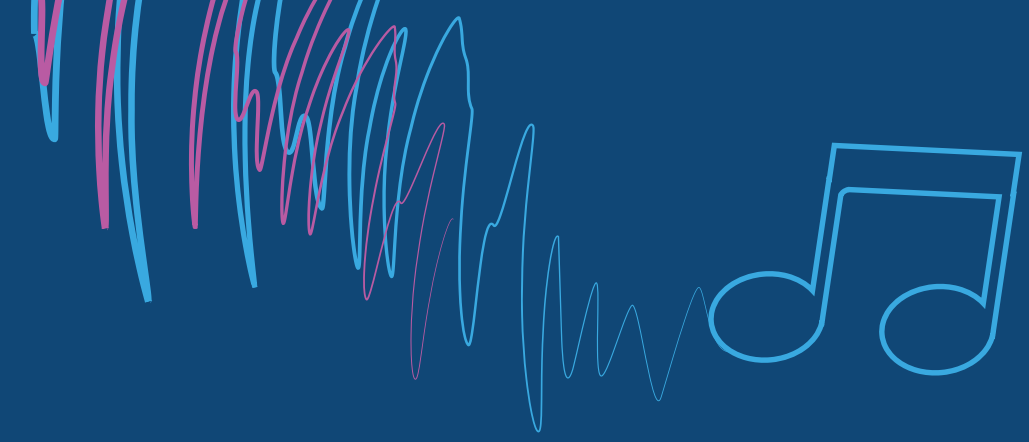
Remembering Walter Mischel

Observer

Vol. 32, No. 5 • May/June 2019

How Sound Becomes Music

The Psychological Science of Song



INSIDE

a publication of aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

www.psychologicalscience.org/observer

Observer

ISSN: 1050-4672

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Published 10 times per year by the Association for Psychological Science, the *Observer* educates and informs the Association on matters affecting the research, academic, and applied disciplines of psychology; promotes the scientific values of APS Members; reports and comments on issues of national interest to the psychological scientist community; and provides a vehicle for the dissemination of information on APS.

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Observer
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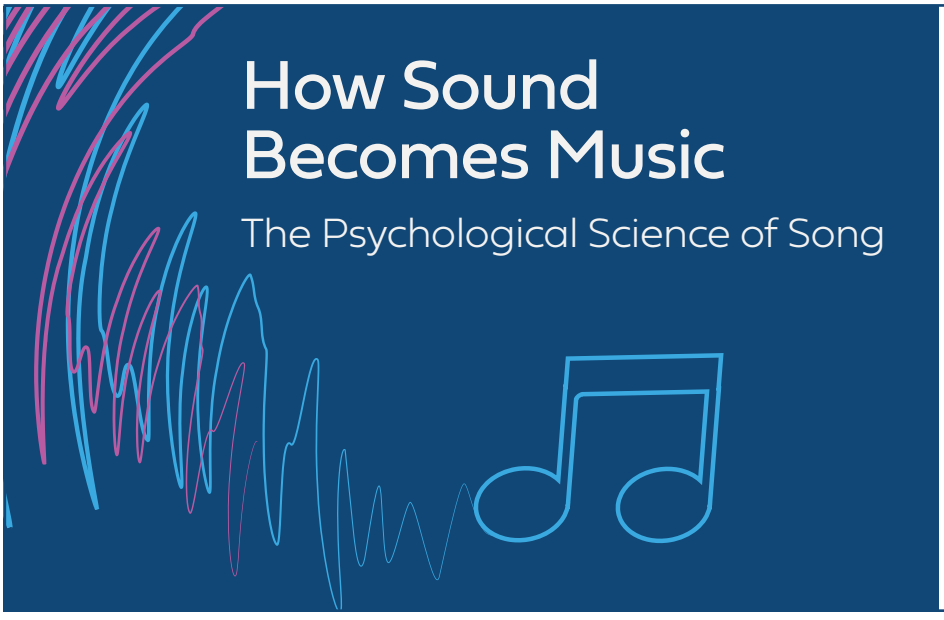

How Sound Becomes Music

The Psychological Science of Song

What makes a lullaby recognizable around the world? Why does thrash metal enthrall some and repulse others? Psychological scientists are discovering the reasons why music plays such a central role in our lives.

Teaching Current Directions in Psychological Science

"Why People Forget and Falsely Remember US Presidents"
by **C. Nathan DeWall**

"The Likely Aftermath of Adversity: Harm, Resilience, or Growth?"
by **David G. Myers**

Departments

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Showcasing Integrative Science

The International Convention of Psychological Science 2019

SEE PAGE 11 FOR MORE PROGRAM INFORMATION

Call for Nominations APS Rising Stars

Deadline: September 30, 2019

The APS Rising Star designation recognizes outstanding psychological scientists in the earliest stages of their post-PhD research careers. Nominations will be evaluated based on the following criteria:

- Significant publications
- Significant recognitions
- Significant discoveries, methodological innovations, or theoretical or empirical contributions
- Work with potentially broad impact

Eligibility: For the 2019 nomination period, eligibility is limited to individuals who received a PhD between January 1, 2013 and December 31, 2016.

Nominations Process: Each nomination must be supported by two APS Members, one of whom must be an APS Fellow. For information on submitting nominations, please visit: **www.psychologicalscience.org/rising-stars**

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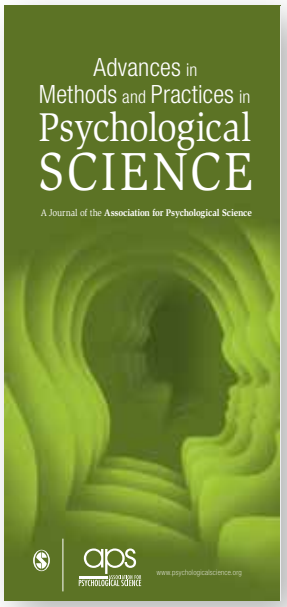

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Perspectives

Psychological science is not only important: It's increasingly important in all realms of life. It's people who make wars and make peace, it's people who contribute to climate change, and it's only people who can reign it in. It's people who make laws, who buy and sell, who vote or don't vote, who raise children, who design cities and automobiles and educational institutions and medical treatments and computer interfaces, it's people who create art and science. All of those activities and more not only are created by people but also are meant for people.

This past year, I invited distinguished scholars from outside our discipline to reflect on ways that they use psychological science in their practice. Although I knew each and thought I was familiar with their perspectives, each response surprised me and enlightened me. We first heard from Stephen Kosslyn, known to the community as a cognitive psychologist and neuroscientist. He left that productive career for another one, bringing psychological science with him to design innovative educational institutions from the ground up on the basis of the best available evidence. Among other things, the program nurtures a Recognize/Access/Apply habit in students: *Recognize* the kind of problem or situation/*Access* the relevant solutions/*Apply* them to the situation. In cognitive terminology: encode/retrieve/act.

We heard from Sarah Goldhagen, an architecture critic, on how people design buildings and even more on how those designs affect people, not always for the best. She urges us to take on human-centric design, particularly the challenge of designing buildings that will enhance the many different aspects of our well-being.

An MD researcher, Donald Redelmeier, and a social psychologist, Lee Ross, described a widespread cognitive bias, the objectivity illusion, according to which all of us, experts like MDs included, think that our own views are truth and therefore shared by others. This raises yet another challenge for us, echoing Kosslyn: how to recognize when we are biased and how to correct those biases.

Eleanor Fox, a lawyer and professor of competition law, showed us that laws, lawmakers, and judges have implicit notions of what people regard as fair and best for human welfare. She observed that those preconceptions do not seem to conform to what research on people's judgments of fairness and evaluations of welfare has shown. Implicit in her analysis is a desire for more research on the subtleties of perception of fairness and welfare. Such research might better inform the law, and would, at the same time, provide more insights into the mind.

Finally, a philosopher, Valeria Giardino, surveyed a century of interactions between philosophy and psychology on the nature of reasoning. Initially, formal logic took hold in philosophy. Subsequent psychological research made clear that formal logic (perhaps like formal analyses of language and of choice) does not describe human reasoning, which is messier and more embodied. Philosophers who study the practices of mathematicians and scientists have come to a similar realization, providing new opportunities for productive interchanges.

Barbara Tversky
APS President

Revelation. Two others accepted my invitation but unfortunately were unable to contribute columns in time. One is an actor-director-teacher who is an avid reader of social neuroscience and embodied cognition, both central to his craft. The other is an innovative designer of human-computer interfaces who tests his designs on humans. Surely we would have been surprised by and could have learned from each of them. I could have invited many others, but I've run out of columns.

Each commentator, implicitly or explicitly, urged us to do research on issues of importance to their work where solid relevant research is missing: Research on human-centric design to create buildings that enhance well-being and to create interfaces that help us accomplish tasks we need to perform, and research on the subtleties of solving problems and overcoming biases and impulses on the ground in real time, on assessing the subtleties of judgments of fairness and trade-offs for welfare. These are win-win opportunities for us to both expand our understanding of fundamental psychological processes and to make a difference in the world. Of course many of you (of us) have been doing this for years.

Two themes have run through my columns this year, bringing in views on psychological science from outside the field and exploring the depth and breadth of spatial thinking (take note of the words). Those themes intertwine. A core feature of spatial thinking is perspective taking, and giving psychology away entails taking the perspective of other disciplines. As I put forth in February, taking other perspectives is probably the most promising way to generate new ideas, to develop new areas of research, and to find new solutions. The implication should be clear.

We are living in divisive times. Historically and sadly even today, leaders attempt to unite people by focusing outside, by appealing to a common enemy. Could focusing outside to cooperate on a common good offer a better solution?

Our annual convention in May will provide ample opportunities to cooperate, to study cooperation, and to learn other perspectives. The Presidential Symposium continues the theme

> Taking other perspectives is probably the most promising way to generate new ideas, to develop new areas of research, and to find new solutions. The implication should be clear.

of bringing in views from outside, in this case, from the arts. Like science, the arts are uplifting, and both are all the more needed in divisive times. What is remarkable is that each of the speakers combines art and science seamlessly. We will hear from Jonathan Berger, a music theorist-composer who also studies the perception of music, and from Andrea Kantrowitz, an artist who also studies the creation of art. The Symposium also includes two psychological scientists who have made contributions to the study of the arts: David Kirsh on dance and architecture and Jeff Zacks on film.

Cooperation unites our two keynote speakers who otherwise study very different populations: Mike Tomasello, who studies cooperation in children and other primates, and Betsy Paluck, who studies cooperation and conflict reduction in diverse groups across the globe. Lee Ross will be interviewed for the *Inside the Psychologist's Studio* video series; among his many contributions to social psychology is work, in the lab and in the field, on conflict resolution.

This is only a sliver of the terrific program that will broaden, enrich, and challenge us in Washington, DC, this May. I look forward to seeing you there.

You can view the full program and register for the 2019 APS Annual Convention at
www.psychologicalscience.org/conventions/annual

Lisa Feldman Barrett Named a Guggenheim Fellow

APS President-Elect Lisa Feldman Barrett, known worldwide for her revolutionary research on emotion in the brain, has been selected to receive the 2019 Guggenheim Fellowship in neuroscience.

Barrett is among a diverse group of 168 scholars, artists, and writers chosen for the Fellowship from a pool of nearly 3,000 applicants. The John Simon Guggenheim Memorial Foundation awards these prestigious fellowships annually on the basis of prior achievement and exceptional promise.

A University Distinguished Professor of Psychology at Northeastern University, Barrett is a leading scholar in the field of emotion research. Her work has shaped how we understand people's inner lives, revealing that emotional experiences and their expressions are varied within individuals and among cultures. She has discovered that emotions do not "live" in certain brain structures (e.g., fear is not housed in the amygdala) and explores the neuroscientific basis of emotions.

Barrett began her career as a clinical psychological scientist, but she quickly became interested in the body's role in mental life. She eventually pursued training in neuroimaging with the help of colleagues and collaborators, as well as funding from the US National Science Foundation and the National Institutes of Mental Health.

"Honors like these are never the effort of a single individual," Barrett tweeted after learning of the award. "THANK YOU to my many generous collaborators who patiently shared their expertise so I could become a neuroscientist."

Barrett received her PhD in clinical psychology at the University of Waterloo in Canada, where she undertook additional concentrations in social and personality psychology, statistics, and philosophy of science. Her professional interests quickly shifted toward psychophysiology, and she eventually pursued training in neuroimaging.

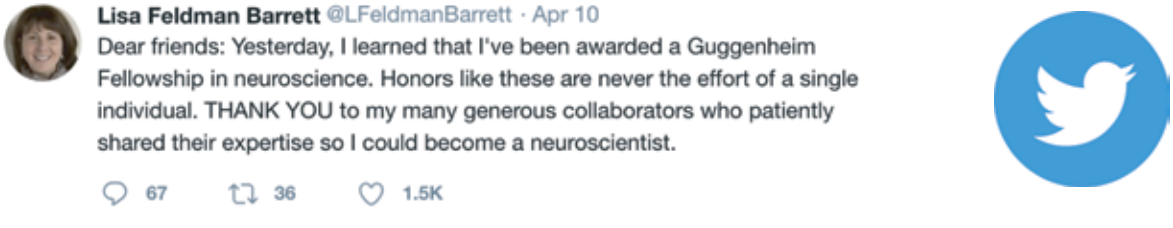
Barrett, who served as an at-large member of the APS Board from 2011 to 2014 and who received the APS Mentor Award in 2018, is also a research fellow at Harvard Medical School and has a research appointment at Massachusetts General Hospital Department of Radiology. She has published more than 200 academic papers in such outlets as *Psychological Science*, *Nature Neuroscience*, and *Science*. She has given a popular TED talk, has testified before US Congress on the role of emotional literacy in public health, and has appeared on the *Today Show* to discuss her research. Her popular 2017 book, *How Emotions Are Made: The Secret Life of the Brain*, details how emotion is constructed mentally and physiologically in the moment and across the life course.

Lisa Feldman Barrett
APS President-Elect

Barrett has received multiple awards for her work, including the National Institutes of Health Director's Pioneer Award. She is a Fellow of the American Academy of Arts & Sciences, the Society of Experimental Psychologists, the Royal Society of Canada, the American Association for the Advancement of Science, the Society for Personality and Social Psychology, and the Mind and Life Institute.

Guggenheim Fellowships are one-time-only grants that allow scholars, artists, and scientists the time and creative freedom to complete their research, book, or other projects. The 2019 Fellows cohort also includes Miguel Eckstein, a University of California, Santa Barbara, cognitive psychologist who studies how the brain handles everyday perceptual tasks.

You can watch Lisa Feldman Barrett's TED talk at bit.ly/2ZLxGWm



Eleven APS Fellows Elected to American Academy of Arts & Sciences

The American Academy of Arts & Sciences has announced the election of more than 200 new members, including 11 APS Fellows.

The 2019 class includes APS Past Board Member and James McKeen Cattell Fellow **Stephen J. Ceci** (Cornell University), and APS Mentor Award Recipient **Mark H. Johnson** (University of Cambridge and Birkbeck, University of London) was named an international honorary member.

Ceci — who studies the development of intelligence and memory as well the accuracy of children's courtroom testimony — is the author of approximately 450 articles, books, commentaries, reviews, and chapters and was one of the founding editors of the APS journal *Psychological Science in the Public Interest* (*PSPI*). He has also studied women's underrepresentation in science, and he was a lead author of a 2014 *PSPI* report (psychologicalscience.org/publications/women-in-academic-science.html) on that topic.

Johnson has published more than 10 books on brain and cognitive development in humans and other species. His work focuses on typical, at-risk, and atypical functional brain development in human infants and toddlers. He will receive the Mentor Award at the 2019 APS Annual Convention, to be held May 23–26 in Washington, DC.

Other APS Fellows elected to the Academy are **Marlene Behrmann**, Carnegie Mellon University; **Jennifer Crocker**, The Ohio State University; **Michele J. Gelfand**, University of Maryland; **Jonathan Haidt**, New York University; **Keith J. Holyoak**, University of California, Los Angeles; **Brenda Major**, University of California, Santa Barbara; **Roy D. Pea**, Stanford University; **John T. Wixted**, University of California, San Diego; and **Jeremy M. Wolfe**, Harvard Medical School. Psychological scientists **Susan R. Goldman** (University of Illinois at Chicago) and **Margaret Beale Spencer** (University of Chicago) are also among the new members.

The scientists are among an accomplished group of scholars, writers, artists, and civic, corporate, and philanthropic leaders newly elected to the academy. The 2019 class includes former First Lady Michelle Obama, former Indiana Governor Mitchell E. Daniels, Jr., former Massachusetts Governor Deval Patrick, journalist James M. Fallows of *The Atlantic*, and actress and playwright Anna Deavere Smith.

The Academy, founded in 1780, is both an honorary society that recognizes and celebrates the excellence of its members and an independent research center convening leaders from across disciplines, professions, and perspectives. The new class will be inducted at a ceremony in October at the Academy's headquarters in Cambridge, Massachusetts.

Learn About Behavioral Modeling in Barcelona With Support From the Estes Fund

The Barcelona Summer School for Advanced Modeling of Behavior (BAMB), with the support of the William K. & Katherine W. Estes Fund, will offer 30 psychological scientists at the PhD and early-career levels the opportunity to learn the conceptual and technical skills necessary to carry out model-based behavioral analysis.

The program, organized by Alex Hyafil (Universitat Pompeu Fabra, Spain), Christopher Summerfield (University of Oxford, UK), and Klaus Wimmer (Centre de Recerca Matemàtica, Spain), will be held September 4–10, 2019, at the Institut d'Estudis Catalans in Barcelona. The program will include lectures on the fundamentals of Bayesian analysis, standard models of decision making, and integrating neural data into behavioral models; extended talks covering classical models and current research; hands-on tutorials; and an off-hours group project in which pairs of trainees will apply what they've learned to data from their own ongoing research.

The application deadline is June 3, 2019. More information on the application process is available on the BAMB website: bambschool.org/home

The Estes Fund supports training opportunities in mathematical and computational modeling for PhD students, postdocs, and advanced researchers. The fund was jointly established by APS and the Psychonomic Society in 2013 to honor the legacy of Bill Estes, one of the most influential psychological scientists of the 20th century.

You can learn more about the Estes Fund at psychologicalscience.org/members/awards-and-honors/estes-fund.

Oral-Health Researchers to Be Recognized at APS Convention

The National Institute of Dental and Craniofacial Research (NIDCR) has selected four scientists who are conducting research at the intersection of psychological science and oral health to receive the 2019 Building Bridges Travel Award, offered jointly with APS.

The awardees will present research posters at the 2019 APS Annual Convention in Washington, DC. Their research covers a range of topics, including eating behavior, health-risk perceptions, and the effects of pain-related fear:

Amanda Crandall, University at Buffalo, The State University of New York

The Interaction Between Food Insecurity and Hunger When Eating in the Laboratory

Stephanie Njoku, California State University, Los Angeles

Tobacco and Nicotine Consumption Methods and Health Risk Perceptions in the United States

Cecelia Nelson, West Virginia University

Pregnancy Effects on Pain-Related and Dental Fears in Appalachian Women

Carolyn Amir, National Institutes of Health

Perceptions of Healthcare Provider Competence Affect Pain Expectations

The full details of these poster presentations are available online at psychologicalscience.org/observer/oral-health

You can learn about the awardees' research in person on Friday, May 24, from 1:00 to 2:00 PM at Poster Session IV, poster boards 145–148.

NSF Calls for Research on Harassment in STEM Contexts

The National Science Foundation (NSF) has announced a call for research on sexual harassment in science, technology, engineering, and mathematics (STEM) contexts. Researchers are invited to submit proposals to programs across NSF that support progress toward safe and secure educational and research environments for current and future scientists.

This announcement follows the publication of an NSF-funded report conducted by the National Academies of Sciences, Engineering, and Medicine on the prevalence and impact of sexual harassment in STEM departments and programs. The report, titled *Sexual Harassment of Women: Climate, Culture and Consequences in Academic Science, Engineering, and Medicine*, includes a recommendation to "conduct necessary research" on topics related to sexual harassment.

In the call, NSF emphasizes its continuous support of theory-driven, peer-reviewed research that advances fundamental knowledge about the nature of sexual harassment and about mechanisms to assess sexual harassment prevalence, prevention, and responses within organizations.

The behavioral sciences are particularly equipped to examine the problem of harassment in science settings. A number of NSF programs accept proposals addressing sexual harassment research on the underlying social and behavioral dynamics of harassment. These projects may include basic research, conferences about sexual harassment in a particular context, and international research collaborations.

Behavioral scientists who are interested in submitting a proposal are advised to contact the Liaisons for Harassment Research in the NSF directorate or office most relevant to the research to be conducted. Proposals should be submitted to preexisting programs.

This call for research follows new NSF policies to combat sexual harassment in the research community. As of October 2018, all organizations funded by NSF are required to report findings of sexual harassment and assault to NSF, and NSF may remove principal investigators from research projects, reduce funding for projects, or terminate awards depending on findings.

You can read NSF's new call for research on sexual harassment at nsf.gov/pubs/2019/nsf19053/nsf19053.jsp

Call for Applications

APS Fund for Teaching and Public Understanding of Psychological Science

Small Grants Program

APS invites applications for nonrenewable grants up to $5,000 to launch new projects broadly addressing the categories below:

- **Scholarship of Teaching and Learning (SoTL)**: Grants in this category support high quality, potentially publishable scholarship directed at the teaching and learning of psychological science.
- **Meetings and Conferences:** Grants in this category support efforts that facilitate communication among teachers of psychological science who share common challenges and who would benefit from sharing ideas and resources.
- **Technology and Website:** Grants in this category support projects leveraging technological resources to enhance the teaching and learning of psychological science, and to increase the reach and efficient dissemination of related resources.

NEXT APPLICATION DEADLINE: OCTOBER 1, 2019

For details, go to: **www.psychologicalscience.org/smallgrants**

Questions? Contact **teachfund@psychologicalscience.org**

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The Teaching Fund was established with the support of The David and Carol Myers Foundation.

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MUST-SEE SCIENCE — ONLY AT APS

Becoming Human: A Theory of Ontogeny

Fred Kavli Keynote Address

Michael Tomasello
Duke University and the Max Planck Institute for Evolutionary Anthropology, Germany

How to Change Norms, and Why We Should

Saturday Keynote Address

Betsy Levy Paluck
Princeton University

Register Today

Psychological Science Overlaps the Arts

Presidential Symposium

Barbara Tversky (Chair)
Teachers College, Columbia University and Stanford University

Jonathan Berger
Stanford University

Andrea Kantrowitz
State University of New York at New Paltz

David Kirsh
University of California, San Diego

Jeffrey M. Zacks
Washington University in St. Louis

CROSS-CUTTING THEME PROGRAMS

ARTIFICIAL INTELLIGENCE AND PSYCHOLOGICAL SCIENCE

Leslie Kaelbling
Massachusetts Institute of Technology

David Sussillo
Google Brain

Nikolaus Kriegeskorte
Columbia University

Josh Tenenbaum
Massachusetts Institute of Technology

ME, MY PHONE, AND I

Eiman Kanjo
Nottingham Trent University, United Kingdom

Arko Ghosh
Leiden University, Netherlands

Ethan F. Kross
University of Michigan

Tracy A. Dennis-Tiwary
Hunter College, The City University of New York

PSYCHOLOGICAL SCIENCE AND POLICY

Christina A. Roberto
University of Pennsylvania

Karina Davidson
The Feinstein Institute for Medical Research at Northwell Health

David M. Clark
University of Oxford, United Kingdom

Elke Weber
Princeton University

Linda Steg
University of Groningen, Netherlands

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Brown University

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AWARD PROGRAMS

James McKeen Cattell Fellow Award Addresses

PTSD, Resilience, and Everything in Between: Mapping the Heterogeneity of Potential Trauma

George A. Bonanno
Columbia University

Sensory Technology as Target and Tool for Applied Psychological Science

Roberta L. Klatzky
Carnegie Mellon University

What I've Learned About Psychology by Collaborating With Non-Psychologists

Robert J. MacCoun
Stanford Law School

APS Mentor Awards and Panel Discussion on Mentoring

Chair: Robert W. Levenson,
University of California, Berkeley

2019 APS Mentor Awardees:

Geraldine Downey
Columbia University

Carol S. Dweck
Stanford University

Marcia K. Johnson
Yale University

Mark H. Johnson*
University of Cambridge and Birkbeck University of London, United Kingdom

*Mark H. Johnson is unable to attend the Convention

William James Fellow Award Addresses

Prisoners of Now: Prospection, Presentism, and the Allocator's Illusion

Daniel T. Gilbert
Harvard University

Taking James Seriously: The Implications of Multiple Memory Systems

Lynn Nadel
The University of Arizona

The Impact of Everyday Emotion

Elizabeth A. Phelps
Harvard University

How Babies Begin Learning Their Native Language

Janet F. Werker
University of British Columbia, Canada

APS Janet Taylor Spence Award Symposium

Chair: Lisa Feldman Barrett,
Northeastern University

The new class of Spence Award recipients will receive their awards during this symposium. The event will also feature presentations by the following past Spence Award recipients:

Catherine Hartley
New York University

Kurt Gray
University of North Carolina at Chapel Hill

Iris-Tatjana Kolassa
University of Ulm, Germany

Thomas L. Griffiths
Princeton University

SPECIAL EVENTS

Inside the Psychologist's Studio

Lee D. Ross
Stanford University

Interviewed by Andrew Ward, Swarthmore College

Lee D. Ross, one of the world's leading scientific authorities in the the field of human inference, judgment, and decision making, will look back on his distinguished career in an interview with his former student, Swarthmore College professor Andrew Ward. Be part of the live studio audience for this special event.

Clinical Science Forum

Organized by the Psychological Clinical Science Accreditation System (PCSAS) and the Academy of Psychological Clinical Science (APCS). Continuing Education credits offered for these sessions.

- The Rising Stars of Depression Research
- Cutting-Edge Training in Clinical Science
- New Developments in the Clinical Science of Behavior Change

Organizers:

Alan G. Kraut
Psychological Clinical Science Accreditation System

Robert W. Levenson
Psychological Clinical Science Accreditation System and the University of California, Berkeley

David A. Sbarra
Academy of Psychological Clinical Science and the University of Arizona

Increasing Vaccination: Putting Psychological Science Into Action

PSPI Symposium*

Valerie F. Reyna (Chair)
Cornell University and Editor: *Psychological Science in the Public Interest*

Noel T. Brewer
University of North Carolina

Gretchen B. Chapman
Carnegie Mellon University

William M. Klein
National Cancer Institute

Melinda Wharton
Centers for Disease Control and Prevention

* This annual symposium features recent reports from the APS journal *Psychological Science in the Public Interest.*

Hackathon

Best Research Practices Made Easy

Kelci Harris (Chair)
University of Toronto, Canada

Emorie D. Beck
Washington University in St. Louis

Lorne J.Campbell
University of Western Ontario, Canada

Jessica Flake
McGill University, Canada

Eiko Fried
Leiden University, Netherlands

Melissa Kline
Massachusetts Institute of Technology

How People Learn II: Learners, Contexts, and Cultures

Consensus Study Report of the National Academies of Sciences, Engineering, and Medicine

Margaret E. Beier (Chair)
Rice University

Robert Goldstone
Indiana University

Arthur C. Graesser
University of Memphis

Ruth Kanfer
The Georgia Institute of Technology

Zewelanji N. Serpell
Virginia Commonwealth University

Sujeeta Bhatt
National Academies of Sciences, Engineering, and Medicine

SPECIAL EVENTS

SSCP Distinguished Scientist Award Address

Prevention of Depression in Youth: Current Evidence and Future Directions

Judy Garber
Vanderbilt University

APS-David Myers Distinguished Lecture on the Science and Craft of Teaching Psychological Science

Leading Students Toward Contribution to Society

Carol S. Dweck
Stanford University

Keep Current With CEs

Earn the credit you need at the APS Annual Convention. APS offers programs approved for continuing education (CE) credits, all included with your Convention registration.

STUDENT EVENTS

Meet fellow student scientists, converse with leaders in the field, and get guidance on the next steps of your budding career in psychological science. Learn more at www.psychologicalscience.org/studentevents

The Naked Truth Part I: Getting Into Graduate School

Get advice on applying to graduate school from the experts — graduate students.

The Naked Truth Part II: Surviving Graduate School

Learn the necessary survival skills to succeed in graduate school.

The Naked Truth Part III: Navigating the Job Market After Graduate School

Get answers to your questions about finding your first postgrad position.

The Naked Truth IV: You're Working Where?

Hear from psychological scientists who pursued careers off the beaten path of academia.

Champions of Psychological Science

A unique opportunity for students to talk in an informal setting with some of the most respected and well-known scientists in psychology.

How to Get Published

Editors from top journals will give valuable advice and be available to answer questions.

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26TH ANNUAL APS-STP TEACHING INSTITUTE

Sponsored by the Association for Psychological Science and the Society for the Teaching of Psychology.

This pre-conference program offers informative talks and practical advice from experts on the teaching of psychological science as well as poster presentations centered on this theme.

Learn more at www.psychologicalscience.org/conventions/annual/teachinginstitute.

Concurrent Session Speakers

Natalie Ciarocco
Monmouth University

Wind Goodfriend
Buena Vista University

Jessica Hartnett
Gannon University

David S. Kreiner
University of Central Missouri

Bridgette Martin Hard
Duke University

Ali Mattu
Columbia University

Distinguished Lecturer

Tania Israel
University of California, Santa Barbara

Opening Plenary

Betsy L. Morgan
University of Wisconsin, La Crosse

Closing Plenary

Neil S. Lutsky
Carleton College

Workshop

Elizabeth Yost Hammer and Jason S. Todd
Xavier University of Louisiana

Society for the Teaching of Psychology Invited Talks

David Dunning
University of Michigan

Nadine J. Kaslow
Emory University

Nora S. Newcombe
Temple University

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STAY FOR THE CITY:

Take advantage of all the amazing (and free) attractions, sites, and sounds that our nation's capital has to offer. Here are a few favorites:

- National Air and Space Museum: Celebrate the 50th anniversary of the Apollo missions!
- National Gallery of Art
- "Presidential Portraits On View" at the National Portrait Gallery
- National Zoo (right next to the Convention venue)
- D.C.'s famous monuments and memorials (Martin Luther King, Jr. Memorial, the Washington Monument, and the World War II Memorial, to name a few)

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2019 APS Janet Taylor Spence Awards for Transformative Early Career Contributions

Eight psychological scientists have been recognized with the 2019 APS Janet Taylor Spence Awards for Transformative Early Career Contributions for their cutting-edge research on fields varying from the development of decision-making skills to mathematical models of happiness and how we rationalize disturbing realities. The award, named for APS's first elected president, honors the most creative and promising researchers who embody the future of psychological science.

This year's recipients shared their experiences and ongoing research with the *Observer*. The awards will be presented at the 2019 APS Annual Convention, May 23–26, in Washington, DC.

Luke Chang

Dartmouth College
cosanlab.com

My research is focused on understanding the psychological and neurobiological mechanisms underlying emotion and social interactions. For example, what are emotions and how do they affect our social interactions? How do we learn about others' mental states, beliefs, and feelings? How do we encode, compress, and transmit this information to others? Our laboratory adopts a unique approach in addressing these questions.

We attempt to study emotions and social interactions using increasingly naturalistic experimental designs and rely on computational models to aid in quantifying and testing our hypotheses in these complex environments. Much of our work requires novel measurement and analytic techniques, and we are committed to developing open-source tools to aid in studying these social and emotional processes. Ultimately, we hope that our work will help improve our understanding of interpersonal relationships, dysregulation of affect in psychiatric disorders, and the mechanisms underlying the therapeutic effects of provider-client interactions.

Our laboratory has spent the past few years developing a collection of new methods to study real-time social interactions using web applications, mobile apps, wearable sensors, language, and facial expressions. We are excited to use these tools to tackle many understudied questions pertaining to group decision making, belief transmission, conversation, collective memory, shared affective experiences, and gossip.

Mina Cikara

Harvard University
intergroupneurosciencelaboratory.com

I am fascinated by how tribalism shapes people's thoughts, emotions, brains, and behaviors. Specifically, I study how processes such as empathy, cooperation, and communication break down when the social context shifts from "me and you" to "us and them." I'm equally interested in the behavioral consequences when these processes break down, including discrimination, conflict, and aggression. My approach integrates classic and contemporary theories of intergroup relations with cognitive neuroscience and computational approaches to discover, for example, how people overcome their aversion to harm in order to hurt out-group members, how the mind and brain represent "us" and "them," and how we should go about reducing intergroup bias and conflict.

An overwhelming amount of evidence indicates that humans are, by default, cooperative, moral, and deeply averse to harming others. And yet, by some counts, more than 200 million civilians have been killed in acts of genocide, war, and other forms of group conflict over the last century alone. How do we reconcile humanity's tendency toward good with its capacity for the unspeakable? Since I was 10, when my parents began housing a series of family members seeking asylum from the Yugoslav wars, I have understood that the line between these competing impulses is far dimmer than most people are willing to entertain. Intergroup dynamics fundamentally reshape people's views of what is acceptable or fair and therefore represent a critical boundary condition on our most cherished theories of morality and justice. This is why I use intergroup contexts as a lens to understand when people are good, when they are bad, and why.

Molly Crockett

Yale University
crockettlab.org

Blaise Pascal described human beings as "the glory and scum of the universe." Each of us carries blueprints for an astonishing range of social behaviors, from the heroic to the atrocious. My research seeks to understand this paradox by studying the cognitive building blocks of human morality, including social learning, impression formation, empathy, moral judgment, and decision making. I draw upon methods and insights from social psychology, behavioral economics, computational neuroscience, and philosophy.

Lately I've been thinking deeply about the psychology of moral narratives. Humans are natural storytellers and there is evidence that our sense of self is narrative in structure. My lab is currently working on developing a cognitive neuroscience of moral narratives. How do we construct stories that enhance or hinder our sense of ourselves as moral creatures? How do moral narratives shape social conflict and reconciliation? With the rise of smartphones and social media, our collective attention is becoming ever more consumed by the stories on our screens. I hope to better understand how these stories can be harnessed for social progress.

Katherine Ehrlich

University of Georgia
research.franklin.uga.edu/ugahealthlab

I am a developmental health psychologist whose research focuses on how social experiences, such as poverty, family experiences, and chronic stress, are associated with mental and physical health across the lifespan. I am also interested in immunologic mechanisms that might help explain how social experiences "get under the skin" to influence health. More recently, my work has broadened to include examination of how various stressors might be linked to the body's production of antibodies following vaccination. This research provides an in vivo test of adaptive immunity and allows us to examine how life experiences might influence the immune system.

I'm very excited about our lab's progress in designing vaccination studies with children and teens. We benefited from collaborators on campus who could help us understand measures of adaptive immunity (a new area for our lab), and we are just beginning to analyze data from the 2018–2019 flu season. Although youths generally have a robust response to vaccinations, we have some preliminary evidence that chronic stressors may reduce antibody production for several influenza strains. We are excited to take a closer look at what kinds of stressors appear to be most toxic for youth, as well as whether there are any protective factors that can offset these stressful experiences.

Willem Frankenhuis

Radboud University Nijmegen, The Netherlands
ru.nl/bsi/research/group-pages/deep-lab

I study skills and abilities that develop in response to adversity. Conventional instruments may not measure these "hidden talents." My applied goal is to leverage these skills and abilities in educational and work settings.

Some of my childhood friends grew up in harsh conditions. I once saw one of them respond violently to a (perceived) social transgression. I was dismayed. His behavior was impulsive and resulted from poor judgment — or so I thought. Later that day, he turned to me and said: "I know you don't like what you saw. People think I'm crazy. But where I grew up, I had to bite when people took my stuff. Otherwise I would lose everything." He read my mental states, described his strategies and abilities, and explained these as an adaptive response. Similar reflections exist in ethnographies and interviews. This complexity is overlooked when only viewing such behaviors as maladaptive. Of course, we do want to change harmful behavior. Therefore, I ask how stress-adapted strategies and abilities can be used for positive ends. This is hard to imagine for violence but easier to imagine for reading other people's thoughts and feelings, finding creative solutions with limited means, multitasking in a chaotic environment, and solving other challenges that are prevalent in harsh environments.

Read the full interviews online to learn more about the 2019 Spence Award recipients and their exciting work: psychologicalscience.org/observer/2019-spence-awards

Jon Freeman

New York University
psych.nyu.edu/freemanlab

I'm interested in the cognitive and neural mechanisms that allow us to make sense of other people. When we encounter others, we instantly make any number of social judgments. For example, we categorize others into social groups, perceive their emotions, and infer their personality. We often arrive at rich, elaborate impressions and form an internal model of another person from even the most minimal cues. All the while, we're rarely aware that we're making these judgments, and we also have little conscious access to the specific cues that drive them. My lab's research aims to understand the mechanisms that drive such split-second social perceptions and, in turn, how they drive behavior.

We use functional neuroimaging, behavioral paradigms (e.g., real-time behavioral techniques such as mouse tracking), and computational modeling to investigate how a variety of social cognitive and visual processes shape perceptual and interpersonal decisions. We try to take an interdisciplinary and multilevel approach to examine these questions, incorporating insights across social psychology and the cognitive, vision, and neural sciences. My lab's research is also currently taking additional directions at the juncture of social cognition, vision, emotion, and decision making.

Michael Treadway

Emory University
treadlab.org

Every day we make hundreds of decisions about when and how to invest our effort to best achieve our goals. This process is so fundamental yet poorly understood. How does the brain adjudicate between all the competing options and opportunities with which we are faced? This question has long fascinated me as a cognitive neuroscientist and remains a central focus of the lab. As a clinician, however, I have been even more intrigued by how this process breaks down in mental disorders. I have sat across from numerous depressed patients who tell me that they are too unmotivated to get out of bed or even walk across the room to answer the phone. How does this happen? What is altered in these effort-based decision-making circuits when people become stressed or depressed that makes routine tasks seem impossibly overwhelming? These are the questions that drive my research program.

A core question in clinical psychology is why some people develop mental illness and others don't. Even when equating for a host of external and internal factors, individual differences predominate. While my early work focused on the possible role of dopamine dysfunction in the pathophysiology of motivational deficits in depression, a nagging question had always been why the dopamine system was vulnerable in a subset of depressed patients. A recent set of studies begun since I joined Emory have focused on the role of the immune system in altering dopaminergic reward circuitry. Most recently, this line of work has included the adoption of an induced pluripotent stem cell (IPSC) model to identify personalized genetic vulnerabilities to the effects of inflammation on IPSC-derived neurons. I think this type of approach has tremendous potential for bringing the "precision medicine" revolution to the field of mental health.

Scott Vrieze

University of Minnesota
genome.psych.umn.edu

My research interests center on parsing and understanding etiology in mental illness when experiments are infeasible. We use various genetically informative designs to do this, ranging from twin/adoption studies to population studies with measured genetic relatedness to transgenic animal studies. To improve our understanding of environmental influences, we also work to incorporate new measurement technologies to obtain improved measures of environmental context (like GPS location) to complement self-report questionnaires.

The ultimate goal, for me at least, is to make inroads to understand gene-environment interplay in human behavior, with a focus on mental illness and addiction. That's both an old question and a tall order, but now as ever it is an exciting time to be a clinical psychologist and behavioral geneticist. We are working with new data-collection techniques and experimental tools that rapidly generate a large amount of information on a large number of people (e.g., genome sequencing, electronic health records) or in model systems (e.g., CRISPR'd cell lines or model organisms) that allow new and powerful approaches to old questions.

Highlights in Pictures

ICPS 2019
INTERNATIONAL CONVENTION OF PSYCHOLOGICAL SCIENCE
PARIS FRANCE 7 – 9 March
APS ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

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Sindhuja Sankaran, University of Warsaw, talked about research showing how people judge refugees' morality based on their standing stance.

In a plenary address at the preconference Teaching Institute, APS Fellow **Wolfgang Stroebe** provided evidence that university administrators' emphasis on student evaluations may bias instructors toward lowering course demands and grading more leniently. Stroebe is Emeritus Professor of Social Psychology at Utrecht University and the University of Groningen in the Netherlands.

Henrik Ehrsson, head of the Brain, Body & Self Laboratory at Karolinska Institutet in Stockholm, in the Integrative Science Symposium "**How Changing Our Bodies Changes Ourselves**."

APS William James Fellow **Nora S. Newcombe**, Editor of *Psychological Science in the Public Interest*, and Lindsay Drayton of Cell Press fielded questions about barriers and best practices for getting integrative research published.

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Lera Boroditsky, University of California, San Diego, presented research conducted around the world showing how language shapes the way we think about color, space, time, causality, and agency.

APS Fellow **Arnaud Rey**, French National Center for Scientific Research and Aix-Marseille University, talked about his research on sequence learning in nonhuman primates.

More than 2,700 people from 70 countries attended the convention.

Stephen Fleming, University College London, and **Enny Das**, Radboud University in The Netherlands, were among the speakers in an Integrative Science Symposium titled "**Changing Minds and Behaviours Throughout Society: The Greatest Challenge of Our Times**."

Speakers in the Integrative Science Symposium "**From the Heart to the Eye: Interoception and Awareness**" included, from left, **Martin P. Paulus**, Laureate Institute for Brain Research; **Catherine Tallon-Baudry**, École normale supérieure; APS President-Elect **Lisa Feldman Barrett** of Northeastern University; symposium organizer **Aikaterini (Katerina) Fotopoulou**, University College London; and **Manos Tsakiris**, Royal Holloway University of London.

Mariam Chammat, Executive Advisor at the French Behavioral Insights Unit at Direction interministérielle de la transformation publique, and **Faisal Naru**, Head Strategic Management and Coordination in the Executive Director's Office of the Organisation for Economic Cooperation & Development, joined scientists and policymakers from Germany, France, Norway, Singapore, and the United States to share their work applying behavioral science insights to public policy.

Experts from science, the humanities, and the professional wine world — along with a volunteer taste-tester from the audience — shared insights into the psychological processes that underlie how we taste and enjoy wine.

More than 90 volunteers, including graduate students participating in the international Junior Researcher Programme, helped attendees register, find sessions, and locate their poster board numbers.

Attendees presented their research findings in more than 1,600 posters across 13 poster sessions.

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INTERNATIONAL CONVENTION OF PSYCHOLOGICAL SCIENCE

PARIS FRANCE 7 – 9 March

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Deficit or Development?

BJ Casey on Self-Control in the Adolescent Brain

The teenage brain has been likened to a defective vehicle: all accelerator, no brakes or steering. In a car, this is a recipe for a disastrous ride, and some data suggest that adolescence is a dangerous time: Adolescents are more likely to engage in risky behaviors and suffer from mental illness compared with people in other age groups. But some developmental psychological scientists argue that the rash decisions, impulsive behavior, and susceptibility to peer pressure that mark this period are an important developmental feature, not a bug.

In her Fred Kavli Keynote Address at the International Convention of Psychological Science in Paris, APS Fellow BJ Casey, a professor of psychology at Yale University, discussed why the seemingly deviant behaviors of adolescence are actually an intrinsic part of brain maturation.

Many studies of adolescents use an age cutoff of under 18 years, but APS Fellow **BJ Casey** has been designing studies to examine exactly when self-control reaches maturity in social and emotional contexts

Social Sensitivity

Casey defines adolescence as the period during which a person transitions from dependence on the caregiver to relative independence, with an onset that typically coincides with puberty. It is characterized by heightened sensitivity to the rewards, threats, and social influences that affect self-control — the ability to engage in adaptive emotions, desires, and actions and suppress inappropriate ones.

"Adolescence is this extended period of development where there's a heightened sensitivity to social situations and information. We think that this sensitivity is actually helping to enhance their ability to learn about the social information, because that is going to be key as they take on adult roles in the larger society," Casey said.

To measure self-control, Casey often uses a go/no-go task, in which subjects view a series of images and are instructed to perform an action in response to some of the images (e.g., pressing a button to whack a pesky mole when it appears in an on-screen garden) but to inhibit that action when they see other items (e.g., refrain from pressing the whacking button when an innocent vegetable appears). Their accuracy is a reflection of their level of impulsivity: Committing more errors indicates a more impulsive pattern of responses, or less self-control.

Accuracy on this basic task tends to increase with age until the early teen years, at which point it remains relatively stable into adulthood. However, when 13- to 17-year-olds are presented with social and emotional images (e.g., smiling or fearful faces) during this task, they make more impulsive errors than they do when they are presented with neutral images — a pattern not observed in children and adults.

Many studies of adolescents use an age cutoff of under 18 years, but Casey has been designing studies to examine exactly when self-control reaches maturity in social and emotional contexts. To identify when an adolescent actually becomes an adult, Casey homed in on the ages of 18 to 21, a developmental period during which some adult rights are conferred (e.g., voting) while others are not (in the US, the ability to buy and consume alcohol).

Using a go/no-go task, Casey looked at subjects' accuracy under positive arousal and threat conditions. She presented subjects with brief cues of positive arousal, such as a smiling face, or negative arousal, such as an alarmed face. Subjects also performed this task under sustained positive (possibility of receiving $100) and negative (possibility of hearing a loud aversive noise) conditions. Under both negative arousal conditions, 18- to 21-year-olds performed similarly to younger adolescents — and differed from adults. Brain imaging data showed that the limbic systems of adolescents and 18- to 21-year-olds were more active during these conditions relative to adults, who showed relatively greater activation in prefrontal control regions associated with decision making.

"These findings suggest that at younger ages, the task is still more emotional, and at the older ages, it's treated more as a cognitive task," Casey explained.

These findings indicate that socioemotional control processes develop later relative to cognitive capacity, meaning that even when adolescents have the cognitive ability to exercise self-control, the social and emotional context of a situation still

> Social factors are important for us to consider when we're thinking about trying to enhance self-control, and also for policies trying to enable and provide opportunities for young people to learn self-control.

greatly modulates this ability. This pattern of findings has been shown cross-culturally, implying that this is not a US-specific phenomenon, and the results also align with neurobiological changes in the developing brain.

"This lag in development, or perhaps hierarchical changes in these abilities, actually map onto neurobiological models of the adolescent brain, suggesting that in these deep emotional centers related to desire and fear and rage, the circuitry within them is changing before circuitry between them and among them is fully developed," Casey said. These circuits build upon each other throughout the teen years and into the 20s, informed by the rich emotional experiences of adolescence.

Developmental Differences

Taking inspiration from the seminal work of her friend and collaborator APS Past President Walter Mischel, Casey has delved into exploring how self-control varies across individuals and across development.

In one study, she followed up with a subset of subjects from one of Mischel's famous marshmallow test experiments, in which young children were given the option to have a single marshmallow at that moment or to wait and receive two marshmallows later. Forty years after the original experiments, Casey had subjects who had been well below or well above the average delay score complete impulse-control tasks that included neutral and positive cues (a neutral or smiling face). Casey found that low delayers were less accurate in response to positive social cues than were high delayers. However, the two groups showed no differences in the neutral condition. Brain-imaging data collected during the task revealed a relative increase in reward-circuitry activity in response to positive social cues among low delayers compared with high delayers, hinting at a possible mechanism behind self-control.

"Differences in self-control, as indexed by delay of gratification, do not reflect general impulsivity, but rather impulsivity specific to cues of value — a marshmallow or a smiling, accepting face," she explained.

Casey and her collaborators are increasingly interested in accounting for the social factors associated with individual differences in self-control. A recent reappraisal of findings from some of the original marshmallow test studies, for example, found that the link between children's ability to delay gratification and their life outcomes is weakened when external factors such as family background, early cognitive ability, and home environment are accounted for.

And research suggests that one of the most salient socioenvironmental factors may be a person's race. Building on persistent negative stereotypes of black men as threatening and evidence that individuals tend to act more impulsively under conditions of threat, Casey and colleagues assessed subjects' impulsivity in response to black and white faces. Compared with neutral and positive conditions, both black and white participants in the threat condition responded more impulsively to black faces than to white ones, committing more false-alarm errors under the sustained threat condition.

"Social factors are important for us to consider when we're thinking about trying to enhance self-control, and also for policies trying to enable and provide opportunities for young people to learn self-control," Casey said.

Several longitudinal studies with large samples are now under way around the world, with the aim of examining the neurological and psychological development of children and young adults. These studies have the potential to enhance our understanding of these important developmental periods, but they must reckon with social factors, Casey said.

"What's going to be essential for all these studies is that we consider the social environment in which this development is occurring, and that social environment is going to play a key role when we consider trying to predict outcomes, risk, and resilience."

-Amy Drew

You can watch a video of BJ Casey's keynote address at psychologicalscience.org/observer/Casey-keynote.

Why Anthropomorphism Is Not a Scientific Sin

Frans B. M. de Waal Shows the Parallels in Human and Animal Emotions

APS Fellow Frans B. M. de Waal says he's not a fan of research that relies on self-reports. That's why he prefers to study species who can't give them.

True emotions are manifested in *behaviors* and are easily measured in animals, de Waal says. In his Fred Kavli Keynote Address at the International Convention of Psychological Science, the prominent Emory University primatologist entertained the audience with a variety of videos that showed how mammals express emotions — from a baby gorilla laughing when tickled to a vole comforting a distressed mate.

"My personal view is that there are no human emotions that don't have a parallel in animal emotions," he said.

Anthropomorphism, the act of attributing human experiences to other species, has long been dismissed in the scientific community — a resistance that de Waal attributes to a fundamental belief in human exceptionalism. But, as he warns in his new book, *Mama's Last Hug: Animal Emotions and What They Tell Us About Ourselves,* when we reject similarities between human and animal emotions we obstruct our understanding of who we are as a species. He calls this rejection "anthropodenial."

Emotion science tends to focus on conscious awareness, or how we judge our feelings in addition to how we express them. But de Waal notes that there isn't always a correspondence between the two — sometimes we smile when we feel nervous or cry when we feel happy. Scientists may not be able to assess animals' feelings, but they can still learn about emotions to on the animals' reactions, he says.

"If you study the voice, if you study all these physical body signs of emotions, you can have a perfectly objective science, without knowing much about the feelings that are associated with it," he said.

In fact, anthropomorphism is the primary tool that de Waal and others in his field use to understand primates. He takes exception to oft-used terms like "mouth-to-mouth contact" and "vocalized panting" to describe ape behaviors, instead referring to them as "kissing" and "laughing," respectively. Chimpanzees will often kiss on the mouth to reconcile after fighting, or to greet each other after long periods apart.

Facial expressions are a clear window into the parallels in human and primate emotions, de Waal says. Scientists once thought that the number of muscles in the human face far exceeded that of any other animal. But recent anatomical studies show that chimpanzees and humans not only have an identical number of facial muscles, they have the same number of facial expressions, as well.

APS Fellow **Frans B. M. de Waal** shows examples of adult bonobos hugging and quieting juveniles in distress, which he describes as a display of empathy.

That doesn't mean that a chimp's toothy grin or a gorilla's furrowed brow signal the same emotional states that they do for us. Macaques, for example, will pull their lips away from their teeth, in a grin, to signal fear and submission, whereas in humans the same expression, the smile, has a friendlier meaning.

Of all the emotions that scientists regard as uniquely human, disgust stands out. Strangely enough, for a emotion that arose in reaction to rotten or contaminated foods, de Waal says, psychologists now declare it a product of culture more than biology. But experiments suggest that animals, like humans, will express disgust at a basic level. Chimps hate rain, for example, and in a downpour they will scrunch their noses in the same way that we usually do when we're irritated or repulsed.

Bad Bananas

Animals have also been found to spurn foods that may be toxic or that they simply find revolting. De Waal showed an example of such research in a video. The clip shows the work of Cécile

Sarabian, who studies the evolutionary origins of disgust at Kyoto University's Primate Research Institute in Japan. In the experiment, conducted at a bonobo sanctuary in the Democratic Republic of Congo, an adult bonobo approaches a row of six banana slices in which the slice at the right sits atop some feces. The primate eats all of the slices except two — the one on top of the feces and the one adjacent to it. Sarabian and her colleagues have recorded similar behavior in chimpanzees and macaques, and they interpret the results as an indication that primates can assess possible contamination in a set of food items and make decisions on the basis of that information.

Soothing Hugs

And de Waal showed examples of animals displaying basic forms of another emotion: empathy. Adult bonobos were observed rushing over to hold and comfort a screaming juvenile that had been bitten by another member of the group. Upon being held, the young bonobo immediately stops crying.

In a related experiment with prairie vole pairs, which are famously monogamous, experimenters took the female out of the cage to another room, where they gave the rodent a shock. Shortly thereafter, they return the distressed vole to its mate, who often stays close to the female and even grooms her. When the female is taken away but not shocked, the male doesn't respond strongly to her when she is returned to the cage. Additional trials showed that females have similar reactions when the roles are reversed. Other experimenters have shown that if the voles are made immune to the effects of oxytocin (a bonding hormone), they don't respond to their mates' stress. It's not clear how the voles left behind were able to sense the returning mate's distress, but de Waal and his colleagues know that the responses do not represent a learned behavior because they tested each vole only once.

Studies have also indicated that primates can be altruistic. In one experiment, de Waal and members of his research team grouped chimpanzees into pairs — the researchers presented one partner in each pair with a bucket full of green and red tokens. That chimp learned to select one token at a time and hand it to the experimenter in exchange for treats. One color would result in a treat for both partners, while the other color would result in treats only for the chooser. The chimps making the selection overwhelmingly preferred the color that resulted in shared treats, especially if their partners waited patiently rather than making a fuss.

You can listen to Frans de Waal talk about his research and his new book on NPR's "Fresh Air"
n.pr/2GFR12r

> "If you study the voice, if you study all these physical body signs of emotions, you can have a perfectly objective science [of animals' emotions], without knowing much about the feelings that are associated with it."

De Waal points to a variety of other animal behaviors that have parallels in human interactions, including elephants comforting one another by placing their trunks in each other's mouths and dogs who yawn simply by hearing — not necessarily seeing — their owners yawn.

Researchers have even found evidence of reconciliation behavior in a variety of species, including dolphins, hyenas, and wolves. The lone exception that de Waal cited generated chuckles from the audience.

"There's only one animal, which many of you have at home, where they have looked for reconciliation but not found it," he said, "and that is the domestic cat."

-Scott Sleek

Adapting Into the Future

Atsushi Iriki Investigates the Evolution of the Brain

The human brain isn't the biggest of all animal brains, but evidence suggests that it's worthy of another superlative: most sophisticated. Our capacity for abstract thought, imagination, self-awareness, perspective taking, and other mental feats makes the human brain unique — but how did we get here? In his Fred Kavli Keynote Address at the International Convention of Psychological Science, neuroscientist Atsushi Iriki discussed research-based insights into the evolutionary phases of brain development and hypotheses about what may be coming next.

Learning to Evolve

According to Iriki, Head of the Laboratory for Symbolic Cognitive Development at RIKEN Center for Biosystems Dynamics Research in Japan, the first transition between evolutionary phases occurred with the emergence of the primate brain about 70 million years ago.

In the mammalian order, primates are phylogenetically closest to rodents, but the brains of the two types of mammals are strikingly different. Big rodents, such as the capybara, have brains that are larger but otherwise structurally analogous to those of smaller rodents. Big primates, on the other hand, have brains that are structurally different from those of smaller primates, with a larger primary cortex and a much larger association cortex. Primate brains are also unusually neuronally dense: Capybaras and a rhesus macaques have brains that are relatively similar in size, but the macaque brain contains almost six times as many neurons.

The emergence of the primate brain, a rapidly self-evolving machine, marked the first phase transition, said Iriki, but the second phase transition occurred more recently, about 1 to 2 million years ago.

Judging by the archaeological record, brains increased in size at a steady rate from primates to prehominids. Then hominins appeared. Between *Homo habilis* and *Homo neanderthalensis*, our closest human relative, brain size skyrocketed. What caused this explosive growth?

There are many theories as to the cause, but a compelling one is the coevolution of tool use and language, Iriki said. To study this in the lab, Iriki focused on tool use, which shares core brain structures with language and is easier to teach. Although Japanese macaques aren't natural tool users, Iriki and his team found that they could train the monkeys to use a small rake to grab tasty treats. The macaques then learned how to use the rake to reach food they could not directly see, taking information from a live video feed to direct the rake to the appropriate spot.

Recordings from parietal cortex neurons representing both somatosensory and visual information around the monkeys' hands revealed that the tool had been incorporated into their visual and tactile receptive fields, becoming an extension of their body schema.

Monkeys in the wild show a cognitive development spectrum that stops short of humans', but studies show the potential to expand that spectrum, says neuroscientist **Atsushi Iriki**.

Additional studies revealed that after the tool-use training, monkeys began combining tools to reach even farther, a skill they were never taught.

And the researchers discovered that these behavioral changes were accompanied by changes in gene expression in the parietal cortex and increased intracortical connection between the temporoparietal junction and parietal cortex.

Gaining Perspective

Monkeys in the wild show a spectrum of cognitive development that stops short of humans'; monkeys don't regularly use tools because they don't need to, Iriki said. But the results of the training studies showed that artificial training could enable an expansion of this spectrum, creating more of an overlap between human intelligence and monkey intelligence.

"I'm not saying that we can make a monkey a human," he added. "Because of their capacity, we cannot introduce *all* of the elements of human intelligence."

But training does facilitate some of those elements, including some high-level metacognitive skills.

“Acquiring a perspective of one's self is rare for monkeys and it is a relatively late-developing skill among human children. But this skill is what allows us to think of ourselves as existing continuously through time.”

After years of trial and error, Iriki and his team were able to expand the monkeys' tool-use repertoire to include tools that augmented their sensory ability. The researchers took a hand rake, similar to those used in the earlier studies, and attached a big mirror at the end, adding a sensory cue to a tool that was already integrated with the monkeys' body image. The monkeys were then able to explore the surrounding environment with the mirror and reach for the food with the rake.

Several training steps later and the monkeys were able to use a small camera, similar to an endoscope, attached to the end of the rake.

“This is as if you're grabbing your eyeball and sticking it at the tip of the tools to explore where you cannot see,” says Iriki.

This tool may seem functionally similar to the mirror-rake tool, but the camera's video feed gave the monkeys an unprecedented ability: They could now see themselves from a third-person perspective.

Acquiring a perspective on one's self is rare for monkeys, and it is a relatively late-developing skill among human children. But this skill is what allows us to think about ourselves as existing continuously through time, and with this concept of a continuous core self comes the ability to think about and plan for the future.

Constructing the Future

To understand how the metacognitive ability to think about one's self distinguishes humans from other animals, Iriki asked the audience to think about beavers and humans.

Beavers adapted to an aquatic environment by modifying it, building dams to make it habitable; in doing so, they created a novel niche. Humans, with our buildings, cars, and roads, are also engaged in niche construction. However, humans, unlike beavers, aren't satisfied with a job well done; we are always seeking continuous improvement, striving for whatever is bigger, better, or more comfortable.

This puts humans in a niche construction loop, in which new tools become part of the environment. Our ability to adapt to these new tools leads to further brain development, which facilitates novel cognitive functions. These novel cognitive functions allow us to acquire or develop more sophisticated tools and continue the cycle.

Importantly, this plasticity isn't limited to an individual lifetime, but is carried on through extragenomic means. As the earlier monkey-training studies showed, adaptation to changes in the environment, including learning how to use new tools, can induce changes in gene expression. Thus, the cultural inheritance of knowledge through social learning may have accelerated the expansion of the brain to its current human form, Iriki said.

And we now may be constructing a new niche through the limitless expansion of our symbolic space, he added, as the development of technology allows us to externalize our brains in ways that were previously impossible.

Whether we are aiming for increased quality, sophistication, happiness, or comfort, “there are many ways we can seek growth without hitting the physical limit of the resources,” he said.

What will happen next? Iriki offered the audience a speculative hypothesis: a third phase transition spurred by our integration with artificial intelligence.

-Anna Mikulak

You can watch a video of Atsushi Iriki's keynote address at psychologicalscience.org/observer/Iriki-keynote

Bridging Science With Clinical Practice Around the World

PCSAS Joins French Society to Promote Clinical Science Model

Creating stronger connections than ever before between science and practice is becoming an overarching theme in international psychology discussions. For decades, many clinical psychologists have argued that mixing science with clinical judgment and intuition makes for a poor recipe in mental health care. But with the pressing need to address staggering rates of mental illness worldwide, the call for a strong clinical-science model is spreading across graduate training programs in many parts of the globe.

Researchers from China, Israel, the European Union, North America, and other parts of the globe shared their successes and hurdles in promoting a science-focused clinical training model as they gathered at the International Convention of Psychological Science in Paris.

"A great number of clinical psychologists do advocate that the practice of psychology be based on scientific principles," said Raphaël Trouillet, an assistant professor at the University of Montpelier in France and immediate Past President of Société Française de Psychologie (SFP). "What is the future of the practice of psychology, and what is the future of the training in the practice of psychology?"

SFP and the North America-based Psychological Clinical Science Accreditation System (PCSAS) hosted a symposium and roundtable discussion at ICPS to discuss these questions.

PCSAS, in particular, was founded with a primary commitment to scientific perspectives in all aspects of clinical psychology. "Science is paramount at PCSAS and we believe that training for clinical practice and for conducting clinical research should be fully science based and reciprocal. Research should inform all aspects of clinical practice and clinical practice should continuously inform research," said PCSAS Executive Director Alan G. Kraut, who also is APS Executive Director Emeritus.

"It's one thing to say we're going to connect these things," said APS Past President Robert W. Levenson, who serves as PCSAS Board president and is a professor at the University of California, Berkeley. "But to make that bridge is not always easy. How do we build that bridge?"

During the symposium, APS Fellow Eva Gilboa-Schechtman of Bar Ilan University in Israel discussed how technology can help give trainees real-time feedback on their therapeutic results. She discussed an ongoing study in which the researchers are collecting data from both the patient and therapist-in-training, tracking vocal outputs, facial expressions, and other nonverbal cues, in addition to patient self-reports and the therapist's clinical judgment. Supervisors use these data in combination to provide trainees with specific, immediate feedback about each session. The trainees can see session-by-session progress for each patient, compare that with expected outcomes, and make treatment corrections along the way, Gilboa-Schechtman explained. Data collected from this kind of research can make use of artificial intelligence for automatic coding, diagnostics, and data analysis in clinical-training settings.

Pennsylvania State University's doctoral training program embraces the philosophy that clinical science should inform clinical practices — and vice versa, said Aaron Pincus, a professor in the university's psychology department. The top training goal of the program is to achieve a seamless integration of clinical science and practice.

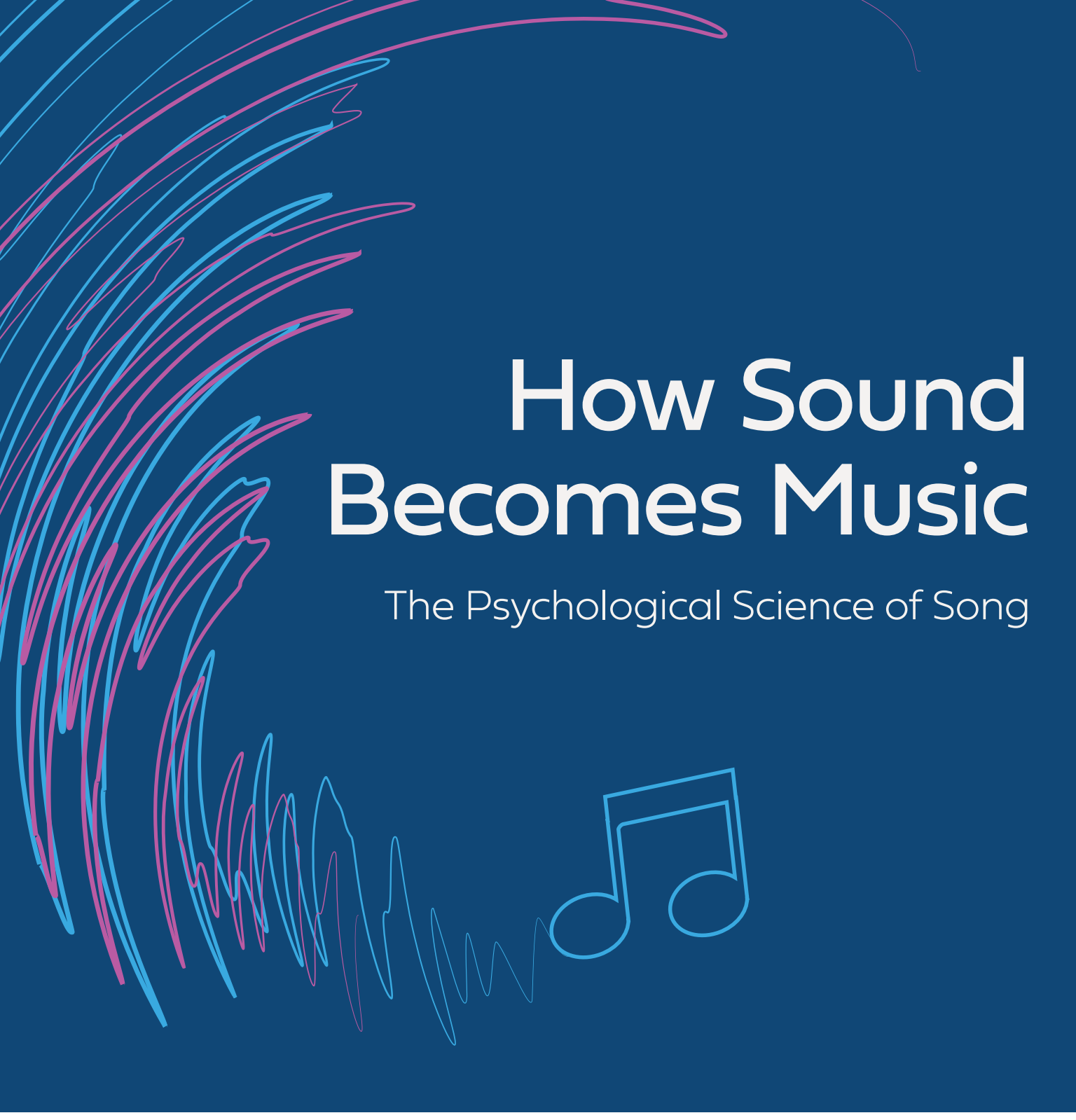
Penn State has a Practice Research Network (PRN), where practitioners, faculty members, and graduate students collaborate in selecting clinically significant topics to investigate, designing and implementing studies, and disseminating findings. The PRN includes a large community mental health center with about 200 active adult clinical cases each year. The PRN tracks diagnoses, treatment utilization, and demographic data. A committee made up of faculty, a community clinician, and a graduate student representative reviews clinical study proposals for approval, making sure research projects have a strong balance between clinical and training relevance.

"What we are trying to do was model our PRN processes after teaching and research hospitals in the United States, pretty much in terms of how they obtain patient consent, to provide things like deidentified data, and also managing data practices within the training plan," Pincus said.

In other nations, the clinical-science model has been stymied by legal and demographic issues, ICPS attendees said. China has only 10 PhD clinical psychologists across the entire country (two of whom were present at the roundtable). Norway, meanwhile, is in the midst of a regulatory controversy over professional designation for clinicians, explained Inger-Lise Bråthen, a Norwegian Society of Psychological Science board member.

Regardless of these differences, the discussion participants agreed that the time has come to promote international cooperation to intensify the integration of clinical science and clinical practice worldwide. The discussions revealed that although efforts to promote clinical science are under way around the world, these efforts have not increased communication and collaboration across countries. The symposium and roundtable marked an important step in fostering this international integration.

-Scott Sleek



How Sound Becomes Music

The Psychological Science of Song

Music plays many roles. It can awe a concert hall full of adoring fans, woo a would-be lover, or soothe a fussing child — and psychological scientists are discovering just how deep our connection with this intimate art form goes.

By Kim Armstrong, *APS staff writer*

It may seem almost trivial to say that music is universal; every known culture in the world seems to have something that ethnographers and ethnomusicologists would describe as music. What's far more interesting is how music is universal, says psychological scientist Samuel Mehr, principal investigator at Harvard University's Music Lab.

Through analyzing the lab's Natural History of Song database, an archive of nearly 5,000 songs and performances from more than 100 societies across the globe, Mehr and his team have been able to distill the musical complexities of a given song into a few key dimensions, such as level of formality, religious/secular purpose, and positive/negative affect. These dimensional labels, Mehr continues, create intuitive clusters of songs that align with the most common genres of music, including songs traditionally accompanied by dancing, ceremonial healing songs, love songs, lullabies, and spiritual or religious music.

This tells us something about the basic types of music that exist across cultures, he said, and although the evidence is mixed for every culture producing every type of music, there is always a certain amount of musical variety within a culture.

"In our data, no culture produces only very formal songs and no informal songs, or only very religious songs and no secular songs, so what that suggests is that not only is music universal in a trivial sense in that it turns up everywhere, but there seem to be key ways that music is patterned similarly across human societies," Mehr explains.

The universality of these patterns means that people are often able to identify the intended purpose of songs from cultures they may otherwise have little or no experience with. In an online study with 750 participants from 60 countries, listeners rated the perceived purpose of a random sampling of 36 song excerpts from the Natural History of Song archives. The excerpts were drawn from a larger set of 118 songs in 75 languages from 86 small-scale hunter-gatherer, pastoral, and subsistence-farming societies. Participants, who were completely unfamiliar with the societies from which these songs originated, rated their perceptions of the songs' functions — and their ratings correlated highly with what the songs were *actually* used for in the societies from which they were gathered. Participants rated dance songs highly on the dimension "used for dancing," lullabies highly on the dimension "used to soothe a baby," and healing songs highly on the dimension "used to heal illness." They weren't able to do so for love songs, however.

In a follow-up study of 1,000 participants, half of whom lived in India and half of whom lived in the United States, Mehr and colleagues found that while all four song types showed reliable differences in their musical features, some were more distinct than others. Participants rated the same set of dance songs and lullabies as having the most unique musical profiles; dance songs' more numerous singers, instruments, and greater complexity were easily distinguished from the simpler and often female-led style of lullabies. Errors also appeared to happen nonrandomly – when participants identified a healing or love song as having a different function, for example, it was often because the song possessed features typical of another genre, or the genre was less distinct in general.

Songs that share a social function may take a similar form because those musical features help amplify the music's social signal, Mehr writes in *Current Biology*. Drawing numerous singers and instrumentalists into a performance may help reinforce dance songs' coalition-building effects; lullabies' slow melodies, on the other hand, can have a calming effect that helps lower arousal in young children.

These soothing songs aren't just for putting children to sleep, however — in research published in *Psychological Science*, Mehr and colleagues found that infants use lullabies and other melodies to orient themselves in their newfound social environment.

In a study of 32 infants, the researchers asked parents to sing one of two lullabies to their children at home over the course of 1 to 2 weeks. At the end of this period, in which the parents reported singing the lullaby an average of 76 times, the 5-month-old babies then viewed a pair of videos in which two strangers sang those same songs. Although they were equally attentive to both strangers while they were singing, the infants looked at the singer of the familiar song for longer after they had finished singing, and infants who had heard their assigned lullaby the greatest number of times looked at this singer the longest.

Two later studies, with another group of 64 infants, revealed that infants who received either a musical toy or video calls in which someone sang to them over a 2-week period did not show this attentional effect.

Together, these results suggest that infants may use the songs produced by their parents and others close to them to learn about their social world, Mehr says. Much like remembering the native language spoken around them, remembering the songs their parents sing may help infants determine who is most likely to provide care.

Do You Hear What I Hear?

Drawing from these findings, some researchers, including APS Fellow William Forde Thompson of Macquarie University in Australia, have proposed that the similarities between humans' linguistic and musical abilities suggest that the functions may have arisen from a common protolanguage.

Evolutionary biologist Charles Darwin was among the first to suggest the possibility that a musical protolanguage split into both referential speech and emotive music at some point in humans' evolutionary history.

This more simplified system of communication, Thompson explains, might have been similar to the way mammals such as vervet monkeys communicate threat information to other members of their troop. These primates make a specific nervous sound when there is a snake in the grass, for example, prompting members of their troop to climb up into the trees; another sound signals the presence of a predatory eagle, prompting the monkeys to avoid more exposed branches.

Thompson's work with people who have congenital amusia, or tone deafness, also suggests a connection between the faculties responsible for human musicality and those responsible for emo-

“The fact that art is subjective doesn’t mean that we’re as likely to consider any collection of sounds as musical as any other, of course. There are certain features, says psychological scientist Elizabeth Hellmuth Margulis, director of the Music Cognition Lab at the University of Arkansas, that encourage our brains to perceive a given collection of sounds as music — namely, repetition.”

tional speech. In one study on emotional prosody – the changes in tone throughout an utterance that reflect the emotional state of the speaker — 12 participants previously diagnosed with amusia and 12 with no diagnosis were tasked with distinguishing between sets of 16 phrases that communicated happiness, sadness, fear, irritation, tenderness, and no emotion.

Overall, the amusic group correctly classified the emotional prosody of a statement in 77% of trials on average – making them 10% less accurate than their peers without amusia. Accuracy varied considerably across emotions, however. While people with and without amusia were able to detect fear and emotionally neutral statements with similar levels of accuracy, tone-deaf participants were 20% less accurate at detecting happiness, and they struggled with differentiating among sadness, tenderness, and irritability, as well.

Similar to Mehr’s findings on musical features common across cultures, these misinterpretations seemed to reflect auditory overlap in the emotional prosody of the statements. Participants were most likely to confuse emotion statements that had similar intensity and vocal duration, mistaking sadness for tenderness, irritability for fear, and happiness for neutrality.

Amusia does not reduce an individual’s ability to understand the linguistic content of speech, Thompson and colleagues note, suggesting that emotional communication may represent a fundamental link between the domains of music and language.

Metalheads, Metal Minds

The types of music and the purposes they serve may share similarities across cultures, but our individual responses to music can vary widely, and niche genres such as death metal provide an illustrative example of this. Songs in this subgenre often contain lyrics depicting real or imagined moments of extreme violence, and fear about the effects that such music could have on its listeners made it a prime target of the “Satanic Panic” in the United States during the 1980s. But Thompson’s research suggests that death-metal fans may not be thrashing to their favorite songs for the reasons critics once thought.

For one thing, Thompson said, fans and nonfans of a particular genre can experience that music very differently. The 97 college students in his study who were not fans of death metal reported feelings of tension, fear, and anger after listening to songs like “Hammer Smashed Face” by Cannibal Corpse and “Waiting for the Screams” by Autopsy. But the 48 students who self-identified as death-metal fans reported a far more positive experience, including feelings of power, joy, peace, wonder, nostalgia, and even transcendence.

On average, death-metal fans scored slightly lower than nonfans on the personality traits of agreeableness and conscientiousness (as measured by the Big Five Inventory) but similarly on the Interpersonal Reactivity Index, suggesting no between-group differences in empathy for others. Fans who scored highest on openness were also more likely to report feeling higher levels of power and joy.

When asked to describe the musical features of death metal, fans were also more likely to bypass the graphic lyrics — which nonfans described as “gruesome and intense” — to focus on more technical elements, such as the “evocative…fast — paced tempo, down-tuned instruments and blast beats.”

Overall, Thompson writes, these findings suggest that people listen to music for many different reasons, and they can experience that music quite differently from how we might expect. This should make us think twice about stereotyping individuals according to their listening habits, he said.

Time After Time

The fact that art is subjective doesn’t mean that we’re as likely to consider any collection of sounds as musical as any other, of course. There are certain features, says psychological scientist Elizabeth Hellmuth Margulis, director of the Music Cognition Lab at the University of Arkansas, that encourage our brains to perceive a given collection of sounds as music — namely, repetition.

Repetition. Repetition. Repetition. Repetition.

Annoying, right? Repetition in speech, and in writing, often strikes us as grating — and can even cause words to “lose their meaning,” in the case of semantic satiation. But Margulis’s research suggests that this same feature can turn an otherwise simple series of sounds into music.

Previous research by APS Fellow Diana Deutsch (University of California, San Diego) has shown that simply repeating a spoken phrase can shift people’s perception of the utterance from

speech to song, a phenomenon known as the speech-to-song illusion. Deutsch did not find evidence of this effect, however, when the syllables of the phrase were presented out of order.

In a recent follow-up study, Margulis and collaborator Rhimmon Simchy Gross (University of Arkansas) investigated how this illusion might extend to nonspeech sounds. The researchers had 58 students listen to environmental sounds, from bumblebees buzzing to the crackle of breaking ice and the scraping of a shovel being dragged across the ground. Each of the 20 sounds was repeated seven times to form a 10-second clip. After listening to the original, untransformed clip, some students then heard the same clip eight more times, while other students heard eight "jumbled" versions of the clip in which the sound was looped and interrupted at different time points. After each 10-second clip, participants rated the clip's musicality on a scale of 1 (*sounds exactly like environmental stimuli*) to 5 (*sounds exactly like music*).

As in Deutsch's study, Margulis found that participants rated stimuli as being more musical the more the clips were repeated. Unlike in the previous study, participants also reported experiencing this "sound-to-music illusion" regardless of how the sounds were transformed.

This suggests, Margulis writes, that the speech-to-song illusion may be a function of semantic satiation suppressing the meaning of repeated words and phrases, causing them to be perceived as more musical. When the semantic meaning of a phrase is disrupted by scrambling the syllables of its component words, satiation does not occur, and the musical effect vanishes. This doesn't seem to be the case with environmental sounds, however.

"A succession of drops of water that has been rearranged is still just a succession of drops of water," Margulis writes. "Rearranging individual components of the sound does not tend to alter this source identification."

These phenomena highlight the foundational role that repetition serves in music, both within individual songs and in listening to the same songs over and over again, Margulis notes in *Frontiers in Psychology*. Similar to the rituals we use to mark holidays and other significant events, repetition in music can cause us to enter a "special mental state" in which we focus on the lower-level properties of an action or stimuli — in this case, the changes in tone and rhythm throughout a familiar song or sound. Repeated listening can also cause us to experience an attentional shift toward larger — scale elements, such as lyrical phrases and song structure, that might be lost on a first-time listener.

Great Expectations

Margulis, who studied piano at the Peabody Conservatory of Music, said that her experience as a performer inspires her to ask questions that get at some of the more elusive things that happen in the practice room, in the teaching studio, and on stage.

"Musicians tend to think about music in terms of gestures and metaphors, but researchers often think in terms of quantitative, measurable attributes," Margulis says. "The really exciting stuff happens when you find ways to move back and forth between these modes of understanding."

The Myth of the Mozart Effect

Music can both alarm us and inspire us, and because it profoundly effects our emotional states, it — like any other enjoyable stimulus — can also affect our performance.

In a study of the "Mozart effect" published in *Psychological Science*, participants who listened to an energetic Mozart sonata scored higher on a spatial-reasoning task than did those who listened to a sadder, slower piece or who sat in silence. These effects disappeared, however, when Thompson and colleagues controlled for differences in individuals' self-reported enjoyment, arousal, and mood.

Previous studies have shown similar or higher performance boosts after individuals received a small gift, watched a cartoon, or listened to a story, depending on their personal preferences. Taken together, the authors write, these findings suggest that the Mozart effect may be an artifact of positive affect and arousal rather than anything specific to Mozart or music in particular.

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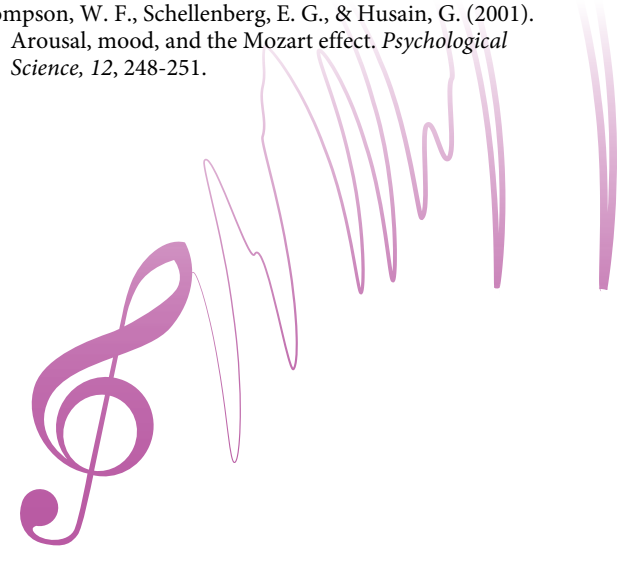

Jonathan Berger, a composer and professor of music at Stanford University's Center for Computer Research in Music and Acoustics (CCRMA), has an ear in both worlds as well.

As a composer, Berger's work ranges from the monodrama "My Lai," a one-man show that reflects on the massacre of more than 500 civilians at the hands of American soldiers in the village of My Lai during the Vietnam War, to electronica and string quartets like "Swallow," a five-movement piece inspired by the chirps, whines, and gurgles these birds use to communicate. As a self-described "amateur researcher," Berger's Music Engagement Research Initiative (MERI) has shone a light on the neural mechanisms underlying music perception and performance and on how listeners engage with individual songs.

In one exploratory study led by CCRMA Research Scientist Blair Kaneshiro, 13 musicians with at least 5 years of training listened to a cello concerto while their physiological responses were measured. The results showed that the musicians' cortical responses (measured by electroencephalogram), respiratory rate, and galvanic skin response, but not heart rate, correlated with the musical highpoints in the concerto, such as the first entrance of a cello, an unexpected pause, or an orchestral climax.

Those data were gathered from a relatively small group of participants listening to just one song, though; to further pursue the question of how people engage with music in their day-to-day lives, Berger, Kaneshiro, and colleagues turned to Shazam, a website and mobile app that helps users identify the music playing around them. The researchers analyzed 188.3 million time-stamped queries related to the top 20 songs of 2015's Billboard Year-End Hot 100 chart, which included such hits as "Shut Up and Dance" by Walk the Moon and "Can't Feel My Face" by the Weekend. The data revealed that users were most likely to search for a song shortly after the onset of vocals and the start of the first chorus. But the relationship between salient musical events and listener engagement continued to evolve throughout the "life cycle" of a song — as songs became more popular, listeners began searching for them as soon as they started.

The researchers note that the timing of user queries doesn't necessarily mean that those musical features were the most interesting points of these songs, just that they were the first point in the song interesting enough to compel listeners to learn more.

These points of interest, whether spurred by an instrumental entrance, a vocal feat, or a beat drop, often elicit one essential reaction: surprise.

"Manipulation of expectation is at the very core of a composer's craft," Berger explains.

Musicians intuitively create these moments of surprise by changing tone, volume, and timing throughout a piece, but the actual processes through which these expectations are formed or violated remain mysterious, he said. Although research on this fundamental aspect of musical engagement has been limited, Berger and others continue to seek new methods for bringing this and other acoustic wonders into the lab.

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Remembering Walter Mischel

1930–2018

A decade ago, then-APS President Walter Mischel called on psychological scientists to get over the "toothbrush problem." That was the term he used to describe researchers' general resistance to using any theories but their own and their reluctance to build on someone else's work.

Thanks in large part to Mischel's wisdom and leadership, scientists are now collaborating across disciplines and geographic boundaries, as exemplified in the biennial International Convention of Psychological Science (ICPS) that he helped create.

Mischel, who passed away in September 2018, co-chaired the Initiative for Integrative Psychological Science with APS Past Board Member Gün R. Semin. The initiative, a collaboration of APS and pan-European scientific groups, spawned the first ICPS in 2015 in Amsterdam. That event, repeated in 2017 in Vienna and 2019 in Paris, showcases the fresh, sophisticated methods and techniques that integrate psychological science with neuroscience, genetics, anthropology, and a host of other fields of research. Science owes a huge debt of gratitude to Mischel for his role in the creation of this celebration of scientific collaboration.

With his own empirical work, Mischel laid the foundation for decades' worth of research on self-control and life outcomes across the lifespan. He is widely known for the marshmallow test — the name tied to the experiments he designed in the 1960s to measure young children's willpower in the face of temptation. Those experiments led to a larger course of study on the links between childhood self-control and later achievement and well-being.

Mischel was the Robert Johnston Niven Professor of Human Letters in the psychology department at Columbia University, which he joined in 1983 after holding faculty positions at Harvard University and Stanford University. An APS William James

Fellow, he was elected to the National Academy of Sciences in 2004, and received the University of Louisville Grawemeyer Award in Psychology in 2011.

His work earned him and his collaborators, APS Fellow Yuichi Shoda and Philip Peake, the Golden Goose Award — an honor given annually to highlight US-government-backed studies that have led to major scientific discoveries and benefits to society. And his 2017 interview for APS's *Inside the Psychologist's Studio* is one of the most widely viewed in a series that features some of the world's most influential psychological scientists.

In the following collection of reminiscences and tributes, Mischel's colleagues and former students — all distinguished scientists themselves — celebrate not only his vast scientific contributions, but his immense curiosity, energy, and warmth.

Ozlem Ayduk

University of California, Berkeley

I met Walter Mischel for the first time on a hot, hazy August day in 1993 in his Columbia office at Schermerhorn Hall. I had arrived in the US from Turkey earlier that summer to start my PhD studies in his lab, not quite grasping at the time how important a figure he was in the history of psychology. During the following many years, I got to know him not only as a mentor, but also as a friend. The list of graduate students he mentored may not be particularly long, but the relationships he developed with many of them, including myself, ran deep.

As a mentor, one of the most important things Walter taught me was the meticulous front-end work that needs to go into setting up experiments, from the general atmosphere of the physical setting to the punctuation in written instructions. He believed we needed to ensure participants experienced as "real" a situation as possible, not only because he wanted the study to "work" but also because he wanted the findings to have a shot in predicting behavior outside of the lab.

During many of the impromptu lunches we had around the small coffee table in his lab, he would recount history, from his family's escape from Nazi Austria, to his early years as a psychologist in the Caribbean, to the most intellectually challenging moments of his academic career. Personal history and the history of psychology entwined seamlessly in most of his stories, leaving us, his students, equally in awe of the man and the scholar, humbled by the realization that maybe, just maybe, in some small way, we were also becoming part of that history.

Walter had a way of turning setbacks into triumphs throughout his life. Even though he could not sleep for more than 4 or 5 hours a night, he welcomed his insomnia, using the wee hours of the morning to work so he could "play" in the afternoon. In his 40s, he was diagnosed with celiac disease. I did not hear him complain even once. Instead, he used his illness as an opportunity to explore new culinary favorites, including the lab's go-to dessert, David Glass's flourless chocolate cake. In his 70s, Walter was diagnosed with extreme osteoporosis. His response was to go to the gym regularly to lift weights, which eventually helped — literally — reverse his diagnosis. Whenever I face a setback in my own life, I role-play being Walter, exercising the art of mentally transforming every disappointment as a new beginning.

Walter loved being an academic. In joking around in the lab, he recounted many times the moment in graduate school when he realized that he was going to get paid for doing what he loved the most, research! He carried that enthusiasm for discovering the mysteries of human behavior until the very end. I miss him dearly.

Mahzarin R. Banaji

Harvard University

A mark of great teachers is that they practice their craft everywhere and all the time. They ask in a way nobody else has before: Look! What is this thing? Where did it come from? How is the same X so different here than it is over there? Can both be true?

Walter Mischel was so intensely curious about the world, and had such an infinity of views about it, that hanging out with him was like being in a garden full of butterflies, with him chasing one and then another and yet another. You would rejoice in the adventure even as you fell exhausted from the dizzying fun.

Walter Mischel was never, in any formal sense, my teacher; we never spent time at the same institution; we never collaborated on research. We saw each other occasionally at conferences, as visitors to each other's departments, and when we served on the APS Board. And yet he has been a part of me, my education, and my world view. That we were friends in spite of so many differences is among the great joys of a profession where it is nothing except ideas and a commitment to particular ways of knowing that connect people to each other. Over the 30 or so years I knew him, he became an increasingly important touchstone. If I tried out an idea or conclusion on him and he nodded, it meant something to me. If he frowned, I took it seriously.

There was nothing bland about Walter Mischel. In life and in science, he was fast, trenchant, and funny. If you had any sense, you knew immediately that you were in the presence of an unusual and superior mind; somebody both humble about the larger enterprise of understanding the mind and intensely confident about the role that psychology had to play. If you were willing, you could have the greatest intellectual ride of your life with him. Sometimes, literally, a ride. He once rented a red convertible at the Society for Experimental Social Psychology (SESP) meeting in Santa Barbara and took three of us on a high-spirited ride through that laid-back town, saying to any police officer with a raised eyebrow, "I'm just from New York!"

No matter what he studied, the two concepts of the situation and the person, the outside and the inside, were ones he engaged with. He was fascinated by the adaptation of people

in dramatically changed environments. When we talked prior to my interview with him in Vienna (for the APS series *Inside the Psychologist's Studio*), I was struck by many observations he offered about why he came to be interested in the problems he worked on, but none more than his memory of the change in his parents' personality. In Vienna, before they had to flee, Walter's father was a proud man of respectable standing, a chemist, if I recall. His mother, he said, was neurotic, stayed at home, and could easily have been granted admission to Freud's circle of patients in that very city. After they were eventually in NYC, and Walter was in his early teens, he said he couldn't help but notice a rather extreme reversal of personality. His father, who had to take a job as a clerk in a five-and-dime, was a cowed down man with little confidence. His mother, realizing that money was needed, became a waitress, and the emotional backbone of the family. How is the same X so different here than it is over there?

That ability to introspect about matters of the mind and the world that didn't make easy sense, to pursue them rigorously by translating them into scientific questions, and to teach us about surprising aspects of ourselves, orthodoxy be damned — that was Walter Mischel's great talent and his gift to us to observe and learn. Beyond this, there was so much more: his research on consciousness, control, and self-regulation; his constant striving to hang out with younger scientists and join in new learning; his support of the collective. For all these reasons, he will remain in my heart and in my mind, in unique ways in each situation, of course.

Albert Bandura
Stanford University

Walter joined the Stanford faculty when the field of personality and psychotherapy was undergoing a transformative paradigm change. At the time, human behavior was attributed to global traits and unconscious complexes. In illuminating field studies, Walter demonstrated that human behavior is contextually variable and conditionally manifested. This causal conception sparked a fiery trait war. Someone once remarked that Walter's *Personality and Assessment* was the most widely cited *nonread* book in personality! Weary of trait warfare, Walter shifted his program of research to self-regulation via delay of gratification. Walter longed for the excitement of New York City. He found the pacific life amidst the balmy palms too tranquil. He left for Columbia where he continued his illustrious career.

Frances Champagne
Columbia University

Walter Mischel was a dear friend and colleague. When I joined the faculty at Columbia University in 2006, Walter's enthusiasm for epigenetics came as a surprise — though I would soon come to appreciate his rationale. The ability of genes to predict behavior is context-dependent, being shaped by their "epigenetic state" — this resonated with Walter's views on personality. Epigenetics was to the genome-behavior relationship what situational context was to the personality-behavior relationship. Walter was so dedicated to gaining a better understanding of epigenetics — I recall him sitting diligently through a 10-hour marathon of lectures I put together on this topic. A lifelong learner, Walter had a passion for integrative science that pushed us all out of the dogmas and habits that come so easily within a field of study.

Walter's legacy within my own field of study comes from his work on the importance of self-control for development across the life course. Risk and resilience in childhood and beyond are such fundamental constructs in developmental science. Walter's demonstration of the trajectories associated with capacity for self-control have generated novel targets for educational and policy approaches that foster resilience. Even Sesame Street has realized the powerful message of Walter's work. Cookie Monster's attempts to resist the urge to eat the cookie are an inspiration for us all — thanks, Walter.

Walter was generous and always moving forward toward the next challenge. I will miss our lunches at Le Monde in Morningside Heights — not quite Paris, but a great place to philosophize about the past and present.

Tory Higgins
Columbia University

A bright star in our sky has blinked out, never to be replaced. Walter is irreplaceable because, like all very special people, he was multidimensional. He was a *Parent* who nurtured, advised, and mentored his students *and* his colleagues. He was a *Scientist* who explored, pondered, and discovered who we are as persons. He was an *Artist* who captured, revealed, and expressed otherwise hidden meanings in the world around us. In all of these ways, Walter was a truth seeker and a truth teller.

Walter was that special scientist who was a great observer of contextualized human behavior. He recognized that what was different among people was not how they generally behaved across situations but what they chose to do in different specific situations, with the stable pattern of their different choices in different situations defining their personality. Not since Freud has anyone made such a significant contribution to understanding personality. He also recognized that the importance of what people choose to do is not the same for all situations. Some situations reveal more about a person's ways of dealing with the world than others. And, famously, he identified a situation that revealed a person's strategies for self-control — the "marshmallow test" of resistance to temptation.

Walter was the best kid to join in the sandbox. Whatever ideas he had, he shared them with enthusiasm. If you had a new idea to share, he was equally enthusiastic. This was the secret to his special charm: *sharing enthusiasms*. I loved his "instant replay": You say something he likes — he laughs, then instantly repeats what you said, then laughs again. He lets you enjoy what you said in such a way that, together, you share the moment. Now that's a kid worth joining in the sandbox.

Ethan Kross
University of Michigan

Walter's sharpness, creativity, and ability to see the big picture was like no other I have encountered. He was a brilliant, forward-thinking scientist who was a continual source of intellectual inspiration. Walter will long be remembered as one of the great psychologists of all time.

Having barely escaped extermination during the Holocaust, Walter felt grateful to spend his life asking questions about human nature. As a result, he took his job seriously. And he demanded that his students do the same. So seriously in fact, that it was not uncommon for him to call me at 6 in the morning when I was in graduate school to share his latest feedback on manuscripts I had sent him before going to bed just a few hours earlier. What was a little sleep when there was important science waiting to be performed?

Fortunately for Walter, he didn't require much sleep to operate at full capacity — just 3 or 4 hours a night and he was raring to go. That left him with ample time to "play," which he took full advantage of, frequenting museums and movie houses several times a week during breaks from work. One of my fondest graduate school memories was a private weekday tour of the Metropolitan Museum of Art that Walter took me and a few others on. After ushering us through a secret members-only entrance to the museum, Walter proceeded to point out with enthusiasm his favorite artwork. In doing so, he demonstrated that his passions extended well beyond the lab (he was a great fan of music and traveling, too, though not sports, which I learned early on in our relationship when my attempt to engage him in conversation about the Yankees was met with an uncomfortable blank stare). Although Walter dedicated his life to studying the mind, he was far from unidimensional in his interests. He was a true renaissance man.

What I will remember most about Walter, however, is his warmth. The relationship between an advisor and advisee is often a special one. But I always thought about my relationship with Walter as more than that. For close to 20 years, Walter was one of my closest friends, someone I could turn to for advice not just about work, but life more generally. Indeed, that was one of Walter's greatest gifts — the ability to create meaningful relationships with his students that transcended psychology, relationships that science shows are the basis of so much of the joy we human beings experience.

There are many things I miss about Walter — his mind, penchant for joking, undeniable charm, and contagious zest for life. But what I miss the most are the frequent conversations I no longer have with one of my dear friends.

Gün R. Semin
ISPA – Instituto Universitário, Portugal and Utrecht University, The Netherlands

If my memory serves me well, I first met Walter in 1993 at the SESP meeting in Santa Barbara and remember talking about diverse things while walking with him, and I was taken aback that he knew about the work that I was doing then on language and social cognition and that he showed some interest. I was taken aback because there was not much interest in this topic and yet there was this person, who had made major contributions with the cognitive-affective system theory of personality and with his delay of gratification work, talking about language and social cognition. At the time, I had not fully realized how much of an intellectual commitment Walter had to an integrative science and the situated nature of psychological processes.

It was, therefore, not a coincidence that we got together again in the 2000s, with the support, help, and commitment of Alan Kraut and Sarah Brookhart at APS, contributing, together with a number of scholars, to what became the International Convention of Psychological Science — an "unconventional" convention that aspired toward an integrative science, inviting neighboring disciplines to inspire psychology and be inspired by psychological science. During the diverse meetings that shaped ICPS, Walter, the gentle giant, was an incredible source of inspiration. He was a product of his journeys across cultures, his passion for both the arts and sciences, his receptive intellect, as well as being a source of kindness and light. He never lost his infectious and youthful joy or his unbridled enthusiasm for science and the arts. And all these were the natural forces propelling this generous and creative mind.

Like so many others who knew him as a colleague, a mentor, and, above all, a friend, we shall remember him by his historic body of achievements and miss him by his giving heart.

Yaacov Trope
New York University

Since I joined NYU, some 30 years ago, Walter and I regularly met for lunch either on the Upper West Side or in Greenwich Village. On the Upper West Side, it was mostly in his apartment, where he was eager to show me his latest paintings. In Greenwich Village, we met at the historic Reggio Café, where Walter would reminisce about his NYU college years in the early 1950s, how he spent hours in that café drawing portraits and hoping that his bohemian artist look would have a romantic appeal. But wherever and whenever we met, our conversations would always turn to psychology. Walter would become impassioned and enthusiastically connect current trends in psychology to its early days at the turn of the last century, and to his vision about the future of psychology and its contribution to human betterment. He was so excited about new advances in psychological science that he kept saying he wished he could have another life to see where it was all leading, and actually take part in it.

This was coming from a scientist whose 60-plus years of seminal scholarship helped capture, measure, and understand "willpower" in scientific terms, a scientist whose inventive methodology opened a window into the self-control processes crucial for adaptive human functioning — beginning in early childhood, influencing adolescent development, and continuing over the life course. Most important, it was coming from a scientist who tackled the big question of stability and flexibility in human behavior, framed and reframed it in light of new developments in psychology, and, in the process, inspired generation after generation of young scientists.

These accomplishments, and many more, were not enough for Walter; they only fed his passion for science, the arts, and his zeal for life. I was sitting at Walter's bed on the last day before he slipped away, when he pulled me closer to him and whispered, "Yaacov, sorry we didn't get a chance to talk about ideas today." There was a gleam in his eye when he said that.

Barbara Tversky

Teachers College, Columbia University and Stanford University

I will let others speak on marshmallows and trait X situation, and I on Walter's taste in the arts. When Amos and I joined the department at Stanford in 1977, Walter took it upon himself to educate us, newly arrived from the battles of the Middle East, in contemporary American culture. His view. Not *Star Wars*, but Sam Shepard's startling plays at the Magic Theatre in San Francisco. It was an excellent arrangement; he picked us up and dropped off one of his lovely daughters to babysit. Walter was even-tempered, gentle, and contemplative, yet he was drawn to the erratic, conflicted, violent characters that Shepard let loose on the stage. True, those characters had fleeting moments of affection, even love, family attachments too strong and compelling to break. Walter was drawn to Albee. Like Shepard, Albee made theater that was alternately brutal and sweet. Like Shepard, he put the multiple personae dwelling within us out on the stage, to fight it out. Though no fan of psychoanalysis, Walter took from Freud the struggle at our core: attachment versus independence. We must have both.

An even greater passion was art. Walter was a gifted and eclectic painter, using Jello powder when he couldn't afford oil, painting on any surface, even kitchen cabinets and doors. His paintings ran the gamut: scenes, people, abstractions; they could be reflective, exuberant, somber, funny, playful. His last stunning paintings were on X-ray films, souls emanating from the bones and disappearing into the confetti of star dust. What he collected and hung in his apartment took your breath away: the evocative curve of a back, black on white, minimalist and elegant. What he was drawn to see, quite the opposite: the contorted beauty of ugliness. He dashed through galleries at marathon speed but didn't miss a thing. Guston, baring his shame joyfully in ironic reds and pinks; Dubuffet, exposing his childish gloppy blobs and clumpy shapes and jarring eyes; Giacometti, shrinking into creases and wrinkles. This was a mind that saw the nuances and complexities and contradictions, the art from the turmoil deep inside.

APS Past President Mahzarin R. Banaji interviewed Walter Mischel at the 2017 International Convention of Psychological Science (ICPS) in Mischel's birthplace of Vienna, Austria. Mischel was a driving force behind the creation of ICPS, a biennial event hosted by APS.

You can watch the entire *Inside the Psychologist's Studio* interview with Walter Mischel at psychologicalscience.org/r/ITPS-Mischel

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Using an Automated Wizard to Process Minimal-Risk Research

By Sandra L. Schneider and Jane A. McCutcheon

Issues of mission creep and excess administrative burden are abundant in the area of human–subject research protections (e.g., Fost & Levine, 2007; Grady, 2010; Gunsalus et al., 2006, 2007; Joffe, 2012). Although there is no question that protecting research participants is essential, procedures for providing this assurance are often quite cumbersome and time-consuming but contribute little to the intended goal. This is especially problematic for the class of minimal-risk research that qualifies for exempt status on the basis of categories described in the Office of Human Research Protections (OHRP) regulations, wherein the cost of extensive review is far higher than the benefit given the low level of risk. The Notice of Proposed Rulemaking published in the Federal Register on September 8, 2015, stated that "a web-based decision tool … will provide determination of whether or not a study is exempt" (p. 53936). Although such a web-based tool, or "wizard," was not mandated in the final rule (partly because of the lack of a widely used tool), the regulatory environment is now supportive of using this kind of wizard to determine which research proposals should be exempt.

> "A wizard could provide a huge reduction in administrative burden and provide as much or more documentation of the protection of human subjects in minimal-risk research."

In 2014, the Federal Demonstration Partnership, a cooperative initiative among 10 federal agencies and 154 institutional recipients of federal funds, launched a pilot study to provide a proof of concept that an automated wizard could allow investigators to accurately self-determine exempt status. The wizard was created on the basis of OHRP guidelines, adhering closely to decision flowcharts that the OHRP made available on its website. The pilot, which was completed in 2017, included 542 case studies from 10 volunteer universities. Each case study was processed using the wizard and was also independently reviewed by the university's institutional review board (IRB). On average, investigators required less than 15 minutes to complete the wizard questions and receive a decision, suggesting the potential for a vast savings of investigator and staff time if the wizard's decisions agreed with university IRB determinations.

The results of the pilot study (Schneider & McCutcheon, 2018) were informative and quite promising. Of the 264 studies that were fully processed through the wizard, 81% agreed with the determination of the IRB. A case-by-case review of these studies suggested that the agreement might have been even higher if it were not for institution-based criteria for stricter review than required (at least 10 cases) or misunderstandings by investigators regarding the OHRP exempt categories (up to 23 cases). With these adjustments, agreement might have been as high as 94%.

The wizard was built with a mechanism to identify cases that might not be amenable to automated review. Roughly 30% of the case studies were flagged by the wizard as involving potentially vulnerable populations (e.g., children or prisoners), possible conflicting researcher-participant relationships (e.g., instructor-student or provider-client), or other concerns that might require a more detailed review. Thus, the wizard can also serve as an effective screening tool to quickly and easily identify cases that may benefit from additional review. Another 120 cases were flagged because of anomalies suggesting that investigators were having difficulties in interpreting the OHRP definitions of "research" and "human subjects." This suggests a pervasive need to clarify these nuanced definitions and develop more user-friendly explanations.

The review of pilot results also suggested a few areas for improvement. Most importantly, the wizard did not adequately screen for sensitive information (e.g., potential reports of criminal activity or substance abuse) when potentially identifiable data were being collected. The wizard also seemed best suited

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— and most commonly needed for — research using surveys, interviews, or questionnaires;, research in classroom settings; and research using identified secondary data.

We have revised the wizard on the basis of these findings. First, we have moved to the beginning of the process any questions that would exclude a study from wizard review. In this way, investigators whose projects are not amenable for review by the current automated tool will spend very little time entering project information into the wizard. In a live demonstration at the May Federal Demonstration Partnership meeting, it took less than 4 minutes for the investigator to be notified that the project was not eligible for wizard review.

On the basis of on the original pilot, we have also expanded the exclusionary criteria to increase the efficiency and effectiveness of the wizard. The current version is limited to exemption categories for research using surveys, questionnaires, interviews, classroom-based research, and secondary-use data. This simplification also reduces the potential for investigator errors in recognizing the appropriate exempt category. The remaining exempt categories are being ruled out using exclusionary criteria. Over time, additional modifications may be created to accommodate some or all of the remaining exemption categories.

A second addition to exclusionary criteria involves the addition of questions to determine whether projects will contain potentially sensitive information when identifiers are collected. These include drug and alcohol use, explicit sexual behavior, mental illness, criminal behavior, immigration status, and personal financial information. These cases are being referred for additional IRB review.

Finally, we also added clarification of the definitions of "research" and "human subjects" on the basis of OHRP guidance to help investigators ensure that they provide accurate responses. This included the addition of contrasting explanations of terms associated with OHRP's definitions of research and human subjects, such as observation versus intervention or interaction, identifiable versus private information, and information that is or is not about the person. We also added itemization of what is excluded from the definition of research, such as single case reports of individualized observations; data collection not aimed at generalizing knowledge; and use of public databases, death records, or unidentifiable preexisting data.

A demonstration comparing the current version of the wizard with human review is in progress. This conservative approach, excluding projects that might be better served by a human review, combined with the clarifying questions to reduce confusion about terminology, provides a solid platform for self-review. Moreover, the wizard's tracking capabilities allow IRBs to monitor self-reviewed studies, providing a mechanism for oversight without requiring valuable reviewer time for minimum-risk reviews. We are optimistic that this will save large amounts of time for both investigators and IRB staff and board members. Thus, a wizard could provide a huge reduction in administrative burden and provide as much or more documentation of the protection of human subjects in minimal-risk research.

"We are optimistic that [the wizard] will save large amounts of time for both investigators and IRB staff and board members."

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You can learn more about the Federal Demonstration Partnership's IRB Exempt Wizard initiative at thefdp.org/default/committees/research-compliance/irb/irb-exempt-wizard/"

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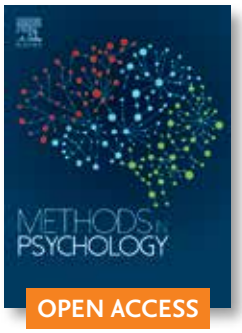

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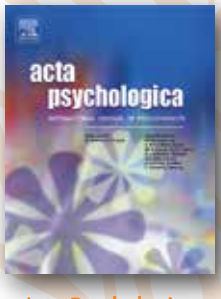

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Bottling the Symphonic Scents of Emotion

Our sense of smell is multidimensional, says APS Past Board Member Gün R. Semin, and beneath the more pungent, prominent aspects of an odor are subtler molecular compounds that appear to play a critical role in psychological science's understanding of human happiness, disgust, and fear.

"When it comes to odors, it's like an entire invisible orchestra, so you don't know what performers or instruments the orchestra consists of," says Semin, principal investigator and director of the William James Center for Research at the ISPA-Instituto Universitário in Portugal.

Toward that end, Semin is leading one of 10 international, interdisciplinary teams working to identify, and artificially reproduce, the chemical compositions of the scents of human happiness, rest, and fear as part of the ongoing Promoting Social Interaction Through Emotional Body Odors (POTION) project.

Earlier this year, POTION received €6.5 million ($7.3 million) in funding as part of the European Commission's Horizon 2020 program for high-risk, high-reward research. There's no guarantee that researchers will be successful at identifying and reproducing the chemical profiles of these odors, Semin said, but there's a reasonable expectation of success over the next 5 years.

Semin's team is engaged in the first step of the POTION process, which involves collecting emotion-induced sweat samples from participants (100 men and 100 women). Although this may seem relatively straightforward, participants must provide happy, fearful, and neutral odor samples on three separate test dates (which must fall at the same time in the menstrual cycle for the women), while avoiding activities such as smoking or consuming asparagus, garlic, and other foods that might contaminate their body odor. These strict standards can make participant retention difficult, and if an individual doesn't show up to all three appointments, none of their samples can be included in the study, Semin explains.

After these samples have been collected, researchers in Italy, Ireland, and France will investigate how to artificially reproduce these scents, clearing the way for additional studies in Spain on how these odors may influence social interaction in virtual reality environments, research in Italy and Sweden on how the scent of happiness might improve treatment outcomes for people with anxiety and depression, and work in France on how best to design devices for distributing these scents in places like seminar rooms and cinemas.

The possibility of manipulating people using emotional scents raises considerable ethical issues, Semin acknowledges, and a team of ethicists and lawyers from the Katholieke Universiteit Leuven in Belgium has also taken on the task of creating rules and regulations for this technology's use.

But synthetic scents are unlikely to cause the kind of profound emotional changes required to, say, disperse a striking crowd or put an end to protests, Semin says. Much like a laugh track on TV, "canned" happiness might enhance an already pleasant experience, but an odor alone isn't enough to significantly alter someone's perception of an otherwise negative situation.

"You cannot induce an alternative state in a person who's not ready to accept it," Semin explains.

Previous studies, outlined by Semin and his colleagues in *Perspectives on Psychological Science*, have suggested that humans are able to obtain information from body odors — a process also known as chemosignaling — through a top-down process dependent on context and the goals of the receiver, among other factors. An individual's reaction to a given scent, the authors note, appears to arise from associative learning rather than instinct alone. That is, a positive experience paired with a scent could cause an individual to react positively to that scent in the future, or vice versa.

In a study of chemosignaling in *Psychological Science,* Semin and his colleagues also found evidence of a "disconnect between olfaction and language." As part of the experiment, 36 female participants were fitted with electromyography (EMG) electrodes to measure the minute differences in the women's facial expressions after they smelled sweat collected from male volunteers who had watched happy, scary, and neutral film clips.

Participants exhibited happier facial expressions on average after smelling sweat collected from volunteer donors who watched upbeat film clips, such as the "Bare Necessities" scene from *The Jungle Book*, compared with those who watched fear-inducing or neutral videos. When the women were asked to evaluate the relative pleasantness of a series of Chinese characters, however — a task designed to measure the misattribution of affect to neutral stimuli — there was no significant difference in ratings between conditions.

This, combined with previous study findings, suggests that chemosignaling occurs on a prelinguistic level, allowing scents to subtly influence our emotions without conscious labeling on our part.

-Kim Armstrong

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Edited by C. Nathan DeWall and David G. Myers

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Why People Forget and Falsely Remember US Presidents

By C. Nathan DeWall

DeSoto, K. A., & Roediger, H. L., III (2019). Remembering the presidents. *Current Directions in Psychological Science, 28*, 138–144. doi:10.1177/0963721418815685

Imagine a classroom of American students preparing to take a US history test. The year is 2219. Asked to recall all US Presidents, preferably in order, students breeze through the test for a while. Then, after a few minutes of work, their responses slow, their brows furrow, and they give up. Although this test will take place 200 years in the future, the research highlighted by K. Andrew DeSoto and APS Past President Henry L. Roediger, III (2019) hints at which US presidents these future students will remember and forget.

George Washington and the most recent presidents will stand out, but Barack Obama and Donald Trump will likely fade from collective memory. That might seem unimaginable now. Swaths of today's Americans know intimate details about both Obama and Trump. Obama practiced self-control throughout his presidency, including his nightly ritual of eating only seven almonds, though he later confessed to succumbing to the temptation for sweets on occasion (Shear, 2016). Trump, in contrast, flaunts a less restrained approach to life, tweeting titillating texts and wolfing down McDonald's sandwiches. Not only will few future Americans remember these newsworthy items — they will likely forget that Obama or Trump ever occupied the White House.

Why? US presidents aren't immune from the classic serial position curve (Ebbinghaus, 1913). Memory for US presidential order perks up at the beginning (*primacy effect*), sags in the middle, and rebounds at the end (*recency effect*) (Roediger & DeSoto, 2014; DeSoto & Roediger, 2019). Distinctiveness increases memory for Presidents who languish in the middle. Normally, people forget the 16th position in a 45-item list. But when Abraham Lincoln occupies that position — having won the Civil War, perhaps making the rest of the presidential list possible — people tend to remember.

To take this cutting-edge research into the classroom, I reached out to DeSoto and Roediger. They offered several useful examples of easy-to-administer classroom activities. In the first activity, ask students to recall as many US presidents as possible, putting them into correct ordinal position from 1 to 45. Give students 5 minutes to complete the activity. Students can also take the quiz on the popular website Sporcle.com: sporcle.com/games/g/presidents.

Next, ask students to use their laptops, smartphones, or other devices to check their answers. If the test is completed online, students will receive automatic feedback when their time is up. Have students review their results with a partner and try to spot unusual patterns in their data. DeSoto is confident that your students' responses will mimic his students' responses. "Patterns of presidential recall have been very stable over time," he told me. "I'm confident that the results will appear akin to a serial position curve — good recall for the first and most recent presidents, and perhaps also good memory for Lincoln, too."

DeSoto's (2016) work, ask encourages student pairs to consider: Why do we see these patterns? How might members of your generation respond differently compared with members of previous generations? What will these patterns look like in 100 or 200 years? On the basis of your responses and knowledge of the serial position curve, how likely would students be in 200 years to forget that Barack Obama and Donald Trump were US presidents?

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The second activity tests students' recognition of US presidents. Whereas the first activity tested students' recall (similar to a fill-in-the-blank test), this activity will measure how well students can accurately recognize someone as a current or former president (similar to a multiple-choice test). When comparing performance on these two types of memory, recognition often trumps recall. If you're like most people, it's easier to recognize more names of Santa's eight reindeer than to recall them.

Drawing on Roediger and DeSoto (2016), ask students whether they think the following individuals were US presidents (*Yes* or *No*) and how confident they are in their judgments (0 = *not at all confident*, 100 = *absolutely confident*):

1. George Washington
2. Alexander Hamilton
3. Thomas Jefferson
4. Franklin Pierce
5. Benjamin Franklin
6. Chester Arthur
7. Patrick Henry
8. John Tyler
9. Paul Revere
10. George Bush

How many people did students identify as US presidents? The correct answer is six: Washington, Jefferson, Pierce, Arthur, Tyler, and Bush. Students should perform well on this recognition task. In one study, American participants correctly identified 88% of prior presidents (Roediger & DeSoto, 2016). What percentage of your students incorrectly identified Alexander Hamilton as a U.S. president? Seventy-one percent of Roediger and DeSoto's participants made this mistake. Why might so many people make this recognition mistake? Were they more confident with their "yes" responses?

As with recall, DeSoto and Roediger are confident that your students will show responses similar to those of their students and research participants. "There's no replication crisis in presidential recall and recognition," Roediger told me. "The same result every time."

Our collective memory is a novel example of revisionist history, mixing our subjective interpretation of objective historical events with our identity. More broadly, this research shows us how quickly well-known individuals fade from our collective memory. With the next US presidential election looming, we should remember that the candidates and eventual president will fade from memory sooner than we might expect.

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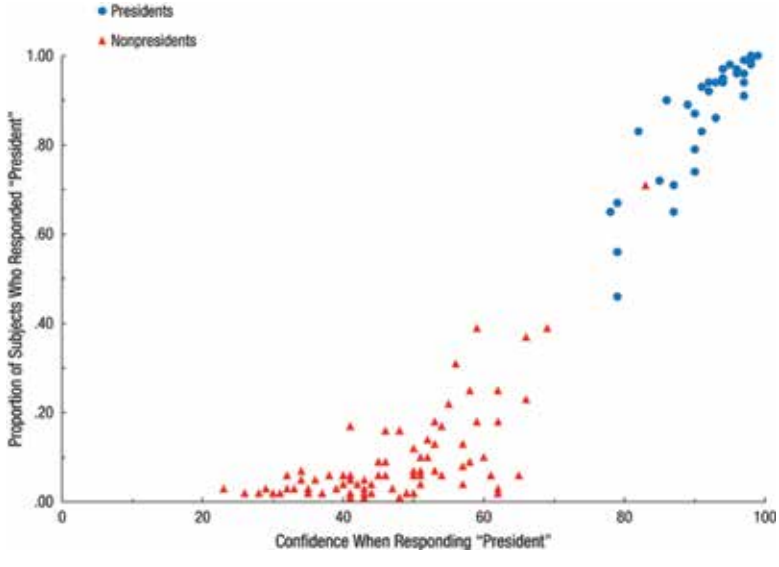

Figure: Scatterplot showing the association between the proportion of subjects who identified each name as that of a president and their average confidence in that identification (each data point represents a name). Alexander Hamilton was the nonpresident outlier (Roediger & DeSoto, 2016).

The Likely Aftermath of Adversity: Harm, Resilience, or Growth?

By David G. Myers

Infurna, F. J., & Jayawickreme, E. (2019). Fixing the growth illusion: New directions for research in resilience and posttraumatic growth. *Current Directions in Psychological Science, 28*, 152–158. doi: 10.1177/0963721419827017

At various times, humans experience deprivation, suffering, bereavement, and even trauma. After the initial emotions of such adversity subside, Frank Infurna and Eranda Jayawickreme (2019) note, there are three possible long-term outcomes:

Harm

Harm entails the enduring toxic consequences of deprivation or trauma. Students could perhaps generate examples from psychological research, such as the following:

- **Severe deprivation**: Early experiences can have lifelong scars, as exemplified by Harlow's isolation-reared monkeys; the orphanage-reared children of Ceaușescu's Romania, whose deprivation enduringly impaired their brain development, intelligence, and social development (Nelson, Fox, & Zeanah, 2014); and the stories of children scarred after family separation by immigration authorities (Chapin, 2019).
- **The worst loss**: Certain catastrophic events can have a deep emotional impact, such as the lingering pain of a child's death (Li, Laursen, Precht, Olsen, & Mortensen, 2005).
- **The toll of trauma**: Other events can also leave a "long trail," such as the distress experienced after school shootings or the toxicity of the prolonged stress of burdensome caregiving (Aneshensel, Pearlin, Mullan, Zarit, & Whitlatch, 1995; Mazzei & Jordan, 2019).

Resilience

Some individuals show resilience, which is characterized by stable and healthy functioning before and after adversity. Again, examples come to mind:

The striking stability of subjective well-being: Negative as well as positive emotions have a short half-life, in that most people recover from romantic breakups, job losses, and infirmities (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998). As the Psalmist observed long ago: "Weeping may tarry for the night, but joy comes with the morning" (Psalms 30:5).

The successful coping of people with disabilities: After suffering paralysis, blindness, or even locked-in syndrome, dispositionally agreeable people are seldom permanently depressed and they often regain near-normal life satisfaction (Boyce & Wood, 2011; Bruno, Bernheim, Ledoux, Pellas, Demertzi, & Laureys, 2011).

The hardiness of some trauma survivors: Even after being stunned by wartime trauma, terrorism, or natural disaster, a common human response is "a stable trajectory of healthy functioning" (Bonanno, 2012). The life successes of children who survived the Holocaust testify to human strengths (Helmreich, 1992).

Growth

In some cases, people can experience positive change as a result of overcoming challenges and crises, as expressed in the aphorism "What doesn't kill you makes you stronger." Examples include:

Cancer survivors gain new perspective: A brush with death reportedly leaves many survivors with altered priorities, a richer spirituality, and a greater appreciation of each day (Tedeschi & Calhoun, 2004).

Coping with challenges strengthens coping ability: Hardship short of trauma can boost mental toughness (Seery, 2011). The opposite — growing up amid affluence — can elevate risks of anxiety, depression, substance abuse, and eating disorders (Lund & Dearing, 2012; Luthar, Barkin, & Crossman, 2013).

Challenges that beget growth: Skilled athletes, entertainers, students, and teachers thrive and excel — and grow in skill – when challenged (Blascovich & Mendes, 2010). And sometimes failure is the parent of success. In late 2018, after being the first #1 seed NCAA-tournament men's basketball team to lose to a lowly #16 seed, "a soul-crushing embarrassment," University of Virginia coach Tony Bennett reflected, "If you learn to use adversity right, it can take you to a place you couldn't have gone any other way" (Feinstein, 2018). In 2019, as if scripted by Hollywood, Virginia won the national championship, leading one jester to tweet: "Bennett sabotaging his 1 seed last year to humble them and motivate them was next level coaching. Can't wait to see the copycat coaches follow his lead in years to come."

So, there are circumstances when adversity begets harmful impairment, stable resilience, and positive growth. But, Infurna and Jayawickreme ask, how common is each — and in what situations do they occur? When is adversity injurious, and when

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does it come with a silver lining? And even if "all things work together for [some] good," can we differentiate the good from the bad consequences? Might some adversity, for example, promote empathy and compassion, while harming health and happiness?

Although human adaptation enables remarkable resilience, the point can be overstated. Studies that track lives over time reveal that, following divorce, job loss, or a spouse's death, people's well-being does rebound — but often to a point short of their pre-adversity status (Diener, Lucas, & Scollon, 2006; Infurna & Luthar, 2016; Jayawickreme & Blackie, 2014). Moreover, Infurna and Jayawickreme note problems with trusting people's autobiographical recall of their own growth.

To illustrate both the research topic and the methodological issues, instructors can invite students to write answers to two questions:

In your own life, what adversity have you experienced? Have you faced a severe stress, a significant loss, a disheartening disappointment, or a difficult hardship?

Looking back, did that adversity harm you? Were you resilient (unchanged)? Or are you, in some way, stronger for it?

Alternatively, instructors might ask: "Imagine asking people with depression if they felt better than they did 6 months ago. Is that a valid method for measuring depression? Why or why not?"

Some autobiographical stories will be too personal to share. Perhaps a few who feel comfortable doing so might briefly share their example of adversity and their response to it. Given studies showing that some 9 in 10 adolescents "report growth following adversity," most will likely tell such stories.

Without discounting or insulting the authenticity of anyone's story — "Adversity sometimes does beget growth, and we can consider these genuine instances of that" — instructors can also ask students why some researchers (including Infurna and Jayawickreme) hesitate to rely exclusively on people's retrospective testimonials. Doing so assumes that people can accurately recall who they used to be, how they differ from their former self, and the source of any change.

Indeed, consider what we have learned from participants in programs that target weight control, smoking cessation, academic support, brain training, and delinquency prevention. By constructing a memory of how bad they used to be and touting how good they are now, clients typically testify to substantial growth. This justifies their expenditure of time, effort, and resources — even when clinical trials reveal no therapeutic benefit. As D. R. Wixon and James Laird (1976) have observed, "The speed, magnitude, and certainty [with which people revise their own histories] is striking." Thus, to judge by testimonials, even ineffective therapies seem to promote growth.

The Socratic instructor might ask: "Given that we cannot experiment with adversity by randomly assigning some people to trauma, what methodology would allow us to better discern how often adversity actually produces harm, resilience, and growth?"

Ideally, say Infurna and Jayawickreme, longitudinal research would compare people "before and after adversity" and with multiple outcome measures. By so doing, we can better understand when, to what extent, and how adversity produces harm, resilience, and growth.

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The complete list of references for this article is available online at psychologicalscience.org/r/TCD57.

Visit David G. Myers at his blog "Talk Psych" (www.talkpsych.com). Similar to "Teaching *Current Directions in Psychological Science*," the mission of Myers's blog is to provide weekly updates on psychological science. Myers and DeWall also coauthor a suite of introductory psychology textbooks, including *Psychology* (12th ed.), *Exploring Psychology* (11th ed.), and *Psychology in Everyday Life* (4th ed.).

QUOTE OF NOTE

"Most of us think we know what 'empathy' is, yet we often mean different things when we use it. Psychologists have (sometimes heatedly) debated its definitions for decades. But despite our quibbling over details, most 'empathy' researchers agree on the big picture … It's an umbrella term that describes multiple ways people respond to one another, including sharing, thinking about, and care about others' feelings."

-APS Fellow **Jamil Zaki**, Stanford University, in his new book *The War for Kindness: Building Empathy in a Fractured World*, Crown, 2019.

Avoiding the "Busy Trap" in Graduate School

One of the first things I noticed when I started my PhD — and something that you've surely noticed by now if you're also a graduate student — is that people in academia tend to be really busy. It didn't exactly come as a surprise; constant busyness seemed a logical and necessary response to the high demands of academic life. But as I stumbled through my first year in graduate school, I came to understand, in a frustrating, firsthand way, that not all kinds of "busy" are created equal.

Much of my time throughout that first year was spent aimlessly toiling away at tasks that either didn't benefit my development as a scholar or disrupted my work–life balance in a way that made me anxious and irritable. I took to these tasks not because I thoughtfully chose them, but because of an all-consuming, mindless urge to occupy myself with something — anything — that might seem productive. Although this fault of mine was due in large part to my unrefined planning and organization skills, it also stemmed from my desire to avoid the guilt I felt when I wasn't wrapped up in whatever I had decided to call "work" that day.

Though I didn't realize it then, this kind of work guilt is common throughout the professional world, and academics may be especially prone to it. Academia is a field with flexible hours and a blurry divide between work and recreation, and this can spawn anxiety — as well as heated debates — about what constitutes a job well done. And what better way to deal with anxiety than to burn time with busywork?

In his 2012 essay "The Busy Trap," Tim Kreider wrote that "busyness serves as a kind of existential reassurance, a hedge against emptiness; obviously your life cannot possibly be silly or trivial or meaningless if you are so busy, completely booked, in demand every hour of the day." This is not to say that the work we do as graduate students is trivial or meaningless, or that being booked all day is a sure sign that we're wasting time and effort. Rather, the point is that by resisting the urge to be busy for the sake of busyness, we force ourselves to step back and ask ourselves what we're really trying to accomplish with our time and how best to accomplish it. Sometimes our work truly demands lots of busyness. But treating busyness as our default state — whether out of ambition or anxiety or a desire to one-up colleagues — may just gray our hair without adding much to our CVs.

At this point, I'd like to be able to return to my own academic character arc and tell you how I've completed my metamorphosis from dithering novice to ruthlessly efficient scholar. But of course that's not true. What I can say is that I'm now a little more resistant to the busy trap than I was before, and I'm working on solidifying a few habits that I think fellow graduate students may find helpful.

Use task-management software

This might seem obvious to many readers. But, if you, like many people seeking an advanced degree, were able to glide through high school and college without ever feeling a serious need to hone your time-management skills, adjusting to the somewhat vague milestones and relative lack of emphasis on grades in graduate school may have been difficult.

One of the most effective ways to help yourself critically assess how you spend your time is to carefully organize everything you have to do, from long-term, big-picture goals to everyday minutiae. Task-management software serves that exact purpose. As Samantha Dubrow and David M. Wallace previously pointed out in the Student Notebook, trying to keep everything organized in your memory is not a good use of your cognitive resources. Use a program like Todoist or Omnifocus to keep yourself on track.

Be able to say no

At the start of graduate school, you might feel like you ought to latch on to every project thrown your way. After all, you want to show your colleagues that you're eager and capable — and that you're in graduate school for a reason. But there is a limit to what you can do before you burn yourself out or stretch yourself too thin. It's wise to spend some time finding your limit, but once you do, you'll find it necessary to be able to respectfully yet firmly refuse an opportunity.

As Helen Kara pointed out in an article for the *Times Higher Education*, habitual overcommitment is a pervasive issue in academia. It's easy to underestimate the heft of your current obligations and overestimate what you're capable of accomplishing in a given period of time. Strategically use a polite "no" as a filter for tasks that you don't think will be worthwhile.

And if you think your refusal to take on that project or to stay a few more hours on a Friday night might seem inappropriate, don't fret too much. Workplace research suggests that we tend to think we're being more assertive than we actually are. Behavior that you think is uncooperative or confrontational may be, in the eyes of your colleagues, completely reasonable.

Delegate

Entrusting other people with certain tasks is an essential part of research and a great way to lighten the demands on your own time, but it isn't always a straightforward endeavor. If you're lucky enough to have someone in your lab who is willing to help you

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with your work, whether they're a high-school-student volunteer or a postdoc, you owe it to them to learn how to effectively manage their time and effort.

Delegating is a skill, and it can be especially tricky to implement in academia because not all research positions are well-defined. For example, sometimes labs have paid technicians who are assigned a specific list of responsibilities. But just as often, there's an amorphous blob of stuff to do and a diverse group of people available to do it. To find the right match between people and tasks, it's helpful to talk with your colleagues so you can learn about their skills and experience and establish clear goals and expectations.

Don't use busyness as a badge of honor

My final suggestion for avoiding the busy trap in graduate school has less to do with specific actions than with attitude. One common reaction to the rigid hierarchies of academia is to equate busyness with success and use the former as a way to measure oneself up against peers. It's an impulse I've unwittingly acted on for years — and still occasionally have difficulty avoiding — and it has the potential to be toxic.

There's a piece of advice that's been floating around Twitter that goes something like this: "In academia, everyone is smart. Distinguish yourself by being kind." To the first sentence I would add that everyone is smart and has a lot to do. Bragging or complaining about busyness can create a tense workplace culture that reinforces the wrong kinds of behaviors and attitudes. Instead of holding ourselves and others to a certain standard of busyness, it may be better to focus on concrete goals, such as submitting that manuscript, learning that new technique, or spending a certain amount of hours each week brainstorming with colleagues.

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'I Could Just Eat You Up'

Ever felt overwhelmed by the desire to pinch a baby or squeeze a puppy because it's just too darn cute? You may be experiencing "cute aggression," according to research by psychological scientist **Oriana Aragón**. The function of these overwhelming feelings remains an open question, but Aragón surmises that they could have evolutionary roots, prompting parents to nurture and hold their helpless infants.

The New York Times

March 15, 2019

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Piers Steel, University of Calgary, Canada, *The New York Times*, March 25, 2019: Why You Procrastinate (It Has Nothing to Do With Self-Control).

Putting the Brakes on Implicit Bias

When we need to think fast, it is easy for race-related implicit biases to take over, says APS MacArthur Fellow "genius" **Jennifer Eberhardt**. Her research, combined with analysis of police data, shows that slowing our thought process down can give us the time to see a situation clearly and may even help reduce the number of officer-involved shootings in the United States.

TIME

March 27, 2019

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Gratitude Is the Attitude to Reduce Theft

Employee theft, whether from occasional cash-skimming or meticulously orchestrated embezzlement schemes, costs US businesses up to $50 billion annually. Fortunately for the Fortune 500, APS Fellow **David DeSteno**'s studies on gratitude suggest that when people are encouraged to think about what they already have, they're significantly less likely to "misreport" the numbers.

Harvard Business Review

April 9, 2019

Coverage of research from an APS journal

Podcast included in coverage

2019 APS Convention Speaker
Washington, DC, USA, May 23–26, 2019

ANNOUNCEMENTS

Send items to apsobserver@psychologicalscience.org

GRANTS

Russell Sage Foundation Programs Accepting Letters of Inquiry

The 26th Annual RAND Summer Institute (RSI) will take place July 8-11, 2019, in Santa Monica, CA. The application deadline is March 15, 2019. The Russell Sage Foundation is currently accepting letters of inquiry for programs and initiatives in the following categories: Behavioral Economics; Race, Ethnicity, and Immigration; Social, Political and Economic Inequality; Decision Making and Human Behavior in Context; Immigration and Immigrant Integration; Social, Economic, and Political Effects of the ACA.

The Russell Sage Foundation was established by Mrs. Margaret Olivia Sage in 1907 for "the improvement of social and living conditions in the United States." The foundation now focuses exclusively on supporting social science research in its core program areas as a means of examining social issues and improving policies. Grants are available for research assistance, data acquisition, data analysis, and investigator time for conducting research and writing up results. Budget requests are limited to a maximum of $175,000 (including overhead) per project (max. 2 years). A detailed letter of inquiry must precede a full proposal.

See russellsage.org/how-to-apply. Questions should be sent to programs@rsage.org.
Deadline: May 23, 2019

Russell Sage Foundation Visiting Scholars Fellowship

The Visiting Scholars Program provides a unique opportunity for select scholars in the social, economic, political and behavioral sciences to pursue their research and writing while in residence at the foundation in New York City. The foundation annually awards up to 17 residential fellowships to scholars who are at least several years beyond the Ph.D. Visiting Scholars typically work on projects related to the foundation's core programs and special initiatives.

The fellowship period is September 1, 2020 through June 30, 2021. Scholars are provided with an office at the foundation, computers, library access, supplemental salary support, and some limited research assistance. Scholars from outside NYC are provided with a partially-subsidized apartment near RSF.

See russellsage.org/how-to-apply/visiting-scholars-program for more info. Questions should be directed to James Wilson, Program Director, at programs@rsage.org.
Application deadline: June 27, 2019

Call for Papers on Organizational Culture and Strategy

Strategy Science is seeking papers for a special issue titled "Reinvigorating Research on Organizational Culture and and its Links to Strategy." The special issue aims to tackle two core questions: First, how do different conceptions of culture relate to one another in organizational contexts, and second, how can integrating these different conceptions help to advance our understanding of a firm's strategy and performance?

The **submission deadline is** October 1, 2019. For more information, view the full call for submissions online. To submit a manuscript, visit pubsonline.informs.org/journal/stsc.

MEETINGS

31st APS Annual Convention
May 23–26, 2019
Washington, DC
psychologicalscience.org/convention

13th Biennial SARMAC Meeting
June 6–9, 2019
Brewster, Cape Cod, Massachusetts, USA
sarmac.org

Conference on Children and Youth 2019
July 4–5, 2019
Columbo, Sri Lanka
youthstudies.co

European Conference for Cognitive Science 2019
September 2–4, 2019
Bochum, Germany
ruhr-uni-bochum.de/philosophy/EuroCogSci2019/home

Society for the Study of Human Development Biennial Meeting
October 11–13, 2019
Portland, Oregon
support.sshdonline.org/

2019 Behavior, Energy & Climate Change Conference
November 17–20, 2019
Sacramento, CA
beccconference.org

DECODING DECISION MAKING, ONE NEURON AT A TIME

*Yale University researcher **Daeyeol Lee**, a pioneering force in neuroeconomics, is integrating methods from a variety of disciplines — including economics, neuroscience, psychological science, and artificial intelligence — to understand the brain's ability to make decisions.*

Daeyeol Lee

You started in economics for your bachelor's degree, transitioned into biology for your master's, and ended up in neuroscience for your doctorate. Can you tell us about that academic path?

As a child, I wanted to become a physicist, but gave up that dream before entering college, because I thought that you must be a genius to be a physicist. During my freshman year, I realized that this is not the case. At the same time, I also learned that studying the human brain is the best way to understand human nature, so I chose to study neuroscience.

Your research often takes a micro-level focus, looking at the activity of individual neurons. What can we learn from these single-neuron recordings?

Understanding the brain requires investigations at multiple levels, ranging from studies on the molecular mechanisms of synaptic transmissions to the functions of large brain structures, such as the cerebral cortex. We focus on the spiking activity of individual neurons because deciphering this neural code is the key to understanding the brain at all levels.

How have the transitions between different universities shaped your work?

Moving the lab across different universities is challenging, but it is extremely rewarding because you get the opportunity to get acquainted with and learn from new colleagues. In addition, my appointments at Wake Forest University and Yale University were in the medical school, which provided more time for research, whereas positions in schools of arts and sciences (e.g., University of Rochester) have given me opportunities to teach undergraduate students. I enjoy both environments.

You've expressed excitement about opportunities afforded by machine learning and artificial intelligence (AI) — how will these complement your work?

I am curious to find out how much flexibility and autonomy AI will acquire in the next several decades, and how an effort to develop such AI will benefit from new findings from neuroscience. In addition, I would like to learn as much as possible about new AI techniques that can help us analyze the increasingly huge amount of data we are getting from our laboratories.

Can you give us a sneak peek of your upcoming book, *The Birth of Intelligence*?

We talk so much about artificial intelligence, but seldom about what intelligence really is. In my book, which will be published in the fall of 2019, I argue that intelligence is a function of life that supports solving complex problems in a variety of uncertain environments. To support this argument, I draw examples from intelligent behaviors in a variety of lifeforms, including plants and bacteria, and compare them with seemingly intelligent behaviors of human-made machines. I look forward to counterarguments.

On July 1, Lee will join Johns Hopkins University as a Bloomberg Distinguished Professor working primarily within the Krieger Mind/Brain Institute.

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