with 8 being the most attractive. For each face, they were quickly shown a comparison of their own rating with the average score given by 200 of their peers. In a second session, they were instructed to rate the attractiveness of the same faces, again in randomized order.

In analyzing the differences in ratings between the two sessions, the researchers found that participants in all three TMS groups changed their ratings in the second session to align with the average ratings from their peers. But those who received the full stimulation to the pMFC adjusted their ratings to a lesser degree compared with the women in the sham treatment and those in the control group. Klucharev and colleagues said their research should be expanded to include men as well as other social situations.

Conforming for the Greater Good

Some scientists are investigating the neural mechanisms that drive conformity in the prosocial or healthy sense. APS Fellow Jamil Zaki of Stanford University has conducted several neuropsychological experiments on conformity and has found benefits ranging from public health to charitable giving.

In an experiment conducted last year, for example, Zaki and graduate student Erik C. Nook of Harvard University had research participants undergo fMRI scans while they rated how much they liked a series of both nutritious and unhealthy food items. The participants then were shown average ratings ostensibly made by 200 of their peers for each item, and then rerated the foods while still in the fMRI.

The volunteers' second group rating shifted to resemble the supposed group average. But more specifically, the participants who showed higher activity in the nucleus accumbens, a brain area critical in reward response, more closely aligned their second ratings with the average compared with those who showed less activity in that area. Additionally, they found that participants showed heightened activity in the ventromedial prefrontal cortex, which plays a role in valuations and decision-making, when they were led to believe that their peers like a particular food more than they did. And those the individuals showed an increased preference for those foods upon rerating them.

Zaki and Nook say further research will explore how long such shifts in preference last, but they view the results of their work as a possible intervention for high obesity rates. Might people develop an aversion to junk food if they believe their friends and neighbors are eating vegetables, fruits, and whole grains?

Zaki says research like his reveals that conformity may not be just a matter of lying or faking in order to fit in — as it's often characterized to be — but actually a path toward changing our opinions and values.

"We see conformity as a weakness; we say it supports bad behavior" such as smoking or overeating, he says. "But if you think conformity is a powerful social mechanism through which we change our ideas about the world, it could be used positively," such as by encouraging people to vote or donate to charity. ●

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APS Award Address

Desirable Difficulties

Making Learning Last

Whether you're a college student preparing for a test or a graduate student reading for your comprehensive exams, the chances are your goal is to make the preparation process as easy and efficient as possible. You might believe, for example, that rereading key chapters of a textbook repeatedly will help you remember the material — and doing so does not require much effort — but research findings have documented that tactics that are more demanding, such as spacing your study sessions and switching between topics, are more effective. At the 2016 APS Annual Convention in Chicago, APS James McKeen Cattell Fellows Elizabeth L. Bjork and Robert A. Bjork, an APS Past President, discussed these and other "desirable difficulties" that learners can introduce to make their studying more productive.

The Bjorks are longtime collaborators and coprincipal investigators of the Bjork Learning and Forgetting Lab at the University of California, Los Angeles (UCLA), but they haven't always been able to work together on their shared research interests.

"Our careers span the decades across which couples couldn't be in the same department, and then later, if they were in the same department, couldn't work on the same topics," Robert noted in his introduction.

It wasn't until 23 years after they were married that the Bjorks coauthored their first paper and began collaborating more frequently. Their research focuses on how we learn versus how we think we learn and on the implications of this research for the optimization of learning and teaching. They have examined why we are subject to illusions of comprehension when studying; why our ability to access needed information and skills at some later time can fall short of our expectations; and, perhaps most importantly, how we can employ counterintuitive learning strategies to enhance the retention and transfer of to-be-learned skills and knowledge.

One of the Bjorks' primary research goals is to understand, from a metacognitive standpoint, why people continue to study and practice in counterproductive ways such as by massing, rather than spacing, repeated study sessions; rereading highlighted passages rather than drawing on the power of self-testing; and blocking, rather than interleaving, the study or practice of the separate components of some studied knowledge or skills. They have found, among other things, that people can be misled by their performance during the learning process, which can be assisted by conditions that are present in the instruction environment but are unlikely to be present in a different place and time when the information is needed (e.g., during a test). For that and other reasons, performance during an instruction or training process is often an unreliable — and sometimes entirely misleading — index of whether learning, as measured by long-term retention and transfer, has happened.

Elizabeth L. Bjork and APS Past President Robert A. Bjork say that, while students may think they are using effective studying strategies such as highlighting and rereading chapters multiple times, "desirable difficulties" such as interleaved learning actually are much more effective for long-term learning.

To illustrate the point, Robert reported an experiment in which participants practiced three different keystroke sequences, each of which involved striking a set of keys in a certain order and in a prescribed time. Some participants received blocked practice, meaning that they practiced each sequence in turn, whereas other participants got interleaved practice, meaning that, while they received the same number of practice trials, the trials on a given pattern were interspersed randomly among the trials on the other sequences. Based on prior findings, Robert and psychological scientist Dominic A. Simon (New Mexico State Unviersity) knew that blocked practice would yield better performance during the training but poorer retention on a later test; however, they wondered whether the participants would interpret their performance during practice as an index of learning.

Intermittently during the practice session and again right before a criterion test was administered the next day, the participants were asked to predict how close they could come to executing each pattern within its prescribed timing. They predicted the exact opposite of their subsequent performance: Those who had studied in blocked sessions predicted they would do well — better than those who had studied in an interleaved manner predicted they would do — but the results showed the opposite.

As summarized by Robert, "What we can observe is performance, but what we have to infer is learning, and that makes us subject to possible illusions of comprehension," such as the mistaken belief by these participants that the good performance on an immediate test following blocked practice arises from effective learning.

Elizabeth mentioned that similar considerations apply to the benefits of spacing, rather than massing, repeated study opportunities.

"That spacing of study attempts is an effective way to create long-term learning is one of the oldest and most robust findings in research on learning," she reported, "but students are not typically aware of the power of spacing for long-term learning, most likely because the benefits of spacing only appear after a substantial retention interval." If the test occurs shortly after studying, massed practice often results in better test performance than does spacing.

In other words, although massed practice can produce good short-term performance (and thus students may feel that such studying produces good learning), their memory for that material is soon lost. In contrast, the learning obtained with spaced practice can last much longer. Every student is familiar with massed practice by its typical name, "cramming" (e.g., staying up all night studying for a test the next morning). When students engage in cramming, they typically just read the material or chapters that will be tested repeatedly until it is time to take the test. Such massed practice can produce good performance on that immediate test, but it won't generate long-term retention of the studied information. The key to good test performance and long-term retention is spaced practice.

The Bjorks also have found that learners are subject to counterproductive beliefs and assumptions. Errors, for example, are assumed to reflect inadequacies of the learner, the teacher, or the teacher's methods rather than being viewed as a necessary component of maximally effective learning. In addition, differences in performance between individuals can be overattributed to innate differences in ability or intelligence, whereas the power of experience and practice is often underappreciated.

As Robert noted, many students assume that "somehow, we work, in terms of our functional architecture, like some kind of man-made recording device … [but] in almost every important respect, we differ" from such technology. The "important peculiarities" of human learning versus man-made storage/memory devices include the following:

- storing information in a virtually unlimited capacity coupled with a highly fallible retrieval process;
- accessing our memories in a way that is highly dependent on environmental, interpersonal, emotional, and physical cues;
- retrieving information or procedures via a dynamic process that alters our memories, mostly in adaptive ways; and
- forgetting, rather than undoing learning, which creates conditions necessary to reach new levels of learning.

The Bjorks also expanded on what has become an unpopular topic for many educators: testing.

"We don't talk about tests because there's a very negative bias about tests among teachers ... so we've come to say 'retrieval practice' rather than test," Elizabeth said. "But there are a lot of virtues" associated with using tests as a teaching strategy.

For example, tests can increase learners' recall ability; being asked to retrieve information is more effective than simply being presented with that information again. That information becomes much more recallable in the future than it would have been otherwise, because recalling correct information helps to inhibit incorrect information associated with the same cues, thereby reducing interference. In addition, tests provide important feedback with respect to what we have and have not learned.

Interestingly, although teachers may not always be enthusiastic about administering tests, students do develop an appreciation for one of the benefits of testing: "The one thing students do seem to understand is that testing will identify what they've learned or not," Robert said.

Yet getting learners to adopt evidence-based study strategies is not an easy task. Robert noted that, given the choice, most people will choose to learn in blocked sessions, not only because blocked practice can create an illusion of rapid learning but also because their teachers and trainers have so often blocked instruction or practice by topic or task. When he and his colleague Nate Kornell, of Williams College, polled students in introductory psychology classes at UCLA, only 20% said that someone (e.g., a former teacher or friend) had given them study advice. Whether that was good advice is questionable, Robert added.

"We worry, in the university context, about the preparation of entering students in domains such as English and mathematics, but not whether students have in place the kinds of skills for this 4- or 5- or 6-year learning enterprise," he concluded. "And there's so much to learn [about] how to do it." ●

-Mariko Hewer

To watch video of Elizabeth L. Bjork and Robert A. Bjork's award address, visit www.psychologicalscience.org/r/learning.

APS Teaching Fund Supports 'The Learning Scientists'

Psychological scientist Yana Weinstein was feeling guilty one night about not doing enough to disseminate her research on learning to students — so she decided to take it to Twitter.

Weinstein, an assistant professor at the University of Massachusetts Lowell, searched "test tomorrow" and realized that many students tweet about how unprepared they feel for their upcoming exams or about how they can't concentrate enough to study. She began tweeting advice at these students. Psychological scientist Megan A. Smith of Rhode Island College noticed what she was doing and suggested adding the hashtag #AceThatTest, which — little did they know — would lead to a collaborative project called "The Learning Scientists," with more than 3,500 followers on Twitter.

A plethora of research on learning, cognition, and memory is available for academics, but that knowledge isn't always applied in classroom settings or when students study on their own. The Learning Scientists project aims to change that. Weinstein paired up with Smith to initiate the project, and they later were joined by psychological scientist Cindy Wooldridge of Washburn University, followed by Carolina Küpper-Tetzel of the University of Dundee, Scotland. The four Learning Scientists were all at Washington University in St. Louis at various times between 2009 and 2015.

Supported by a grant from the APS Fund for Teaching and Public Understanding of Psychological Science, The Learning Scientists website now includes regular blog posts; weekly digests of teaching and learning resources; guest posts by other academics, teachers, and students; and recommended readings, videos, and downloadable materials such as posters and PowerPoints designed to implement the best practices for effective learning and facilitate the conversation amongst researchers, teachers, students, and parents (see p. 32 for an example of a poster from the website).

"Study hard" is a popular mantra for students, but studying hard is much more productive when students are using practices designed for effective learning. The Learning Scientists website highlights six research-based approaches to effective learning and offers posters that can be downloaded, printed out, and hung on walls to remind students how to use each strategy. These posters have now been translated into five languages, and more translations are forthcoming.

One such strategy is elaboration. The Learning Scientists recommend that students expand lessons by making connections to similar and different ideas and relating the new material to their own lives in some way. The researchers say that, in the same vein, discussing class materials with others and describing the ideas accurately in their own words and without looking up the correct answers until later can facilitate learning. To back up these claims, they cite an article by APS Fellow Mark A. McDaniel (Washington University in St. Louis) and psychological scientist Carol M. Donnelly (Northwestern University), as well as one by educational researcher Bernice Y. L. Wong as further reading on this strategy and how it helps.

Another practice is called interleaving. This method has students switch between ideas during a study session to ensure that they don't spend too long on one idea. The scientists also recommend going back over the ideas in different orders and creating links between them to strengthen understanding. They warn that this will feel more difficult than studying one idea for a long time but add that it will be better for learning — as long as students don't switch ideas too often and spend too little time on a topic. At the end of this advice, the blog post cites a review article by psychological scientist Doug Rohrer of the University of South Florida discussing the theory behind how and why interleaving is effective.

The Learning Scientists website also features a series of student-written guest posts titled "Be Your Own Teacher," which includes "How to Study a Textbook" and "How to Study with Flashcards." In her recommendations, the student blogger suggests changes such as breaking up textbook readings into smaller chunks; writing notes, questions, and answers that can be separated and used for later retrieval practice; testing yourself on your own questions and swapping questions with a friend; and being creative with your questions by using a variety of question styles (e.g., true/false, multiple choice, fill in the blank).

Another interesting post from the site is titled "How to Tell if Your 'Science-Backed' Study Tips Are Actually Supported by Science." In the post, Weinstein discusses the rapid pick-up and dissemination of Wooldridge's "5 Study Tips for Students" by another educational source and voices concerns about the lack of quality control in supposedly "science-backed" learning advice. To combat this, she penned seven quick tips on how to tell whether study advice is really backed by science, hoping to "start a dialogue about what other cues [people] look for to determine the legitimacy of science communication in general."

Weinstein follows up her tips with humorous and intriguing explanations:

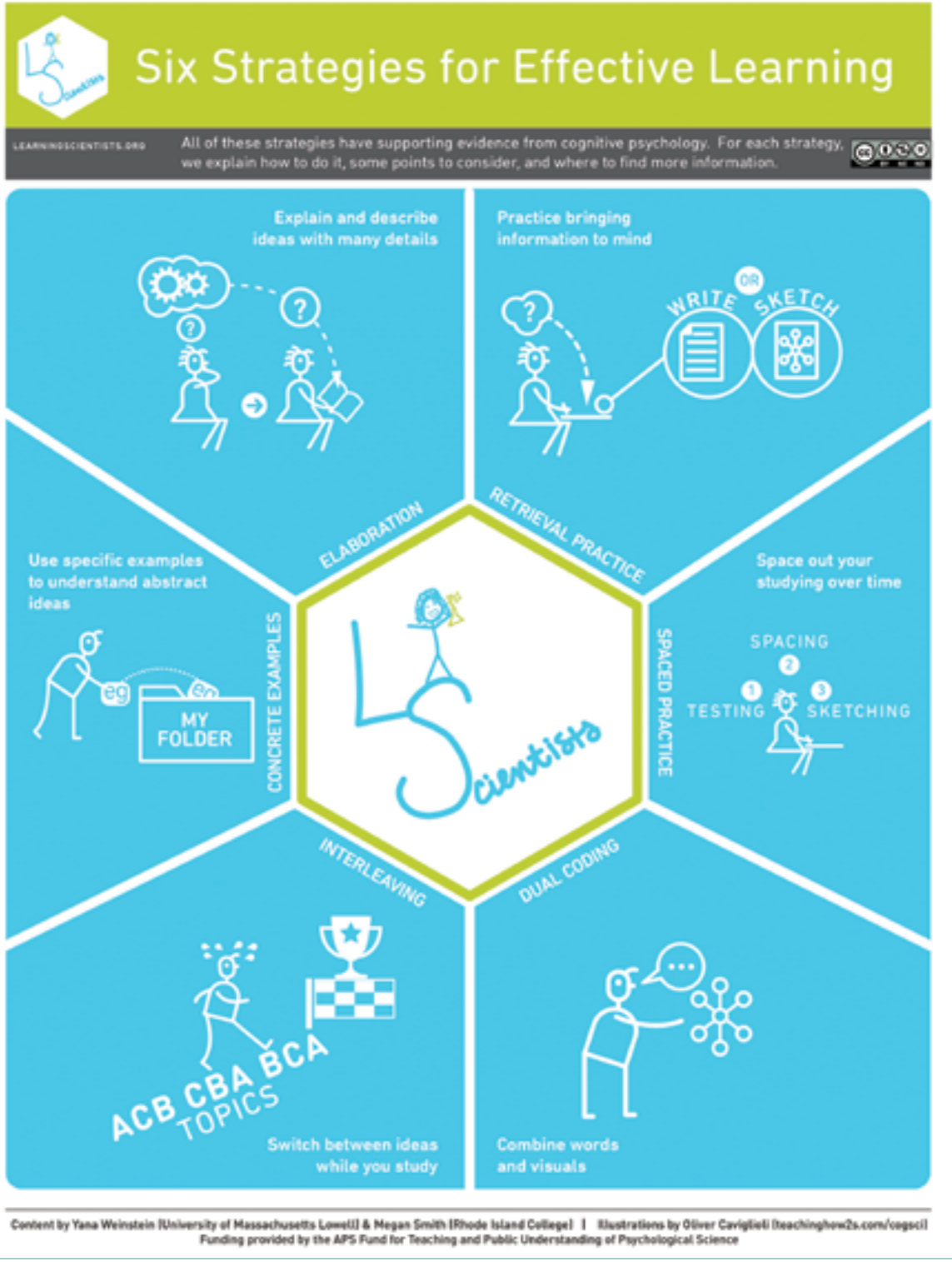
- "We know that people have a limited attention span and quickly stop reading/paying attention when information overload hits, so a good learning scientist would not want to overwhelm the reader with 20+ tips."
- "Learning scientists tend to recognize that all academic learning takes place in, err, the brain; so tautological terms like 'brain-based' learning are just funny to us."

Lastly, the bloggers caution against tips that reference other journalistic pieces that "take you on an endless search for the original source."

The Learning Scientists are hoping to reach teachers, students, parents, and other researchers with their blog and social media outreach. Their informative take on learning — which aims to motivate students to learn, increase the use of effective study and teaching strategies, and improve negative views on testing — already has garnered a great deal of support, including two grants (one from APS and the other from IDEA) and more than 66,000 unique website visitors from 171 different countries.Wooldridge currently is running an intervention study that utilizes materials created for the website.

You can follow The Learning Scientists on Twitter at @AceThatTest and follow the blog at http://www.LearningScientists.org. ●

-Christopher Collins



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Lila R. Gleitman
University of Pennsylvania

BRING THE FAMILY ADDRESS

What Makes the Human Mind Special? Insights From Non-Human Animals

Laurie R. Santos
Yale University

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Sense and Sensibility: How Our Bodies Do — and Don't — Shape Our Minds

Susan Goldin-Meadow (Chair)
The University of Chicago

How Our Bodies Shape How We See

Jessica K. Witt
Colorado State University

How Our Hands Help Us Learn: The Role of Gesture in Cognitive Change

Susan Wagner Cook
The University of Iowa

Evaluating the Research on Postural Feedback: Strong Evidence That Expansive Posture Affects Feelings; Mixed Evidence That it Affects Behavior and Hormones

Amy J.C. Cuddy
Harvard University

The Emergence of American Sign Language From Depiction and Embodiment

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Harvard University

The Implicit Revolution in Social, Cognitive, and Developmental Psychological Science: A Symposium in Honor of Mahzarin R. Banaji*

Speakers: John T. Jost, *New York University*; Anthony G. Greenwald, *University of Washington;* Elizabeth A. Phelps, *New York University*; and Yarrow C. Dunham, *Yale University*

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* 2016 William James Fellow Awardee

SPECIAL EVENTS

CLINICAL SCIENCE FORUM

Rising Stars of Clinical Science

Edward Selby
Rutgers University

Michael E. Newcomb
Northwestern University Feinberg School of Medicine

Sheehan D. Fisher
Northwestern University

Dylan G. Gee
Yale University

Editor's Forum: A Panel Discussion About the Present and Future of Clinical Science

Angus McDonald
University of Minnesota *(Journal of Abnormal Psychology)*

Joanne Davila
Stony Brook University, The State University of New York *(Journal of Consulting and Clinical Psychology)*

Scott O. Lilienfeld
Emory University *(Clinical Psychological Science)*

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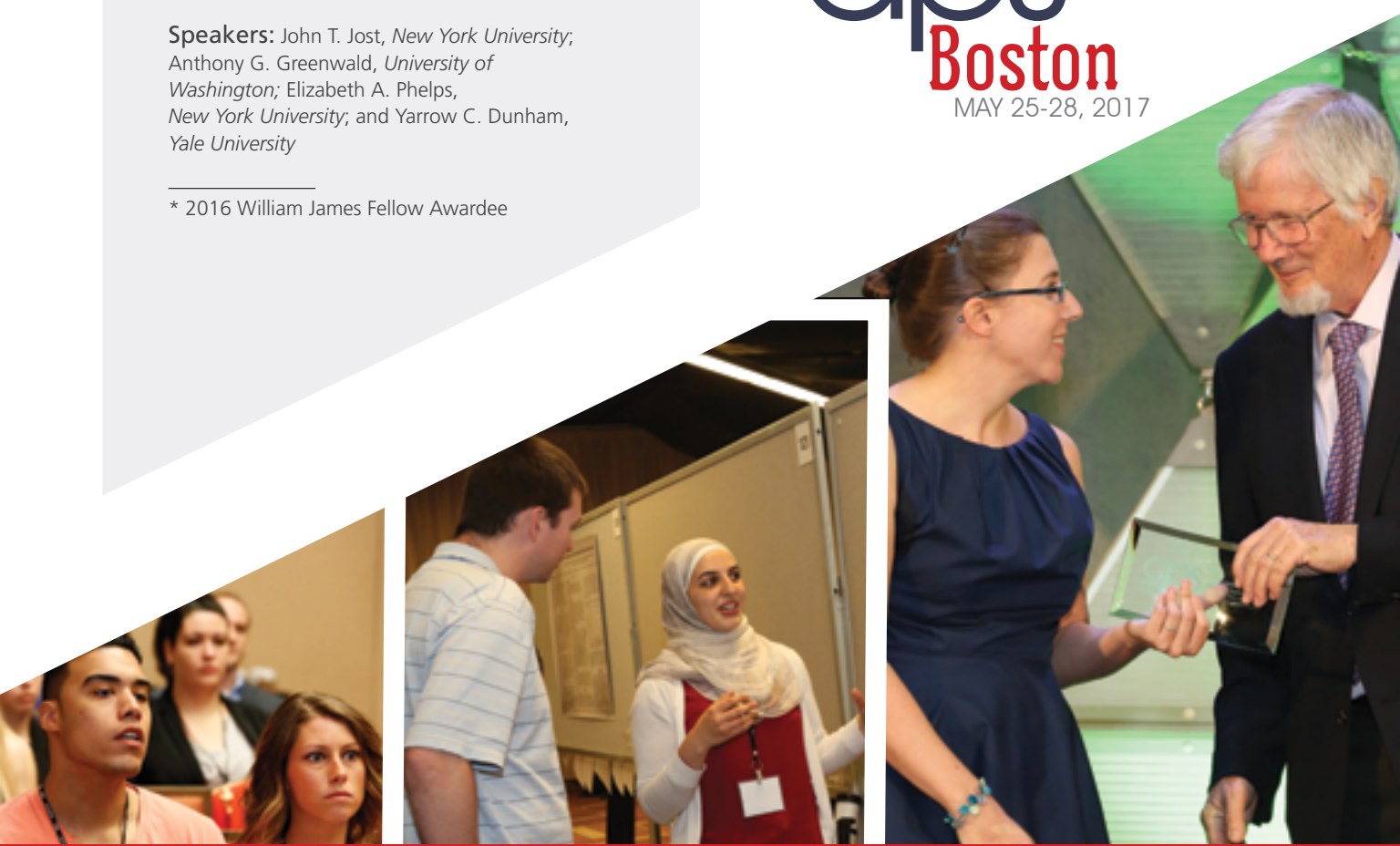

CROSS-CUTTING THEME PROGRAMS

The Many Flavors of Relationships

Patrick Davies
University of Rochester

Katherine Jewsbury Conger
University of California, Davis

Kenneth H. Rubin
University of Maryland, College Park

Shigehiro Oishi
University of Virginia

Belle Rose Ragins
University of Wisconsin-Milwaukee

Sheldon A. Cohen
Carnegie Mellon University

The Science of Fear: From Basic Psychological Mechanisms to Impact on Society

Daniela Schiller
Mt. Sinai School of Medicine

Nnamdi Pole
Smith College

Steven L. Neuberg
Arizona State University, Tempe

Linda M. Isbell
University of Massachusetts, Amherst

Arie W. Kruglanski
University of Maryland, College Park

Doing the Most for the Many: Psychological Scientists Who Inform Public Policies

Ruth B. Balser
Massachusetts Legislature State Representative

Elana J. Eisman
American Psychological Association

Laurence Steinberg
Temple University

Valerie F. Reyna
Cornell University

Patrick DeLeon
American Psychological Association

Timothy B. Baker
University of Wisconsin-Madison

Submit a poster presentation related to any of these topics before January 31, 2017 and let your work be part of these special discussions. Submissions not accepted for a theme poster session are automatically considered for one of the regular poster sessions.

WORKSHOPS

Video Coding, Sharing, and Reuse: Databrary and Datavyu
Karen E. Adolph
New York University

Introduction to R Statistical System
William R. Revelle
Northwestern University

Sara Weston
Washington University in St. Louis

David M. Condon
Northwestern University

Bayesian Inference With JASP: A Fresh Way to Do Statistics
Eric-Jan Wagenmakers
University of Amsterdam, The Netherlands

Conducting Daily Life Research With the EAR Method
Matthias R. Mehl
The University of Arizona

How to Conduct Reproducible Psychological Science: A Tutorial Overview
Tal Yarkoni
The University of Texas at Austin

NIH Funding for Psychological Science
Rebecca C. Ferrer
National Cancer Institute

Documenting the Research Workflow as it Happens
Lorne J. Campbell
University of Western Ontario

Everything You Ever Wanted to Know About Experience-Sampling Methodology
Thomas R. Kwapil
University of Illinois at Urbana-Champaign

Multilevel Structural Equation Modeling
Zhen Zhang
Arizona State University

Now They See It: Visual Communication of The Patterns in Your Data
Steven L. Franconeri
Northwestern University

24TH ANNUAL APS-STP TEACHING INSTITUTE

OPENING PLENARY

Rapport: Friend of Foe?
Janie H. Wilson
Georgia Southern University

CLOSING PLENARY

Helping Students Achieve: Promising Strategies From Cognitive and Education Sciences
John T. Dunlosky
Kent State University

DISTINGUISHED LECTURER

The Invisible Gorilla: From the Classroom to the Real World, and Back Again
Christopher F. Chabris
Union College

WORKSHOP

Advising Strategies to Promote Occupational Success in Job-Seeking Psychology Majors
Drew C. Appleby
Indiana University-Purdue University Indianapolis

CONCURRENT SESSIONS

What's Trending? Social Media in the College Classroom, 2017
Bethany Fleck
Metropolitan State University of Denver

Heather D. Hussey
Northcentral University

Following the Data: Improving Student Learning (and Your CV)
Danae L. Hudson
Missouri State University

Brooke L. Whisenhunt
Missouri State University

Jedi Mind Tricks for Teaching and Learning
William S. Altman
SUNY Broome Community College

On Sages, Guides, and Experts: Models of Teaching and Learning Relationships in Psychology
Eric Amsel
Weber State University

Coordinating Course — and Departmental — Level Assessment
J. Noland White
Georgia College & State University

Challenges and Strategies for Managing Work/Life Balance: Perspectives From Different Stages of Career
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William Jewell College

Beth M. Schwartz
Heidelberg University

Albee Mendoza
Wesley College

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Blood, Gore, and Video Games: Effectsof Violent Content on Players
Brad J. Bushman
The Ohio State University

The Science of Engagement: What We Know and Don't Know About When People Tune In
Thalia Wheatley
Dartmouth College

Bringing Psychological Science Into the Political Arena
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The Role of Psychological Science in Studying Research Misconduct

Thirty-five years ago, a congressional committee led by a young US representative by the name of Albert Gore, Jr., began investigating a growing number of cases involving misconduct in federally funded research. Over time, the exposure of these cases led to the creation of the Office of Research Integrity (ORI), a unit of the Department of Health and Human Services (HHS). Now, ORI is not only proactively developing programs to teach responsible research conduct but also exploring the role behavioral science can play in understanding the root causes of fabrications, falsifications, and plagiarism in reporting the results of federally backed public health research.

The *Observer* recently talked with ORI scientist–investigator Ann A. Hohmann about ORI's work and the role that psychological scientists can play in helping prevent scientific misconduct.

The statements and opinions expressed in the following interview are Hohmann's and are not the official positions of ORI or HHS.

Observer (OBS): ***What is the Office of Research Integrity's mission?***

Ann A. Hohmann (AH): ORI's mission is to protect the health and safety of the public, promote the integrity of Public-Health-Service-supported (PHS) research, and conserve public funds by ensuring the integrity of all PHS-supported work. ORI:

- oversees and directs PHS research-integrity activities on behalf of the DHHS Secretary, including the oversight of research misconduct inquiries and investigations, education and training in the responsible conduct of research, activities designed to promote research integrity and prevent misconduct, and research and evaluation programs;
- makes findings of research misconduct and proposes administrative actions in connection with research conducted or supported by the PHS; and
- reviews institutional policies to ensure compliance with misconduct regulations.

OBS: ***How many reports of misconduct do you receive per year? How many do you investigate during that time?***

AH: ORI receives approximately 30 to 40 investigation reports per year. In the last few years, the number of allegations we have received has increased. This is in part due, I think, to the greater visibility given to the possibility of misconduct in research through various websites such as PubPeer and Retraction Watch.

In addition, there are scientists who regularly report to us when they find figures in the literature that look to them like they may have been falsified.

We take every allegation seriously. If it is not within our jurisdiction, we refer the allegation, if possible, to other federal agencies who are listed as the source of grant funds (e.g., the National Science Foundation, the Department of Defense, the Department of Energy).

ORI does not conduct the investigations. The Division of Investigative Oversight has oversight authority over the investigational processes conducted by institutions that have an assurance with us. Resources on that authority can be found at https://www.gpo.gov/fdsys/pkg/FR-2000-05-12/html/00-11958.htm and at http://ori.hhs.gov/division-investigative-oversight.

Every institution (domestic or foreign) that accepts PHS funding must have an assurance with us (http://ori.hhs.gov/assurance-program).

These institutions conduct the assessment, inquiry, and investigation, and we provide them technical assistance and perform oversight review of the reports they give us. In that function, we can return the report and ask for further investigation and/or for additional information.

Our closed cases, with findings of research misconduct, are published in the Federal Register and on our website (http://ori.hhs.gov/case_summary). Names are removed when the period of administrative action (usually supervision or debarment) is completed. If ORI does not find research misconduct, we never make any part of the case information public.

OBS: ***What are the biggest challenges in your investigative work?***

AH: With my background in social science, the biggest challenge I have had is to learn enough immunology, molecular biology, or whatever basic biological science is the focus of the investigation (plus the associated methods) to understand not only what is wrong and why, but also how significant the

misconduct is. But my colleagues at ORI have a variety of backgrounds representing a broad cross-section of science and medicine, and they are spectacularly helpful and supportive in sharing their expertise.

Since coming here, I have volunteered to learn various programs — including EnCase, a program for searching computer hard drives for evidence of misconduct, and iThenticate, a program for examining allegations of plagiarism — to help in reviewing case evidence. Because of my background, I am also the expert in the office who routinely reviews cases with statistical data.

The most difficult part of this job for everyone who comes to work at ORI as an investigator is to face the reality that there are scientists who deceive their colleagues and supporters. But we know that these people are outliers, and it is our job to do what we can to uphold the integrity of the research enterprise by making sure these cases are properly handled and by ensuring that we are doing what we can to prevent research misconduct in future cases. Our investigative staff is so committed to our mission that we even have a part-time investigator in his 80s who has refused to fully retire until his last two cases (both very large) are closed. The investigators at ORI are very dedicated.

OBS*: Are there particular disciplines within science that seem to generate more investigations than others? How does psychological science fare?*

AH: Most of the current allegations of research misconduct that ORI receives involve figures in published research that is online and can be scrutinized by fellow scientists. That includes basic biological research such as molecular biology, microbiology, genetics, and biochemistry. Without open access to original data, it is very difficult for peers to detect research misconduct in any of the social or behavioral sciences, so very few of the allegations we receive involve the social or behavioral sciences. At this point, we have to rely on people who are working with the data (and see problems) to report allegations to us. That does happen occasionally.

Extensive examples of the types of allegations we get can be found on PubPeer (https://pubpeer.com/). Of course, PubPeer has many allegations that are outside our jurisdiction; ORI has jurisdiction only in cases where there is PHS funding, which includes NIH research (http://tinyurl.com/zkqz5jh).

OBS*: What role do you believe psychological science can play in helping ORI?*

AH: From the psychological perspective, recent research conducted by Dan Ariely, Nina Mazar, On Amir, Francesca Gino, Adam Grant, and others has shown that a psychological perspective to understanding research misconduct is critical.

There are so many angles that could be pursued by psychologists to understand and prevent misconduct. Research focusing on issues of choice, persuasion, cognition, identity and self-concept, social and cultural influences, and/or motivation all could be useful in understanding and preventing misconduct in science. But we need psychological scientists to do this research in settings where research misconduct that ORI oversees occurs: labs that receive PHS funding — most of which comes from NIH. So a good starting point to help the ORI would be for members of APS to design research studies that take place in NIH-funded labs.

OBS*: What would you say would be the biggest benefit(s) for a psychological scientist to engage in this type of research-integrity research? And what are the risks?*

AH: Before coming to ORI, I worked at NIH as a program officer for a program supporting community-based research. I learned from our investigators that, given the reward structure and tenure system of mainstream universities, it is a risk to take on research in the community. It can take a long time to get the cooperation of organizations and potential research subjects, and it requires much more than just a great idea and a clever design to make it happen. So it is challenging, with community-based studies, to quickly produce the publications that tenure committees want to see. In addition, these studies frequently require collaboration with researchers and experts outside your own field. For some departments, that also might pose a problem.

Recently, ORI has committed funding for research in this area. We have started out small with Phase I and Phase II research grants and are hoping to attract graduate students and postdocs. As the research program attracts creative researchers, we hope to be able to expand the program to fund larger projects. We need APS members to design creative research relating to research misconduct that takes place in government-funded labs so that the entire research community can get a handle on what is driving research misconduct and what ways exist to prevent it from occurring. ●

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Questions?

Christina L. Williams
williams@psych.duke.edu
www.cattell.duke.edu

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Remembering George Mandler

(June 11, 1924–May 6, 2016)

Professor George Mandler died at the home in London that he shared with his wife, Professor Jean Mandler, and not far from their two sons, Peter Mandler (Professor of Modern Cultural History at the University of Cambridge and Fellow of Gonville & Caius College, Cambridge, United Kingdom) and Michael Mandler (Professor of Economics at Royal Holloway College, University of London, United Kingdom).

I will not use this space either to list or to praise George's numerous and varied academic achievements. These achievements are well-known to many; in addition, George's work and its significant influences on the field of experimental psychology are elegantly summarised in the memorial piece about George on the University of California, San Diego (UCSD), Department of Psychology website and also in some of the other remembrances in this collection. Furthermore, those wishing to know more about George's reflections on his own life and times should read his book, *Interesting Times: An Encounter With the 20th Century 1924-*. My contribution here is intended to evoke George as I experienced him.

George was my PhD supervisor for 3 years, from 1968 to 1971, in the UCSD department of psychology that he established in 1965. When I try to characterise how he seemed to me then (and, indeed, perhaps always), two things come to mind. The first is *formidable*. The Chambers English Dictionary defines this word as "inspiring awe; causing fear," and I think both of these meanings are appropriate here. George must have had a degree of self-doubt at times, but to me he always seemed supremely self-confident. During the years that I was his rather timid postgraduate student, I cannot say that I was ever totally at ease in his presence, but he always treated me and his other fledglings with generosity and respect, and gave us his full attention when we came to report on and discuss our doctoral research projects. Moreover, George had an outstandingly sharp eye for tractable research questions and a good feel for how to address them experimentally. Under his guidance, I and his other students learned how to think and behave like experimental psychologists.

The second thing that comes to mind is *witty*. Goodness me, he was quick and funny. For all of the many years that I knew him, through thick and thin, George could make me laugh. Once when he was staying at our house in Cambridge, he criticised me for putting the toilet paper on the holder the wrong way (he never hesitated to speak his mind on any topic). I had it placed so that the paper rolled over the top; he thought it should roll from underneath. Even after years of knowing him as a friend, I did not have the courage to argue with him, but I felt slightly miffed by his complaint and — thinking to suggest that my "error" might not be so strange — I said, "I wonder what proportion of people do it each way?" His instant reply was, "Oh, I think we're the dominant race." Any sense of irritation on my part dissolved in giggles. A few months before he died, he'd had a couple of missing teeth replaced, and I emailed him to say that I was looking forward to seeing his new teeth on my next visit to London. His reply was that the teeth were available for inspection by appointment. Finally, I cannot resist repeating what I consider one of his best lines, which he himself reported in his aforementioned book. Not long after B. F. (Fred) Skinner's 1957 book *Verbal Behavior* was published, George was standing near Skinner at a party when another young academic asked Skinner what he was planning to do next. Before he could reply, George quipped "Collect the data on which his book is based."

When my husband Roy and I finished our PhDs at UCSD in 1971 — by which time I had perhaps begun to relax just a little in George's presence — our first jobs were back in Toronto, from where we had come to UCSD. Then in 1975, when Alan Baddeley succeeded Donald Broadbent as the Director of the UK Medical Research Council's Applied Psychology Unit (now known as the Cognition and Brain Sciences Unit), Alan offered both Roy and me positions and we moved to Cambridge. In part because of George's youthful time at boarding school in England and in part because of his strong appreciation of Europe and European culture, George had an abiding attachment to the United Kingdom. He and Jean were regular visitors to London, Oxford, and Cambridge, eventually buying a house in Hampstead. Both of their sons obtained degrees from Oxbridge universities, and both eventually settled in England, providing further impetus for George and Jean's continuing foothold in England. As a result of this, Roy and I saw George and Jean regularly in every one of the last 41 years. We all shared a love of good food and wine and often met for dinner in London; we occasionally travelled together to Wales, Paris, and Sicily. And for all of that time, George was his formidable and witty self. I am very lucky to have known him; I respected and loved him. And although he always referred to my chosen neuropsychological research area as "hole-in-the-head" research, I hope that he respected and perhaps even loved me.

Karalyn Patterson
University of Cambridge, United Kingdom

Rita E. Anderson

Memorial University of Newfoundland, Canada

George combined his impressive intellect and interest in wide-ranging topics with an approachable and caring persona to

➡

create a potent training ground for his graduate students. Over the years, I've come to realize that our weekly lab meetings involved much more than project updates and opportunities for us to hone the basics of research design and analysis, to develop critical listening and thinking skills, to practice thinking outside of the box empirically and theoretically, and to learn how to make constructive suggestions. Because he treated all of us as important individuals, we looked forward to our lab meetings as intellectually stimulating, fun events.

Pat Worden Benson

California State University, San Marcos

George mentored by steering our research in the general direction of the organization of memory, making sure everyone knew what the others were doing, and encouraging us to go at it. Our ideas often were subjected to what Jean once called "Mandler troubleshooting": When presented with an experimental design of dubious possibility, he'd tell the story of the optimist looking into a room filled to the ceiling with dung and exclaiming "there might be a pony in there somewhere!" He often advised us to "do what you think best" and was genuinely excited when something good turned up. Behind his sophisticated and worldly "Viennese uncle" persona was a man driven by intellectual curiosity and the joy of the research enterprise.

Brian Butterworth

University College London, United Kingdom

George was never interested in mathematical cognition; nevertheless, he published with Billie Jo Shebo an important and influential paper in 1982 on *subitizing* [a term coined by Kaufman, Lord, Reese, and Volkmann in 1949 to describe the rapid, confident, and accurate report of the numerosity of arrays of elements presented for short durations]. What he was really interested in was the limits of conscious experience, and subitizing provided a classical route to study this. It is, however, a pity that George didn't follow up on the intriguing ideas in his 1982 paper, because it has taken more than 30 years for others to come up with similar ideas.

Fergus I. M. Craik

University of Toronto, Canada, and Rotman Research Institute

Browsing through some of George's work, I was struck by the point that, although he could be delightfully edgy in conversation and debate, he was an integrator rather than a revolutionary who cast out all old ideas. As an example, in his influential 1962 article "From Association to Structure," he argues for a model embracing both associations and organization. He wrote: "The major notion to be presented in this paper ... is the proposition that an associationist and a cognitive view of behavior may work side by side — that they are compatible." This approach, stressing integration and building on current knowledge, is a hallmark of the Mandler style.

Arthur C. Graesser

The University of Memphis

I still remember many of George's edgy quips that made us think (e.g., "Data trump good ideas that come a dime a dozen."), question (e.g., "Radical behaviorism was a minor hiccup in the history of psychology."), and laugh (e.g., "Show me a very healthy body and I'll show you a sick mind."). The research vision of George Mandler spanned centuries, and he provided a mature intellectual foundation for researchers who were not entirely consumed by the research fashions of the year.

George Mandler and Jean Mandler

Lia Kvavilashvili

University of Hertfordshire, United Kingdom

There is an abundance of research on spontaneous cognitive phenomena, using a variety of different methods such as surveys, diaries, experience sampling, and even laboratory experiments, that enable researchers to capture and measure these seemingly transient and nonmeasurable phenomena (e.g., mind-wandering, involuntary autobiographical memories, spontaneous future thinking, intrusive memories, musical earworms). Results from these studies have begun to show that involuntary recall may be the norm in everyday life rather than the exception — exactly in line with what George was saying some 20 to 30 years ago.

Donald A. Norman

University of California, San Diego

The era that moved us from rampant behaviorism to today's richer, more enlightened and eclectic view owes much to George. He championed modern psychology. He was an early, lonely worker in the field of emotion, which is mainstream today ... His enduring legacy is to have created a great department of psychology, as well as the numerous successful students, postdoctoral fellows, and faculty whom he hired, nurtured, and mentored.

Tim Shallice

University College London, United Kingdom

My memory of George, particularly in the 1970s and 1980s, was of an immensely dynamic person completely at home and self-confident in the academic world and in his major research contributions. On reflection, it is amazing what he achieved in academic life after he had been forcibly sundered from family, culture, and country at so young an age. And through it all he retained his humanity, as illustrated by the kindness and support he showed for many younger academics. I was just one of many fortunate recipients. ●

To read the full text of the remembrances of George Mandler, visit www.psychologicalscience.org/r/mandler.

Current Directions in Psychological SCIENCE

Teaching Current Directions in Psychological Science

Edited by C. Nathan DeWall and David G. Myers

Aimed at integrating cutting-edge psychological science into the classroom, Teaching Current Directions in Psychological Science offers advice and how-to guidance about teaching a particular area of research or topic in psychological science that has been the focus of an article in the APS journal Current Directions in Psychological Science. Current Directions *is a peer-reviewed bimonthly journal featuring reviews by leading experts covering all of scientific psychology and its applications and allowing readers to stay apprised of important developments across subfields beyond their areas of expertise. Its articles are written to be accessible to nonexperts, making them ideally suited for use in the classroom.*

Visit the column online for supplementary components, including classroom activities and demonstrations: www.psychologicalscience.org/teaching-current-directions.

Visit David G. Myers at his blog "Talk Psych" (www.talkpsych.com). Similar to the APS *Observer* column, the mission of his blog is to provide weekly updates on psychological science. Myers and DeWall also coauthor a suite of introductory psychology textbooks, including *Psychology* (*11th Ed.*), *Exploring Psychology* (*10th Ed.*), and *Psychology in Everyday Life* (*4th Ed.*).

Flashbulb Memories: Uniquely Bright or Commonly Forgotten?

By C. Nathan DeWall

Hirst, W., & Phelps, E. A. (2016). Flashbulb memories. *Current Directions in Psychological Science, 25,* 36–41.

Where were you when you learned that Barack Obama had become the first African American to be elected president of the United States? You might remember sitting in your living room, driving across town, or receiving an instant message. Psychologists call these *flashbulb memories* because some public events imbue a level of mental brightness that continues to shine years later.

Are flashbulb memories unique? William Hirst and APS Past President Elizabeth A. Phelps (2016) argue that flashbulb memories have not lived up to their initial hype. They don't belong to a separate mental system of autobiographical memories, something suggested by the originators of flashbulb-memory theory (Brown & Kulik, 1977). We now know that we encode, retain, and retrieve flashbulb memories as we do other types of autobiographical memories. Both types of memories become inconsistent over time at the same rate (Hirst et al., 2015).

C. Nathan DeWall *is a professor of psychology at the University of Kentucky. His research interests include social acceptance and rejection, self-control, and aggression. DeWall can be contacted at nathan.dewall@uky.edu.*

The big difference is that we rarely forget events that comprise flashbulb memories. You might flub the details of the conversations you had, the food you ate, or the clothes you wore the day Barack Obama became president, but you don't flub the fact that Barack Obama became president. That public event is seared into your mind, guaranteed to burn bright the rest of your life.

Some other characteristics distinguish flashbulb memories from other types of memories. One factor is greater-than-usual confidence. In general, people feel confident they won't forget everyday occurrences. Ask people to recall a flashbulb memory and they will feel especially confident that they're getting the facts straight, even if they're not (Talarico & Rubin, 2003).

Flashbulb memories also don't shift according to media exposure (Tinti, Schmidt, Testa, & Levine, 2014). You might read a news article about a flashbulb-memory event, such as where Obama addressed the nation after winning the 2008 presidential election. (It was Chicago.) Such media exposure can help or hinder your ability to learn details about a flashbulb-memory event, but your actual flashbulb memory — where you were when you learned about a public event — will remain unchanged.

To bring this cutting-edge research into the classroom, students can complete the following activity. (Instructors should

remember that they and their students might not have the same flashbulb memories. The average college student was not alive when Princess Diana died and was only 3 years old on September 11, 2001.)

The activity is designed to introduce students to the idea of flashbulb memories, to encourage them to apply the concept to their own lives, and to help them distinguish flashbulb memories from everyday autobiographical memories. To facilitate discussion, have students form pairs. On PowerPoint slides, instructors can show students the following prompts:

Slide #1

Flashbulb memories are "autobiographical memories that involve the circumstances in which one learned of a public event." For example, some people remember where they were when they learned that terrorists had attacked the United States on 9/11.

What is a flashbulb memory from your life? With your partner, take 2 minutes and discuss your flashbulb memory in as much detail as you're comfortable sharing.

Slide #2

Everyday autobiographical memories involve common experiences and interactions. For example, some people remember conversations they have had with friends or family members.

What is a significant memory from the prior year of your life? With your partner, take 2 minutes and discuss your everyday autobiographical memory in as much detail as you're comfortable sharing.

Slide #3

Now let's compare your flashbulb memory with your everyday autobiographical memory. With your partner, discuss:

- How do these two types of memories differ? How are they alike?
- How confident are you that you accurately recalled the flashbulb memory? Are you more or less confident about the accuracy of your flashbulb memory than about the accuracy of your everyday autobiographical memory? Why?
- Do you think learning details about your flashbulb-memory event will change your memory of where you were when you learned about the public event? Why or why not?

Instructors then can discuss the scientific evidence regarding the similarities and differences between flashbulb memories and everyday autobiographical memories. Hirst and Phelps (2016) offer an easy-to-digest review.

Flashbulb memories help to define our lives. December 7, November 22, and September 11 mean different things to different people. To some people, they are only dates on a calendar. To others, these dates bring to mind events — the attack on Pearl Harbor, the assassination of John F. Kennedy, and the terrorist attacks on 9/11 — that caused time to stand still. Although these events involved danger and distress, our flashbulb memories help us build social connections; maybe that's why we hold onto them. By having these memories wedged into our mind, we can share our experiences, learn from others, and make sense of momentous events.

A Science of Meaning in Life

By David G. Myers

King, L. A., Heintzelman, S. J., & Ward, S. J. (2016). Beyond the search for meaning: A contemporary science of the experience of meaning in life. *Current Directions in Psychological Science, 25*, 211–216.

Psychological scientists have gleaned insights into seemingly ineffable yet vital aspects of human experience, such as love, altruism, and joy. So why not also explore the roots and fruits of meaning in life?

In their crisp and lucid essay, APS Fellow Laura A. King, Samantha J. Heintzelman, and Sarah J. Ward (2016) do just that by describing how they and fellow researchers define, measure, and explore meaning:

Defining meaning in life. People sense meaning when they experience their life as having

- purpose (goals and direction),
- significance (value and importance), and
- coherence (predictability that makes sense).

APS Fellow **David G. Myers** *is a professor of psychology at Hope College. His scientific writing has appeared in three dozen academic periodicals, and he has authored or coauthored 17 books, including* Psychology *(11th ed.),* Exploring Psychology *(9th ed.), and* Social Psychology *(12th ed.). Myers can be contacted via his website at www.davidmyers.org.*

Measuring meaning in life. Some surveys addressing this question have asked single, straightforward questions. The Gallup Organization, for example, asked 141,738 people in 132 nations, "Do you feel your life has an important purpose or meaning?" "Yes," answered 91% (Oishi & Diener, 2014).

Instructors also could pose that simple question to their students while acknowledging that some 3% of people currently are coping with severe depression (Pratt & Brody, 2014). Or, to engage them more deeply, they could distribute the 10-item "Meaning in Life Questionnaire" (MLQ) developed by Michael F. Steger, Patricia A. Frazier, APS Fellow Shigehiro Oishi, and Matthew E. Kaler (2015, with the questionnaire available at tinyurl.com/MeaningQ). On the 10 to 70 score range, the researchers' samples of university students, including introductory psychology students, averaged approximately 46.

Outcomes of meaning. King, Heintzelman, and Ward emphasize that meaning matters. People's sense of life meaning, as self-reported on instruments such as the MLQ, predicts positive psychological outcomes (such as quality of life and

absence of psychological disorders) and positive physical outcomes (such as lowered risk of heart attack, stroke, and even Alzheimer's disease). The traffic between mind and body runs both ways.

Predictors of meaning. King and her colleagues winnow five predictors of a strong sense of meaning in life:

1. Social connections that satisfy the human need to belong.
2. A religious faith that provides coherence, facilitates coping, and fosters goals.
3. A good mood. Show the King team someone whose day is marked by positive affect and they will show you a person whose day feels meaningful.
4. An orderly world, including an environment that makes predictable sense.
5. Socioeconomic status. When comparing individuals, abundant means predict ample meaning.

If rich people lead more meaning-filled lives, does this imply that a meaningful life is a first-world luxury? Is meaning something people can experience only when their lower-level needs (a la Abraham H. Maslow) are met? Actually, reported Oishi and APS William James Fellow Edward F. Diener, using the Gallup World Poll data, people in poor countries find "more meaning in life than those of wealthy nations" (p. 422). They attribute this paradoxical finding to the greater religiosity and lesser individualism (and social supports) of less-wealthy countries.

Bringing meaning into the classroom. In addition to asking students about their own sense of meaning in life (perhaps by using the Gallup question or the MLQ), instructors might invite discussion: What activities or purposes give your life meaning? King, Heintzelman, and Ward report that meaning often flows from ordinary, daily activities and responsibilities. Is that true for your students? Or do they only derive meaning from major life events?

As a class demonstration, you could also put some of the King et al.'s conclusions to the test in real time. Go to the General Social Survey database (tinyurl.com/GeneralSocialSurvey). To see if religiosity indeed predicts meaning in a national sample of Americans, enter "doubts4" as the row variable. Enter "attend" as the column variable. Then click "run table." Your students will see that, indeed, a "feeling that life really has no meaning" is rare among those who frequently attend religious services.

Or, to explore but one form of social connection, replace "attend" with "marital" and see that the sense of no meaning is more frequent among those separated or never married.

My Hope College colleague (and meaning researcher) Daryl Van Tongeren teaches a whole course on "Psychology of Meaning." He notes that in the first class period, students

write about (a) what a meaningful life looks like; (b) if they are living a meaningful life, and why; and (c) how they live meaningfully. I have them seal these in a signed envelope, which I keep in my office for the whole term. On the last day of class, they complete these prompts again, and then they compare these to their first-day responses. It's pretty exciting to see how students have experienced growth during the semester.

During other class sessions, he explains,

I assign students a virtue assignment, where they have to do something virtuous or prosocial. We then discuss how it made them feel and the degree to which it may have boosted their meaning (in part by improving relationships with others).

We also do an "obituary assignment" that helps students reflect on their significance. They write about how they'd like to be remembered one day. This also helps them orient toward a sense of purpose, so they can arrange their goals in life.

Finally, we spend a bit of time distinguishing between a meaningful life and a happy one. I think this is an important distinction.

In conclusion, King, Heintzelman, and Ward note that having too meaningful a life is not a problem. Having a sense that existence has no purpose or that one's life does not matter is a problem, as is evident in so many suicides, mass shootings, and terrorist bombings. Ergo, the study and teaching of meaning is meaningful. ●

APS Past President Elizabeth A. Phelps and APS Fellow Shigehiro Oishi will speak at the 2017 APS Annual Convention, May 25–28, 2017, in Boston, Massachusetts.

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Time-Series Methods in Experimental Research

By Trevor Swanson

For many experimental psychologists, the go-to methodological designs are cross-sectional. Cross-sectional studies involve measuring the relationship between some variable(s) of interest at one point in time; some common examples include single-session lab studies and online surveys (e.g., via MTurk). These designs can be useful for isolating relationships between variables, establishing conditions of convergent and discriminant validity, and utilizing samples that are statistically representative of larger populations. Nevertheless, quantitative researchers have noted that attempts to measure and analyze interindividual variation are incomplete without an accompanying account of the underlying temporal dynamics that define these processes (e.g., Molenaar, 2008; Molenaar, Huizenga, & Nesselroade, 2002). This claim follows from the idea that cross-sectional designs, while potentially well-suited for large samples, are often underpowered, overgeneralized, and ill-approximated to the statistical assumptions implied by general linear methods. For these reasons, psychological scientists should consider supplementing their methodological toolkits with time-series techniques to explicitly investigate the time-dependent variation that can be observed within individual subjects.

The purpose of this article is to briefly discuss the importance of time-series methods in experimental research and to acquaint the reader with some statistical techniques that are easily accessible and can be employed when testing hypotheses with time-series data.

Measuring Behavior as a Time Series

According to Daniel T. Kaplan and Leon Glass (1995), there are two critical features of a time series that differentiate it from cross-sectional data-collection procedures:

1. **Repeated measurements of a given behavior are taken across time at equally spaced intervals.** Taking multiple measurements is essential for understanding how any given behavior unfolds over time, and doing so at equal intervals affords a clear investigation of how the dynamics of that behavior manifest at distinct time scales.
2. **The temporal ordering of measurements is preserved.** Doing so is the only way to fully examine the dynamics governing a particular process. If we expect that a given stimulus will influence the development of a behavior in a particular way, utilizing summary statistics will completely ignore the temporal ordering of the data and likely occlude one's view of important behavioral dynamics.

Linear computations such as mean and variance merely describe global properties of a data set and thus may fail to capture meaningful patterns that only can be identified by looking at the sequential dependency between time points. Consequently, time-series techniques provide a valuable approach in studying psychological processes, which are, by their very nature, fundamentally embedded in time. (For a more detailed treatment of this subject, see Deboeck, Montpetit, Bergeman, & Boker, 2009.)

Analyzing Time-Series Data

Once you've collected a series of behavioral measurements on your variable(s) of interest, there are a variety of ways to explore and quantify the observed dynamics. Here are a few techniques that can be used to investigate patterns within time-series data:

Autocorrelation/Cross-correlation. An autocorrelation reflects the magnitude of time dependency between observations within a time series. An autocorrelation plot depicts correlations between measurements X_t and X_{t+n}, such that each value represents the extent to which any given behavior is related to previous behaviors within the series. A cross-correlation involves relating two time series that are shifted in time at lag n (i.e., X_t and Y_{t+n}), and can reveal, for example, whether one process tends to "lead" the other's behavior or whether they oscillate together.

Recurrence quantification analysis (RQA). RQA begins by simply plotting a time series against itself (i.e., X_t against X_t) and then quantifies whether certain states of the behavior remain stable or recur in time, as well as what percentage of the series is constituted by deterministic patterns. Cross-RQA also can be used to analyze the degree of recurrence and deterministic patterning between two processes, and it has been applied to the study of interpersonal coordination and postural control (e.g., Shockley, Santana, & Fowler, 2003) as well as to the quantification of emotional synchrony in dyadic conflict discussions (Main, Paxton, & Dale, 2016).

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Phase space reconstruction (PSR). When obtaining a behavioral time-series, one of your goals could be to determine what variables are involved in producing particular patterns of behavior and what the possible structure of the underlying dynamics may be. One way to accomplish this is to reconstruct the phase space, which is a multidimensional plot that represents all possible states within the process and can be used to approximate the number of variables involved in producing the observed behavioral changes. For example, we may interpret high trait self-esteem as representing a strong tendency for an individual to adopt and maintain positive self-evaluations. Collecting repeated measurements of state self-esteem and then performing a PSR could help describe the strength of that individual's tendency to retain a positive image of herself as well as reveal the compensatory dynamics that follow from a negative self-evaluative state.

Spectral analysis. Mathematically, any time series can be transformed into a linear composition of sine and cosine waves with varying frequencies. One goal in analyzing time-series data is often to find out what deterministic cycles (i.e., which of the component waves) account for the most variance within the series. Performing a spectral decomposition transforms a time series into a set of constituent sine and cosine waves that then are used to calculate the series' power spectral density function (PSD). Plotting the series' PSD reveals the squared correlations between each component frequency and the series as a whole, yielding a similarly intuitive interpretation to R^2 in multiple regression. In this vein, Gottschalk, Bauer, and Whybrow (1995) applied spectral analysis toward studying the changes in self-reported mood among bipolar patients and control subjects, finding that bipolar individuals tended to exhibit cyclical patterns of mood change that were significantly more chaotic and deterministic than the comparatively random fluctuations observed in control subjects.

Differential equation modeling. Essentially, differential equations allow one to study how different variables change with one another as well as how the state of one variable can be influenced by how it is changing (Deboeck & Bergeman, 2013). Derivative estimates of a single time series can be calculated by a number of different techniques from which differential equations then are constructed and tested based on the researcher's predictions about how those variables are related. An intuitive example of this might be in considering a committed romantic relationship, in which changes in one person's level of emotional satisfaction conceivably lead to changes in their partner's level of satisfaction and vice versa. Each partner's feelings might be coupled with the other's in a complex manner, such that differential equations could be used to model their emotional relationship and show how changes in one person's mood are inextricably linked with changes in the other's mood.

Applying These Techniques to Your Research

Though these methods may appear foreign and somewhat challenging at first, they quickly become more intuitive once seen in an applied context. The above list represents only some of the more common techniques used in time-series analysis, especially those that have been applied successfully within the psychological sciences. ●

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HAWAII

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The National Center for Posttraumatic Stress Disorder, (NCPTSD) seeks a dynamic, academically-oriented leader for the position of Director, Pacific Islands Division, Honolulu, HI. We are seeking a senior doctoral-level individual with a strong background in clinical psychology, psychiatry, social work, public health, and/or related field with a solid research and publication record in the area of mental health disparities within a multicultural context. A focus on PTSD or trauma is preferred, but applicants working on other mental health disorders are encouraged to apply. A demonstrated record of publication, national leadership, and research grant funding are essential. Experience with program or policy development is preferred and recognition within the scientific and academic community is required. The Director advances innovative programs and national collaborations in research and education, as well as promotes staff development and scientific productivity. Mentorship/teaching/training experience in the academic and/or clinical applied fields are desirable. Strong communication and interpersonal skills are essential, including sensitivity to issues related to the stigma of mental illness and minority mental health. Full salary and benefits package are competitive and commensurate with experience (GS-15). Credentials should be commensurate with faculty appointment at the associate or full professor level at the University of Hawaii. The Pacific Islands Division of NCPTSD is a multi-disciplinary division of the National Center for PTSD, a seven-site consortium mandated by Congress to study reactions to traumatic stress and develop model educational programs. The Division has a nationally-recognized program that specializes in the development and evaluation of tele-mental health methods for treatment delivery. We are eager to build a new research program that addresses health disparities among veterans with PTSD and provides leadership on this topic to other NCPTSD divisions. There are many potential opportunities to collaborate with NCPTSD colleagues locally and across the country. The Division is located the VA Medical Center in Hawaii, which is the principal tertiary care referral center for Veterans from throughout the Hawaiian Islands, American Samoa, and Guam. The VA Medical Center provides a full spectrum of inpatient, residential, and outpatient medical-surgical and mental health services. The Division also has an affiliation with the University of Hawaii. The Director would be expected to take a leading role with regard to both the VA and university relationships. Please send curriculum vitae and a cover letter to Matthew J. Friedman MD, PhD at Matthew.Friedman@va.gov. Three references may be requested later. For questions, please contact Dr. Friedman at the above email address. Applications will be reviewed as received and will be accepted until the position is filled. Department of Veterans Affairs provides equal employment opportunities (EEO) to all employees and applicants for employment without regard to race, color, religion, sex, national origin, age, disability or genetics. VA also encourages persons with disabilities to apply.

NEW YORK

Rensselaer Polytechnic Institute **Cognitive Science** **Assistant Professor, Psychological Science**

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Applications should include a detailed curriculum vitae, a vision statement for the department, and statements of teaching and research interests. The applicants should also submit a list of five professional references, at least one addressing leadership experience, who will be available to write on their behalf. Please send all application materials via Debbie Ofcarcik (dofcarcik@wpi.edu). Applications from underrepresented minorities in the social sciences are especially encouraged to apply. Review of applications will begin on November 1, 2016 and will continue until the position is filled.

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GRANTS

SRCD Policy Fellowships for 2017–2018 Year
The Society for Research in Child Development (SRCD) is seeking applicants for SRCD Policy Fellowships for 2017–2018. There are two types of fellowships: Congressional and Executive Branch. Both types of fellowships provide researchers with exciting opportunities to come to Washington, DC, and use their research skills in child development to inform public policy. Fellows work as resident scholars within congressional or federal agency offices. Fellowships run from September 1, 2017, through August 31, 2018. Applicants must have a doctoral-level degree in a relevant discipline (e.g., PhD, MD, EdD), must demonstrate exceptional competence in an area of child development research, and must be a member of SRCD. Both early-career and advanced professionals are encouraged to apply. The deadline to apply is December 15, 2016. To apply for the fellowships, visit https://apps.srcd.org/login.

Call for Papers for Special Issue With the Topic "Addressing Gender Inequality"
Group Processes & Intergroup Relations has issued a call for papers for a special issue examining gender inequality. The aim of this special issue is to provide an overview of the many ways in which gender inequality can, and has been, addressed and the consequences — both intended and unintended — that different approaches, interventions, and policies may have. The journal encourages submissions that examine approaches combatting a range of gender inequalities including workplace, social, political, and economic inequalities as well as inequality in the family and other private spheres. They also encourage submissions of work looking at intersectional issues. The submission deadline is April 1, 2017. For more information, please visit http://gpi.sagepub.com/site/CFPs/SI_Gender_Inequality.pdf. Please direct any inquiries to the guest editors Michelle Ryan at M.Ryan@exeter.ac.uk and Thekla Morgenroth at T.Morgenroth@exeter.ac.uk.

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