TEMPLETON SCIENCE OF PROSPECTION AWARDS

The Prospective Psychology Project
University of Pennsylvania Positive Psychology Center
3701 Market Street, Suite 200, Philadelphia, PA 19104
www.ppc.sas.upenn.edu

FINALIST SYMPOSIUM: AUGUST 4–5, 2014

Special Thanks to

The John Templeton Foundation

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SPONSORS

The Prospective Psychology Project

Supported by a grant from the John Templeton Foundation, the University of Pennsylvania Positive Psychology Center has established the Prospective Psychology Project to advance the scientific understanding of prospection, or the mental representation of possible futures. To foster this new field of research, the Prospective Psychology Project announced the Templeton Science of Prospection Awards competition in 2013. The awards will encourage research aimed at understanding prospection, particularly how prospection is measured, mechanisms of prospection, and how prospection can be improved and applied in a broad array of disciplines. To learn more about Prospective Psychology, please visit www.prospectivepsych.org.

The University of Pennsylvania Positive Psychology Center

The Positive Psychology Center promotes research, training, education, and the dissemination of Positive Psychology. This field is founded on the belief that people want to lead meaningful and fulfilling lives, to cultivate what is best within themselves, and to enhance their experiences of love, work, and play.

Positive Psychology has three central concerns: positive emotions, positive individual traits, and positive institutions. Understanding positive emotions entails the study of contentment with the past, happiness in the present, and hope for the future. Understanding positive individual traits consists of the study of the strengths and virtues, such as the capacity for love and work, courage, compassion, resilience, creativity, curiosity, integrity, self-knowledge, moderation, self-control, and wisdom. Understanding positive institutions entails the study of the strengths that foster better communities, such as justice, responsibility, civility, parenting, nurturance, work ethic, leadership, teamwork, purpose, and tolerance.

Some of the goals of Positive Psychology are to build a science that supports:

- Families and schools that allow children to flourish
- Workplaces that foster satisfaction and high productivity
- Communities that encourage civic engagement
- Therapists who identify and nurture their patients' strengths
- The teaching of Positive Psychology
- Dissemination of Positive Psychology interventions in organizations and communities

To learn more about the Positive Psychology Center, please visit www.ppc.sas.upenn.edu.

The John Templeton Foundation

The John Templeton Foundation serves as a philanthropic catalyst for discoveries relating to the Big Questions of human purpose and ultimate reality. We support research on subjects ranging from complexity, evolution, and infinity to creativity, forgiveness, love, and free will. We encourage civil, informed dialogue among scientists, philosophers, and theologians and between such experts and the public at large, for the purposes of definitional clarity and new insights.

Our vision is derived from the late Sir John Templeton's optimism about the possibility of acquiring "new spiritual information" and from his commitment to rigorous scientific research and related scholarship. The Foundation's motto, "How little we know, how eager to learn," exemplifies our support for open-minded inquiry and our hope for advancing human progress through breakthrough discoveries.

To learn more about the John Templeton Foundation, please visit www.templeton.org

SCIENCE OF PROSPECTION STEERING COMMITTEE

Martin E.P. Seligman, Principal Investigator

Dr. Seligman graduated Summa Cum Laude from Princeton in 1964 and received his Ph.D. in psychology from the University of Pennsylvania in 1967. He is currently the Zellerbach Family Professor of Psychology and Director of the Positive Psychology Center at the University of Pennsylvania. He was elected President of the American Psychological Association in 1996 by the largest vote in history. Dr. Seligman works on learned helplessness, depression, optimism, positive psychology and comprehensive soldier fitness. His research has been supported by the National Institutes of Health, the National Science Foundation, the John Templeton Foundation, the MacArthur Foundation, the Guggenheim Foundation, the Annenberg Foundation, and the Robert Wood Johnson Foundation.

Dr. Seligman is a best-selling author, having written 25 books which have been translated into more than 35 languages. His best-sellers include *Learned Optimism* (Knopf, 1991), *The Optimistic Child* (Houghton Mifflin, 1995), and *Authentic Happiness* (Free Press, 2002). His latest is *Flourish* (Free Press, 2011). He is the recipient of three Distinguished Scientific Contribution awards from the American Psychological Association, the Laurel Award of the American Association for Applied Psychology and Prevention, and the Lifetime Achievement Award of the Society for Research in Psychopathology. Dr. Seligman received both American Psychological Society's Williams James Fellow Award (for contribution to basic science) and the James McKeen Cattell Fellow Award (for the application of psychological knowledge). He received the inaugural Wiley Psychology Lifetime Award of the British Academy for lifetime contributions to Psychology in 2009. He holds four honorary doctorates, including the University of Uppsala, Sweden, and Complutense University, Spain.

Roy F. Baumeister

Roy F. Baumeister is currently the Eppes Eminent Scholar and Professor of Psychology at Florida State University. He received his Ph.D. in social psychology from Princeton in 1978 and did a postdoctoral fellowship in sociology at the University of California at Berkeley. He spent over two decades at Case Western Reserve University. He has also worked at the University of Texas, the University of Virginia, the Max-Planck-Institute, the VU Free University of Amsterdam, the University of California at Santa Barbara, and Stanford's Center for Advanced Study in the Behavioral Sciences. Baumeister's research spans multiple topics, including self and identity, self-regulation, interpersonal rejection and the need to belong, sexuality and gender, aggression, self-esteem, meaning, and self-presentation. He has received research grants from the National Institutes of Health and from the Templeton Foundation. He has over 500 publications, and his 31 books include *Evil: Inside Human Violence and Cruelty*, *The Cultural Animal*, *Meanings of Life*, and the New York Times bestseller *Willpower: Rediscovering the Greatest Human Strength*. The Institute for Scientific Information lists him among the handful of most cited (most influential) psychologists in the world. He has received lifetime achievement awards from the Society for Personality and Social Psychology, from the International Society for Self and Identity, and most recently the Association for Psychological Science's highest honor, the William James Award.

Randy Buckner

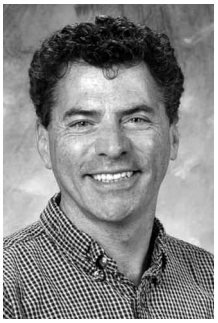
Randy Buckner is Professor of Psychology and of Neuroscience at Harvard University and affiliated with the Center for Brain Science. He is also Professor at the Harvard Medical School and the Director for Psychiatric Neuroimaging Research at the Massachusetts General Hospital. He received his Ph.D. degree in neuroscience from Washington University, under the direction of Steven Petersen and Marcus Raichle. He trained with Bruce Rosen as a postdoctoral fellow and then Instructor of Radiology at Harvard Medical School, where he pioneered new functional MRI methods to study human memory. Over the past decade his work has expanded to include studies of Alzheimer's disease and neuropsychiatric illness with a focus on developing biomarkers for disease detection and progression. This work has led to a description of the brain's default network and how it is targeted early in the progression of Alzheimer's disease. Professor Buckner's awards include the Wiley Young Investigator Award from the Organization of Human Brain Mapping, the Young Investigator Award from the Cognitive Neuroscience Society, the 2007 Troland Research Award from the National Academy of Sciences, and the 2010 Award for Medical Research in Alzheimer's Disease from the MetLife Foundation. He is a fellow of the American Academy of Arts and Sciences.

Laurie Santos

Laurie Santos is Associate Professor of Psychology at Yale University and the director of Yale University's Comparative Cognition Laboratory. Laurie received her B.A. in Psychology and Biology from Harvard University in 1997 and her Ph.D. in Psychology from Harvard in 2003. Her research explores the evolutionary origins of human cognition by studying the cognitive capacities present in nonhuman primates. She has investigated a number of topics in comparative cognition, including primates, understanding of objects and physics, how primates reason about others' minds, the evolutionary origins of irrational decision-making, and the evolution of prosocial behavior. Laurie's scientific research has been featured in *The New York Times*, *The Los Angeles Times*, *The Economist*, *Forbes*, *The New Yorker*, *New Scientist*, *Smithsonian*, and *Discover*. She has also won numerous awards, both for her scientific achievements and for her teaching and mentorship. She is the recipient of Harvard University's George W. Goethals Award for Teaching Excellence, Yale University's Arthur Greer Memorial Prize for Outstanding Junior Faculty, and the Stanton Prize from the Society for Philosophy and Psychology for outstanding contributions to interdisciplinary research. She was recently voted one of *Popular Science* Magazine's "Brilliant 10" Young Minds.

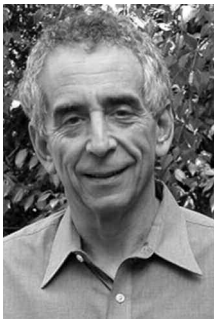
SCIENCE OF PROSPECTION STEERING COMMITTEE

Jonathan Schooler



Jonathan Schooler is a Professor of Psychology at the University of California at Santa Barbara. He received his Ph.D. from the University of Washington in 1987 and then joined the psychology faculty of the University of Pittsburgh. He moved to the University of British Columbia in 2004 as a Canada Research Chair in Social Cognitive Science and joined the faculty at UCSB in 2007. He pursues research on consciousness, memory, the relationship between language and thought, problem-solving, and creativity. He is particularly interested in phenomena at the intersection of psychology and philosophy such as how fluctuations in people's awareness of their experience mediate mind-wandering and how exposing individuals to philosophical positions alters their behavior. He is an author on over 150 scholarly publications and his research has been supported by a host of organizations including the National Institutes of Mental Health, the Unilever Corporation, the Social Sciences and Humanities Research Council of Canada, the National Science and Engineering Research Council of Canada, the Canadian Institute of Health Research, the Bial Foundation, the James Bower Foundation, the U.S. Department of Education Institute of Educational Science, the John Templeton Foundation, and the Fetzer Franklin Trust. He is or has served on the editorial boards of Memory and Cognition, Applied Cognitive Psychology, Consciousness and Cognition, Psychological Science, Social Cognitive and Affective Neuroscience, Encyclopedia of Consciousness, and the Journal of Imagination, Cognition and Personality. His work is frequently featured in major media outlets such as the *New Yorker*, *The New York Times*, *Scientific American*, and *Discover* magazine, among others. He is a fellow of the Association for Psychological Science and co-editor of *Scientific Approaches to Consciousness*, which was published in 1997 by Lawrence Erlbaum.

Barry Schwartz



Barry Schwartz is a professor of psychology at Swarthmore College, in Pennsylvania. He has been there since receiving his Ph.D. from the University of Pennsylvania in 1971. Schwartz has written ten books and more than 100 articles for professional journals. In 2004, Schwartz published *The Paradox of Choice: Why More Is Less*. It was named one of the top business books of the year by both *Business Week* and *Forbes Magazine*, and has been translated into twenty-five languages. Schwartz has published articles in sources as diverse as *The New York Times*, *The New York Times Magazine*, the *Chronicle of Higher Education*, *Parade Magazine*, *USA Today*, *Advertising Age*, *Slate*, *Scientific American*, *The New Republic*, *Newsday*, the *AARP Bulletin*, the *Harvard Business Review*, and the *Guardian*. He has appeared on dozens of radio shows, including NPR's *Morning Edition*, and *Talk of the Nation*, and has been interviewed on *Anderson Cooper 360* (CNN), the *Lehrer News Hour* (PBS), *The Colbert Report*, and *CBS Sunday Morning*. He has lectured the British and the Dutch governments, as well as trade organizations and businesses representing industries as diverse as healthcare, personal finance, travel and leisure, restaurants, supermarkets, consumer electronics, office supplies, software development, e-commerce, advertising, arts and entertainment, cable television, home building, and the military. He has spoken at TED three times. Schwartz's most recent book, written with colleague Ken Sharpe, is *Practical Wisdom: The Right Way to Do the Right Thing*.

Thalia Wheatley

Thalia Wheatley is an associate professor of Psychological and Brain Sciences at Dartmouth College. Dr. Wheatley completed her doctoral training in social psychology with Timothy Wilson and Daniel Wegner at the University of Virginia. After graduating, she received neuroimaging training as a postdoctoral NIH research fellow with Alex Martin, Ph.D. in the Laboratory of Brain and Cognition directed by Leslie Ungerleider. She has more than a decade of experience conducting functional imaging studies and has published several behavioral and neuroimaging studies on animacy, agency, emotion and social networks. Her research investigates how the human brain repurposes basic computations to support social intelligence.

Chandra Sripada

Chandra Sripada works on issues about mind and agency that lie at the intersection of philosophy and the behavioral and brain sciences. He received his Ph.D. in philosophy from Rutgers University in 2006 and completed residency training in psychiatry at the University of Michigan in 2009. He holds a joint appointment at the University of Michigan. One appointment is in the Department of Psychiatry, where he studies brain mechanisms of self-control, decision-making, and prospection. The other appointment is in the Department of Philosophy where he tries to understand how emerging results from the sciences impact our picture of ourselves as free and rational agents.

SYMPOSIUM AGENDA OVERVIEW

MONDAY, AUGUST 4, 2014

8:00 – 9:00 a.m.	FINALIST REGISTRATION & BREAKFAST BUFFET
9:15 – 9:45 a.m.	WELCOME
10:00 – 11:00 a.m.	PRESENTATIONS
11:05 – 11:25 a.m.	BREAK
11:30 – 12:30 p.m.	PRESENTATIONS
12:35 – 1:15 p.m.	LUNCH
1:30 – 2:30 p.m.	PRESENTATIONS
2:35 – 2:55 p.m.	BREAK
3:00 – 4:00 p.m.	PRESENTATIONS
4:10 – 4:30 p.m.	DAY ONE WRAP-UP
4:30 – 5:30 p.m.	BREAK
5:30 – 6:00 p.m.	TRAVEL TO MORTON'S THE STEAKHOUSE
6:00 – 8:30 p.m.	DINNER AT MORTON'S THE STEAKHOUSE

TUESDAY, AUGUST 5, 2014

8:30 – 9:15 a.m.	BREAKFAST
9:15 – 9:30 a.m.	WELCOME / ANNOUNCEMENTS
9:30 – 10:30 a.m.	PRESENTATIONS
10:35 – 10:55 a.m.	BREAK
11:00 – 12:00 p.m.	PRESENTATIONS
12:05 – 12:45 p.m.	LUNCH
1:00 – 1:40 p.m.	PRESENTATIONS
1:45 – 2:05 p.m.	BREAK
2:10 – 2:50 p.m.	PRESENTATIONS
3:00 – 3:30 p.m.	DAY TWO WRAP-UP
3:45 p.m.	SYMPOSIUM CLOSE
4:30 p.m.	CLOSED SESSION: STEERING COMMITTEE MEETING

MONDAY, AUGUST 4 PRESENTATIONS

DAY ONE PRESENTATION SCHEDULE

Presentation Block 1: 10:00 – 11:00 a.m.

Jessica Andrews-Hanna — *Large-Scale Momentary Experience Sampling and Neurocognitive Mechanisms of Functional and Dysfunctional Prospective Thought* *(see p. 12)*

Fiery Cushman — *Social Prospection: A Predictive Coding Model of Mental State Inference* *(see p. 13)*

Felipe De Brigard and Karl Szpunar — *Two Paths to Improving Upon Past Experiences: An Experimental Investigation Comparing the Prospective Benefits of Counterfactual and Future Simulation on Task Performance* *(see p. 14)*

BREAK

Presentation Block 2: 11:30 – 12:30 p.m.

Evelina Fedorenko — *Neural Correlates of Mental Time Travel: Evaluating the Distinct Modalities of Prospection Hypothesis* *(see p. 15)*

Karin Foerde and Daphna Shohamy — *A Role for Dopamine in Prospection* *(see p. 16)*

Jon Freeman — *Using Mouse Tracking to Reveal the Cognitive and Neural Dynamics of Mental Time Travel* *(see p. 17)*

LUNCH

Presentation Block 3: 1:30 – 2:30 p.m.

Brendan Gaesser	*Harnessing Episodic Simulation to Facilitate Prosociality (see p. 18)*
Simona Ghetti	*Episodic Prospection in Childhood: Development and Linkages with Achievement (see p. 19)*
Igor Grossman and Kathleen Vohs	*Adaptive Prospection: Wisdom, Intensity Bias, and Forecasting Accuracy (see p. 20)*

BREAK

Presentation Block 4: 3:00 – 4:00 p.m.

Ben Hayden	*Future-Oriented Decisions in Macaques (see p. 21)*
Sam Maglio and Hal Hershfield	*When Does the Future Start and the Present End? (see p. 22)*
Leaf Van Boven and Eugene Caruso	*Feeling Close: The Phenomenological Foundations of Prospective Psychological Distance (see p. 23)*

DAY TWO PRESENTATION SCHEDULE

Presentation Block 5: 9:30 – 10:30 p.m.

Sam McClure and Anthony Wagner	*Drawing on the Past to Navigate the Future: Neural, Cognitive, and Affective Mechanisms of Prospection (see p. 24)*
David Rand and Jillian Jordan	*Promoting Cooperation With Our Future Selves (see p. 26)*
Adina Roskies	*Prospection, Counterfactual Thinking, and Agency (see p. 27)*

BREAK

Presentation Block 6: 11:00 – 12:00 p.m.

Jonathan Smallwood	*Understanding the Uniqueness of Prospective Thought in Psychological and Neural Terms (see p. 27)*
Devin Terhune	*The Neurochemistry and Enhancement of Time-Based Prospective Memory (see p. 28)*
Matthijs van der Meer	*Hippocampal Sequences as Prospection (see p. 30)*

LUNCH

Presentation Block 7: 1:00 – 1:40 p.m.

Abigail Marsh — *The Role of Prospective Altruism in Stem Cell Donation* *(see p. 31)*

Bethany Teachman — *Adapting Cognitive Bias Modification to Train Healthy Prospection* *(see p. 32)*

BREAK

Presentation Block 8: 2:10 – 2:50 p.m.

Felix Warneken — *Prospection and the Origins of Prosociality* *(see p. 33)*

Phillip Wolff and Bridget Copley — *Linguistic Hints to Causal Models of the Future* *(see p. 34)*

Large-Scale Momentary Experience Sampling and Neurocognitive Mechanisms of Functional and Dysfunctional Prospective Thought

Principal Investigators:
Jessica R. Andrews-Hanna, Ph.D. *Research Scientist/ Associate, Institute of Cognitive Science, University of Colorado Boulder*
Joanna Arch, Ph.D. *Assistant Professor, Department of Psychology and Neuroscience, Director, Anxiety and Health Laboratory, University of Colorado Boulder*

Rather than being psychologically constrained to the present environment, humans have the remarkable capacity to transcend the here-and-now through the process of mental simulation. Prospective thinking — the act of mentally simulating the future — occupies a sizable portion of self-generated cognition and facilitates our capacity to effectively prepare for upcoming events and promote future well-being. Despite the adaptive potential of a future-oriented mind, however, prospective thinking in the form of repetitive worry about the future can fuel distress and poor mental health. Here we propose two studies that pave the way towards ultimately promoting adaptive prospection by (a) broadly characterizing how prospective thinking functions in daily life and (b) assessing the neuro-cognitive mechanisms that define and distinguish adaptive prospective thinking from its less adaptive forms. In Study 1, we will develop a mobile smartphone application to establish normative estimates of the content, consequences, and correlates of prospective thinking in daily life across a large diverse sample (N=1000+). In Study 2, we will elucidate the neurocognitive underpinnings of adaptive relative to less adaptive prospective thinking by examining, across 28 healthy adults and 28 anxious adults, how prospective thinking dynamically unfolds across large-scale brain systems, and how these brain patterns relate to the content and consequences of prospective thinking in the laboratory and in daily life. By simultaneously defining and distinguishing adaptive prospection at levels of brain and behavior, the proposed studies will provide a rigorous scientific platform to promote adaptive prospection, leading to happier, more productive, and more virtuous lives.

Biographies

Dr. Jessica Andrews-Hanna is a Research Scientist and Associate in the Institute of Cognitive Science at the University of Colorado Boulder. She received her Ph.D. in Psychology from Harvard University with specialization in cognitive neuroscience and since has completed a National Research Service Award fellowship at the University of Colorado Boulder and received research support from multiple NIH Institutes. Dr. Andrews-Hanna's program of research seeks insight into the psychological and neural mechanisms underlying self-generated cognition, spanning autobiographical memory, prospection, mentalizing, emotion, and mind-wandering. Across a series of studies bridging cognitive and social neuroscience, she linked these processes to a large-scale brain system known as the "default network." She also pursues a complementary line of work examining how individuals regulate their internal experience using executive control mechanisms. Her more than 20 publications have appeared in prestigious outlets including *Annals of the New York Academy of Science, Neuron*, and *American Journal of Psychiatry*, generating over 5,000 citations to date.

Dr. Joanna Arch is the director of the Anxiety and Health laboratory and Assistant Professor of Psychology and Neuroscience at the University of Colorado Boulder. She received her Ph.D. in Psychology from the University of California Los Angeles with specialization in clinical and health psychology. Her research focuses on the development and evaluation of interventions designed to improve well-being across community and clinical

populations. She is actively involved in understanding the biopsychological moderators and mechanisms of positive psychology and related interventions. Her work also assesses the translational potential of basic research on contemplative practice and learning, memory, and cognition, for improving functioning in novel ways. Dr. Arch has directed multiple large, funded intervention studies in high-impact community settings. Her work has resulted in nearly 30 publications in prestigious outlets.

Social Prospection: A Predictive Coding Model of Mental State Inference

Principal Investigator:
Fiery Cushman, Ph.D., *Assistant Professor of Psychology, Director, Moral Psychology Research Laboratory, Harvard University*

For humans, success and even survival depend upon our ability to guess what others will do before they do it. Social prospection, the ability to reason about the possible future actions of others, relies on ability to make inferences about an internal, unobservable causal structure: goals and beliefs, preferences and personality traits. A remarkable body of evidence has demonstrated that both social reasoning recruits a specific and reliable group of brain regions. Yet, while we have a sophisticated understanding of which parts of the brain support social inference, we have remarkably little insight into how these neural substrates function at a computational level.

This proposal aims to fill that gap. It adapts the predictive coding framework, a computational approach that has proven transformative in other cognitive domains. Predictive coding models posit that the brain generates continuous predictions of upcoming events, and then adjusts these predictions by computing an error signal that tracks deviations between predicted and observed events. This proposal provides a rigorous test of a predictive coding model of social prospection, by testing (a) whether there are distinct neural populations supporting predictions and update errors within regions supporting social inference, (b) if these populations track information about multiple possible future events, (c) how information flows from one region to another in social inference tasks, and (d) how the information encoded in these regions constrains computations performed elsewhere in the brain. In sum, this project moves beyond the "where" of social prospection, providing a new model of "how".

Biography

Fiery Cushman is Assistant Professor of Psychology at Harvard University, where he directs the Moral Psychology Research Laboratory. His research investigates the cognitive mechanisms responsible for human moral judgment, along with their development, evolutionary history and neural basis. Much of his research focuses on the role that mental state inference and causal attribution plays in the process of moral judgment. He has also studied the human aversion to harmful action, and recently proposed a novel theoretical model based on the principles of predictive coding in the domain of reward learning. His research draws on a wide variety of methods including functional neuroimaging, formal computational modeling, behavioral economics and infant and child development, and has been published in *Nature, Proceedings of the National Academy of Science* and *Psychological Science,* among other journals. He received his B.A. and Ph.D. from Harvard University, where he also completed a post-doctoral fellowship. He was Assistant Professor of Cognitive, Linguistic and Psychological Sciences at Brown University from 2011 to 2014.

Two Paths to Improving Upon Past Experiences: An Experimental Investigation Comparing the Prospective Benefits of Counterfactual and Future Simulation on Task Performance

Principal Investigators:
Felipe De Brigard, Ph.D., *Assistant Professor of Philosophy, Center for Cognitive Neuroscience and Duke Institute for Brain Sciences, Director, Imagination and Modal Cognition (IMC) Lab, Duke University*
Karl K. Szpunar, Ph.D., *Postdoctoral fellow, Department of Psychology, Center for Brain Science, Harvard University*

Our capacities to mentally simulate possible future events (i.e., episodic future thinking) as well as alternative ways past events could have occurred (i.e., episodic counterfactual thinking) represent two cognitive strategies by which people attempt to improve upon the outcomes of past experiences. It has been suggested that both kinds of mental simulation play similar prospective roles: to help improve performance and decision-making. Further support for this common functional role hypothesis comes from recent results showing that episodic future and counterfactual thinking are supported by overlapping neural mechanisms, and share a number of cognitive and phenomenological features.

However, despite these similarities, no studies have directly compared episodic future and counterfactual thinking as prospective strategies to improve task performance. The four experiments here proposed aim to help fill this gap in the scientific literature. Specifically, they seek to answer three interrelated questions: 1) Given their common roles, when it comes to improving performance, what difference does it make to mentally locate a hypothetical simulation in a possible future versus a possible past? 2) Since repeated simulation affects future and counterfactual thinking differently, would it impact the effectiveness of one prospective strategy over the other? Finally, 3) what are the similarities and differences in the neural mechanisms underlying future and counterfactual simulations deployed with the intention of improving task performance? These studies promise to illuminate the neural and cognitive mechanisms of prospection, as well as the effect of engaging in either counterfactual or future mental simulation to improve prospection.

Biographies

Dr. Felipe De Brigard, PhD is Assistant Professor of Philosophy at Duke University, and core faculty at the Duke Center for Cognitive Neuroscience and the Duke Institute for Brain Sciences (DIBS), where he directs the Imagination and Modal Cognition (IMC) Lab. He earned a bachelor's degree from the National University of Colombia, a master's degree from Tufts University and a doctoral degree from the University of North Carolina, Chapel Hill. After receiving his doctorate, he spent two years as postdoctoral fellow at the Cognitive Neuroscience of Memory Lab in the Department of Psychology at Harvard University. His research centers on the interaction between memory and imagination—particularly, counterfactual thinking—as well as the relationship between attention, consciousness and recollection, and it has been published in scientific and philosophical venues such as *Neuropsychologia, Psychological Science, Synthese, Philosophical Psychology*, among others.

Dr. Karl Szpunar (Ph.D, Washington University in St. Louis, 2009) is currently a postdoctoral fellow at Harvard University where he is working on developing novel research paradigms to help unravel the cognitive and neural underpinnings of the ability to simulate personal future events, the relations of future event simulation to human memory, and the benefits and pitfalls of future event simulation in daily activities such as learning from classroom

lectures. Dr. Szpunar has published over 30 articles and chapters on the topic of future event simulation and human memory, and was recently recognized with an early career award from the Association for Psychological Science. In 2015, Dr. Szpunar will be joining the Department of Psychology at the University of Illinois at Chicago as an Assistant Professor.

Neural Correlates of Mental Time Travel: Evaluating the Distinct Modalities of Prospection Hypothesis

Principal Investigators:
Evelina Fedorenko, Ph.D., *Athinoula A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital*
Elinor Amit, Ph.D., *College Fellow, Department of Psychology, Harvard University*

Our ability to prospect into the future enables us to direct our actions towards long-term gain, and thus constitutes an evolutionary advantage (e.g., Seligman et al., 2013). What kind of cognitive mechanisms support prospection and how are they instantiated in the brain? Here we advance and evaluate the distinct modalities of prospection hypothesis. According to this hypothesis, grounded in construal-level theory (Trope & Liberman, 2010), prospection about the near/likely future relies on visual imagery, whereas prospection about the distal/unlikely future relies on inner speech. Prior behavioral research has provided initial support for the distinct modalities hypothesis (e.g., Amit, Algom & Trope, 2009), but fMRI allows a more direct evaluation of its key predictions. Across two experiments we will examine the responses of visual and language brain regions to prospection about different kind of events. Both experiments will take advantage of robust individual-subjects functional localization approach (e.g., Nieto-Castañon & Fedorenko, 2012) supplemented with multi-voxel pattern analyses (e.g., Norman et al., 2006). Experiment 1 will focus on temporal distance, and Experiment 2 — on the likelihood of occurrence of future events. Temporally near/likely events are predicted to produce a stronger response in the visual regions, whereas temporally distal/unlikely events are predicted to produce a stronger response in the language regions. This work will shed important new light on the mechanisms that underlie bias towards a particular representational modality for prospection about future events differing in key ways: how far in the future they are and how likely they are to occur.

Biographies

Ev Fedorenko is a cognitive neuroscientist who specializes in the study of the language system and its interfaces with other cognitive systems, in health and disease. She received her Bachelor's degree in Psychology and Linguistics from Harvard University in 2002. She then proceeded to pursue graduate studies in cognitive science and neuroscience at MIT. After receiving her Ph.D. in 2007, she was awarded a K99/R00 career development grant from NICHD and stayed on as a postdoctoral researcher and then a research scientist in the Kanwisher Lab at MIT. In 2014 she joined the staff at MGH/ Athinoula A. Martinos Center for Biomedical Imaging. Fedorenko's research interests revolve around the language system. The goals of her research program are: i) to characterize the brain regions that enable us to understand and produce language; ii) to understand the variability in both healthy and cognitively impaired individuals in linguistic processing, including its neural and genetic basis; and iii) to decipher the relationship between the language system and other cognitive systems. With respect to the latter, Fedorenko

is especially interested in the role that language plays in abstract thought, including reasoning about hypothetical future events.

Elinor Amit received her Ph.D. from Tel Aviv University in 2009. Between 2008 and 2010 she worked with one of her Ph.D. advisors, Prof. Yaacov Trope, at New York University. In 2010-2012 she pursued postdoctoral research at the Psychology Department at Harvard University, working with Prof. Joshua Greene. In the last two years Amit was a College Fellow at the Psychology Department at Harvard. Amit's research focuses on visual and verbal styles of thoughts. She has shown that people preferentially represent information visually, when the object or event is psychologically proximal to them (temporally, geographically, or socially). By contrast, people preferentially represent information verbally when the object or event is psychologically distal from them. In addition to providing evidence for the association between representational style and psychological distance, Amit's research aims to explore the downstream implications of this association to social behaviors, such as ethical decision making and moral judgments, interpersonal communication, and self-regulation. Amit's work was published in high profile journals such as *Journal of Experimental Psychology: General*, and *Psychological Science*.

A Role for Dopamine in Prospection

Principal Investigators:
Karin Foerde, Ph.D., *Research Assistant Professor, Psychology Department, New York University*
Daphna Shohamy, Ph.D., *Associate Professor, Psychology Department, Founder, Learning Lab, Columbia University*

Prospection enables humans to plan and engage in purposive behavior. Research on prospection has focused on similarities between thinking about the future and the past, highlighting the role of episodic memory and its substrates in the hippocampus and medial temporal lobes. Yet, strikingly absent from most of this work is a consideration of motivation, a core driver of human behavior that relies on the adaptive use of memory to guide future actions. Thus, a consideration of mechanisms supporting motivated behavior is critical for understanding how prospective memory achieves its adaptive function, and the dopaminergic system is a particularly promising candidate for this component of prospection. Our goals are to establish the specific role of dopamine in prospection and to determine the cognitive and neural mechanisms through which dopamine influences prospection. We propose that motivation increases the likelihood of engaging in prospective cognition and hypothesize that dopamine is critical for this process, such that high dopamine levels and interactions between dopaminergic and hippocampal systems will enhance prospection. The role of dopamine will be tested with Parkinson's disease as a model, comparing prospection under low (off medication) and high (on medication) dopamine states. To elucidate the mechanisms underpinning dopamine's influence on prospection, we will test three core functions through which dopamine could exert its effects: 1) general motivational processes, 2) interactions with hippocampal-dependent memory, and 3) discounting of the future. A deeper understanding of these neural underpinnings will improve our ability to use prospection more effectively to promote a positive human experience.

Biographies

Dr. Foerde is a research assistant professor in the Psychology Department at New York University. She received her doctorate in cognitive neuroscience at UCLA where she studied the neural mechanisms supporting flexible vs. habitual learning using fMRI with Russell Poldrack and Barbara Knowlton. She continued her training as a post-

doctoral fellow with Daphna Shohamy, Ph.D. in order to examine the contribution of dopamine to multiple forms of learning and memory. She received an individual NRSA fellowship from the National Institute of Neurological Disorders and Stroke in support of this work.

Dr. Shohamy is an associate professor in the Psychology Department at Columbia University. Daphna received a BA from Tel-Aviv University, double majoring in Psychology and Humanities. She then went on to receive a PhD in Neuroscience from Rutgers University, trained as a postdoc at Stanford University's Psychology Department, and founded the Learning Lab at Columbia in 2007. Research in the Learning lab is focused on how the brain supports learning, memory and decision-making in humans, adopting an integrative approach that combines functional brain imaging (fMRI) with patient and developmental studies. Dr. Shohamy's work has been recognized with Young Investigator Awards from the Cognitive Neuroscience Society and the Society for Neuroeconomics and the Spence Award for Transformative Early Career Contributions from the Association for Psychological Science.

Using Mouse-Tracking to Reveal the Cognitive and Neural Dynamics of Mental Time Travel

Principal Investigator:
Jonathan B. Freeman, Ph.D., *Assistant Professor, Psychology Department, Director, Social Cognitive and Neural Sciences Laboratory, New York University*

Humans can readily disengage from the external environment to imagine future prospects. Measuring episodic future thought has proven difficult, and there is a lack of implicit indices of mentally traveling into the future. The overarching goal of the proposed research is to test an innovative paradigm able to measure implicit and spontaneous mental time travel. Four studies will: 1) adapt a word-cueing, computer mouse-tracking paradigm and establish it as an implicit measure of mental time travel; 2) demonstrate the generalizability of this measure across cultures and test for cultural differences; 3) explore individual differences in the extent to which participants spontaneously engage in episodic future thought, and link these differences to meaningful personality characteristics; and 4) use this implicit measure in tandem with brain-imaging to better characterize the role of memory-related systems in episodic future thought. The research has the potential to transform the study of prospection by developing and testing an implicit measure of spontaneous mental time travel via subtle motor movements, and linking this measure to culture, personality, and the brain.

Biography

Jon Freeman is an Assistant Professor of Psychology at New York University, where he heads the Social Cognitive and Neural Sciences Laboratory. He received his Ph.D. from Tufts University and was previously on the faculty at Dartmouth College (2012-2014). His research primarily focuses on the cognitive and neural basis of person perception and rapid social decision-making. He takes an integrative and multi-level approach, incorporating insights across social psychology and the cognitive, vision, and neural sciences. He has expertise and a demonstrated record of productivity using a wide range of methodologies, including real-time behavioral techniques (e.g., computer mouse-tracking), functional neuroimaging, electrophysiology, and computational modeling. He has conducted a substantial amount of broad methodological work on the computer mouse-tracking technique, has published extensively on using this technique to understand cognitive dynamics, and is the developer of the MouseTracker software package used in the proposed work to study implicit mental time travel.

Harnessing Episodic Simulation to Facilitate Prosociality

Principal Investigators:
Dr. Liane Young, Ph.D., *Assistant Professor, Department of Psychology, Boston College*
Dr. Brendan Gaesser, Ph.D., *Postdoctoral Fellow of Psychology, Boston College*
Dr. Elizabeth Kessinger, Ph.D., *Professor, Department of Psychology, Director, Cognitive and Affective Neuroscience Laboratory, Boston College*

This project aims to illuminate the cognitive and neural mechanisms by which prospection can be used to foster prosociality in typically functioning adults. We seek to apply the psychology and neuroscience of prospection to real world issues and explore a novel functional account of prospective cognitive processes such as episodic simulation. Specifically, we propose four studies that investigate the mechanisms by which episodic simulation can be used to facilitate empathy for people in need, testing whether the quality of episodic representation mediates this empathic effect (Study 1), whether this empathic effect interacts with -or is independent from- the ability to consider other people's thoughts and feelings (i.e., theory of mind; Studies 2 and 3), and how episodic processes can be leveraged to help actual people in need (Study 4). This project will reveal how episodic simulation and memory can be used to foster empathy and prosocial behavior in healthy young adults, and, importantly, guide future research targeted at alleviating empathic deficits in patient populations (e.g., autism spectrum disorder, Alzheimer's disease). More broadly, this project will lay the foundation for research at the intersection of prospection, memory, and moral psychology.

Biographies

Dr. Liane Young is an Assistant Professor of Psychology at Boston College. She studies the psychological and neurological basis of human moral judgment. Dr. Young's research employs methods of social psychology and cognitive neuroscience, including functional magnetic resonance imaging (fMRI) and examination of patient populations with selective cognitive deficits (e.g, psychopathy, autism). Her research, published in journals such as the *Proceedings of the National Academy of Sciences*, *Nature,* and *Psychological Science*, has been featured in *The Boston Globe*, NPR, and CNN. Dr. Young received her B.A. in Philosophy in 2004 and her Ph.D. in Psychology at Harvard University in 2008. She completed her post-doctoral training in the Brain and Cognitive Sciences Department at MIT, where she was also a visiting scholar in the Philosophy Department.

Dr. Brendan Gaesser has published work on episodic simulation in *Proceedings of the National Academy of Sciences, Hippocampus*, and *Journal of Experimental Psychology: Learning, Memory, and Cognition*. During his graduate training at Harvard University, he worked with Dr. Daniel Schacter receiving a strong background in the cognitive neuroscience of episodic simulation, memory, and aging using behavioral and fMRI methods. Dr. Gaesser's interests focus on two distinct, though not unrelated, lines of investigation. The first line examines the role of the hippocampus and underlying component processes in constructing future imagined events (i.e., episodic simulations). The second line begins to explore the relationship between episodic simulation, memory, and empathic responses. While initially developing ideas on the role of episodic processes in facilitating empathy, he wrote a single-author review article that will serve as the springboard for his future work (Gaesser, Frontiers in Psychology, 2013). Dr. Gaesser received his B.A. in Psychology from MCLA in 2007 and his Ph.D. in Psychology from Harvard University in 2014. As an independent investigator, he aims to develop a research program that elucidates the cognitive and neural relationship between these intertwined processes and apply this knowledge to facilitate socially desirable behavior that promotes mental health.

Dr. Elizabeth Kensinger is Professor of Psychology at Boston College, where she has directed the Cognitive and Affective Neuroscience laboratory since 2006. She studies the cognitive and neural processes that give rise to emotional memories. She has a particular interest in understanding why emotional memories feel subjectively vivid and in elucidating the types of details that are remembered about emotional events, and the factors that influence which details are remembered. Her research employs the methods of cognitive neuroscience and biopsychology, including fMRI, EEG, eyetracking, polysomnography, psychophysiology, and hormonal assays. Her research has been published in journals such as the *Journal of Neuroscience, Journal of Cognitive Neuroscience*, and *Cerebral Cortex*, and she is the author of the book *Emotional Memory across the Adult Lifespan* (Psychology Press, 2009). Dr. Kensinger received her B.A. in Psychology and Biology from Harvard University in 1998 and her Ph.D. in Neuroscience from MIT in 2003. Prior to joining the faculty of Boston College, she completed her post-doctoral training in Radiology at the Massachusetts General Hospital and in Psychology at Harvard University.

Episodic Prospection in Childhood: Development and Linkages with Achievement

Principal Investigator:
Simona Ghetti, Ph.D., *Professor in Psychology, Center for Mind and Brain, University of California, Davis*

The proposed study will examine the development of episodic prospection (the episodic simulation of personal future events) and its consequences. It will compare age-related differences in episodic prospection in 9-year-olds, 12-year-olds and young adults (N=180) to age-related differences in related constructs to examine whether children's documented difficulties with episodic prospection are due to limitations in their knowledge about plausible future events (via semantic prospection), and/or in the ability to episodically simulate alternative outcomes to personal events (via episodic counterfactual reasoning). It will also examine the effects of episodic prospection on persistence in challenging tasks, an achievement-related behavior, to test whether this ability confers unique adaptive advantages.

Participants will be first assessed on several background cognitive skills and baseline persistence. They will then participate in a series of challenging tasks that will be interrupted and will be the object of the experimental manipulation. In subsequent sessions, participants will produce narratives anchored to the interrupted tasks and according to instructions which will vary based on experimental condition (i.e., episodic prospection, semantic prospection, or episodic counterfactual reasoning). Finally, participants will be tested again on the challenging tasks, this time without interruption. The narratives will allow us to test the hypotheses related to developmental differences in episodic prospection, semantic prospection and episodic counterfactual reasoning. The persistence exhibited on non-interrupted tasks during the final session will allow us to test the hypotheses concerning the effects of episodic prospection on achievement-related behavior. Overall, the proposed research addresses core questions on the mechanisms and applications of prospection.

Biography

Simona Ghetti received a bachelor of science in psychology from the University of Padua, Italy in 1995, and a Ph.D. in psychology from the University of California, Davis in 2001. She held a researcher position at the National Research Council in Bologna, Italy, from 2002 to 2005 and then returned to the University of California, Davis in 2005 where she is now Professor in the Psychology Department and Center for Mind and Brain.

Dr. Ghetti's research integrates behavioral and neuroimaging methods to examine the development of episodic memory and its implications for learning and decision making. Although Dr. Ghetti's work focuses largely on typical development, she has studied atypical memory functioning in children suffering from neurodevelopmental disorders (e.g., ADHD) or medical conditions that affect brain metabolism (e.g., type-1 diabetes). Dr. Ghetti's work has been continually funded by federal agencies and private foundations, and has been recognized with the Award for Early Contributions to Child Development from the Society for Research in Child Development, the Boyd McCandless Young Scientist Award from Division 7 of the American Psychological Association (APA), and the Award for Distinguished Scientific Early Career Contribution to Developmental Psychology from the APA. Dr. Ghetti's record of research and service demonstrate her commitment to the promotion of healthy development.

Adaptive Prospection: Wisdom, Intensity Bias, and Forecasting Accuracy

Principal Investigators:
Igor Grossman, Ph.D., *Assistant Professor of Psychology, University of Waterloo, Canada*
Kathleen Vohs, Ph.D., *Land O'Lakes Professor of Excellence in Marketing, Carlson School of Management, University of Minnesota*

Four experiments will test whether inducing disconnection, defined as a process of mentally distancing oneself from present experiences, produces outcomes linked to accurate forecasting: intensity bias and wise reasoning. Further we will assess forecasting accuracy via a longitudinal experiment. Intensity bias, in which people overestimate the emotional impact of an event, often includes focalism, which means to base predictions too heavily on a prior event. Hence, focalism also will be assessed. Wise reasoning reflects the fact that one's knowledge is inherently limited and the future likely to be different from the present. All four experiments manipulate disconnection, for instance by getting people to think about themselves in the third person. Across all studies, the prediction is that the disconnection condition, compared to relevant comparison and neutral conditions, will weaken the intensity bias, soften focalism, and stimulate wise reasoning. Three experiments use verbal prospections, linguistic software, and physiology as assessment tools. For physiology, we measure heart rate during prospection to calculate heart rate variability (a marker of negative emotionality). The fourth experiment uses a longitudinal design. Tracking participants over 24 weeks, we will assess predictions and naturalistic reactions to social challenges, thereby enabling us to assess forecasting accuracy. We hypothesize that training people to disconnect in an initial session (Time 1) will curb intensity bias and unwise reasoning, in turn enabling less error-prone prospections. Taken together, this work will identify how to improve prospection by determining why some prospections bring about better realized futures than others.

Biographies

Igor Grossmann is a world traveller: Born in the Soviet Union, he lived in Ukraine, Germany, and the U.S. Upon obtaining a Ph.D. from the University of Michigan, he became an Assistant Professor of Psychology at the University of Waterloo, Canada. His main research goal is to understand the processes that enable individuals to think and act "wisely," for instance by using cognitive strategies that facilitate the resolution of social conflicts, or by adaptively regulating emotions that undermine their goals and compromise their health. To approach these issues, his work targets meaningful real world situations at the intersection of affect and cognition, ranging from daily hassles, to career choices, to romantic and societal conflicts. Grossmann's work was published in top

journals, including the *PNAS, Psychological Science, Emotion* and *Journal of Experimental Psychology.* His research on wisdom has been recognized through a Dissertation Award from the American Psychological Association (Division 20), and the Otto Klineberg Intercultural and International Relations Award from The Society for the Psychological Study of Social Issues. He is currently on the editorial boards of the *Journal of Personality and Social Psychology* and *Frontiers in Personality and Social Psychology*.

Kathleen Vohs is the Land O'Lakes Professor of Excellence in Marketing at the University of Minnesota's Carlson School of Management. She was awarded a Ph.D. by Dartmouth College in 2000 and was assistant professor at University of British Columbia. She has authored more than 150 scholarly publications and co-edited 8 books. She won a SAGE Young Scholar Award (2008) and the International Society for Self and Identity Outstanding Early Career Award (2009). She has held named chairs at every school and level in her career: UBC awarded her the Canada Research Chair in Marketing Science and Consumer Psychology; UMN named her McKnight Land-Grant Professor and McKnight Presidential Fellow, the most prestigious university-wide awards given to junior and mid-level scholars. In 2012, Vohs was given an Honorary Chair in Consumer Research at Groningen University, Holland. She won a Free Will Essay Prize from the John Templeton Foundation (2013). In 2014, she was awarded the Anneliese Maier Research Award by Germany's Humboldt Foundation, in a competition across the sciences, humanities, law, and economics. Recently Vohs was named one of the world's most outstanding business school professors under 40. Her work on decision fatigue reportedly has changed President Obama's daily routine (Michael Lewis, 2012).

Future-Oriented Decisions in Macaques

Principal Investigator:
Benjamin Hayden, Ph.D., *Assistant Professor of Brain and Cognitive Sciences, University of Rochester*

We propose to study the basic psychology of future-oriented (i.e. prospective) decisions in rhesus monkeys. Recent studies have challenged the notion that nonhuman animals are "stuck in time" by showing provident behavior in the domain of food caching and tool use. These studies demonstrate that animals can reason about and plan for future contingencies in at least limited ways. Our work will build on these basic studies to ask whether animals have more sophisticated prospective skills. We choose to work with monkeys because their psychology is relatively well understood and because they can be trained to perform complex tasks for hundreds of thousands of trials, allowing us to make multiple manipulations and measure subtle effects. Our research will ask five closely related questions, (1) whether monkeys will pay to gain potentially useful information about future decisions, (2) whether monkeys anticipate future abstract wants, like curiosity, (3) whether monkeys can anticipate future poor self-control and choose to precommit to a beneficial long-term strategy, (4) whether they will pay a positive finite amount to engage in precommitment, and (5) whether monkeys will give up rewards in their possession, and thus overcome the endowment bias, for the possibility of larger future rewards. Our preliminary data suggest all five questions may yield a positive answer. In any case, answers to these five questions will provide a much richer and more detailed portrait of monkeys' abilities to escape the present and prospect about the future.

Biography

Ben Hayden received his Ph.D. in Molecular and Cell Biology work with Jack Gallant at the University of California Berkeley in 2005 and completed a post-doc with Michael Platt at Duke University in 2011. He has been

an Assistant Professor at the University of Rochester for three years. He is interested in the mental and neural processes that explain how we make reward-based decisions. His lab uses a combination of innovative behavioral tasks and unit recordings in prefrontal cortex; his work combines insights from behavioral economics, ethology, comparative psychology, and cognitive neuroscience. Major research goals in his lab include the elucidation of representational schemes for information about reward, computational processes underlying self-control, and delineating the neural basis of foraging decisions. He was the inaugural winner of the Young Investigator award from the Society for Neuroeconomics, and is an Associate Member of the American College of Neuropsychopharmacology. His research is funded by the NIH, NSF, the Sloan Foundation, Brain and Behavior Research Foundation, and the Klingenstein Foundation. He loves running by the Erie Canal with his Brittany Spaniel named Bartlet.

When Does the Future Start and the Present End?

Principal Investigators:
Hal E. Hershfield, Ph.D., *Assistant Professor of Marketing, Anderson School of Management, UCLA*
Sam J. Maglio, Ph.D., *Assistant Professor of Marketing, Rotman School of Management and Department of Psychology, University of Toronto Scarborough*

Whether it concerns saving money, living healthily, or treating the environment in a sustainable way, many individuals have difficulty making trade-offs between the present and the future. A large body of research has examined the many ways that people approach, conceive of, and treat the future, and one recent paper advanced the novel suggestion that rather than solely being motivated by past experiences, navigating the future is a stronger, more central organizing principle of human nature (Seligman, Railton, Baumeister, & Sripada, 2013). Although this research has advanced our understanding of how people approach the future, many important concepts remain unexplored. In this grant, we examine one of them; namely, the simple perception of when, generally speaking, the future starts and the present ends. We set out to assess: 1) whether individuals differ in their perceptions of when the present ends; 2) if such perceptions are linked to intertemporal (present vs.future) decision-making; and 3) whether the sense of when the present ends (and the future starts) can be altered so as to impact important long-term decisions. We propose that people who perceive the present as shorter will be more likely to make patient long-term decisions i.e., if the present ends sooner, the future will bleed more into the "now" and will be given greater weight than it would otherwise receive. An understanding of this dividing line and how it can be altered will not only make a significant contribution to our understanding of prospection but also provide potential avenues for its practical application.

Biographies

Hal E. Hershfield is Assistant Professor of Marketing at UCLA's Anderson School of Management. Prior to UCLA, Professor Hershfield taught at NYU's Stern School of Business, and was a Post-Doctoral Fellow at the Kellogg School of Management at Northwestern University. His research focuses on judgment and decision-making and social psychology, with a particular interest in how thinking about time can strongly impact decision-making and emotional experience. Professor Hershfield received his B.A. in Psychology and English from Tufts University in 2001, and his Ph.D. in Psychology from Stanford University in 2009. He was recently named a

Rising Star by the Association for Psychological Science, and has received funding from the Templeton Foundation's New Paths to Purpose Grant Program, and the Russell Sage Foundation Small Grant in Behavioral Economics. His work has been published in top journals including *Psychological Science*, the *Journal of Personality and Social Psychology, Organizational Behavior and Human Decision Processes*, and the *Journal of Marketing Research*. He also maintains a blog for *Psychology Today* and has contributed op-eds to *The New York Times*, the *Huffington Post*, and *Harvard Business Review*.

Sam J. Maglio is Assistant Professor of Marketing at the University of Toronto Scarborough, with cross-appointments to the Rotman School of Management and the Department of Psychology. He received his B.A. in psychology and English from Stanford University in 2005 and his Ph.D. in social psychology from New York University in 2012. In addition to using lab- and field-based experimental designs, he has worked with labor-intensive experience sampling methodologies to assess daily psychological variables and how they change over time. Dr. Maglio conducts research at the interface of human cognition and emotion. Specifically, he examines determinants by which people come to feel close or far from other people, products, and places, as well as the consequences arising from this sense of relative distance. He has published his work in *Psychological Science*, the *Journal of Experimental Psychology: General, Emotion, Psychonomic Bulletin and Review,* and the *Journal of Experimental Psychology: Applied, and Current Directions in Psychological Science*. This work has been featured in *Time*, the *Pacific Standard*, and the *Columbia Chronicle* and funded by two grants from the University of Toronto Scarborough as well as a Connaught New Researcher Award from the larger University of Toronto. Dr. Maglio's professional academic affiliations include the Association for Psychological Science, the Association for Consumer Research, the Society for Personality and Social Psychology, and the Society for Judgment and Decision Making.

Feeling Close: The Phenomenological Foundations of Prospective Psychological Distance

Principal Investigators:
Leaf Van Boven, Ph.D., *Professor of Psychology and Neuroscience, Director, Center for Research on Judgment and Policy, Director, Emotion, Decision, Judgment, and Intuition (EDJI) Lab, University of Colorado Boulder*
Eugene Caruso, Ph.D., *Associate Professor of Behavioral Science, Booth School of Business, University of Chicago*

Prospection entails bridging the gap between the present and the future. Psychological distance is the sense of large this gap is, how far the future is from now. In the proposed research, we will develop and test a comprehensive theory of the phenomenological foundations of psychological distance. Psychological distance is often poorly defined and confounded with objective distance, or how far the future actually is. We conceptualize psychological distance as defined and affected by the constellation of subjective experiences that coincide with people's movement through time. The proposed research has two aims. First, we will examine whether mere attention to future events and the fluency experienced when considering future events reduces those events' psychological distance, independent of objective distance. For example, we will use procedures that we recently developed to direct people's attention to specific future events, reducing those events' psychological distance. Second, we will examine whether adopting mindsets of prospection rather than retrospection intensifies the experiences associated with psychological distance, thereby reducing psychological distance. For example, we will use a virtual reality technique that we recently developed in which people more forward (rather than backward) through space and time to increase the intensity of experiences associated with prospection, and to reduce the future's psychological

distance. These procedures will be used both to support new theoretical development, to develop interventions that reduce the psychological distance of personally important future events (such as purchasing a home, attending college, and retirement), and to help people better anticipate and plan for the future.

Biographies

Leaf Van Boven is Professor of Psychology and Neuroscience at the University of Colorado Boulder. Van Boven is Director of the Center for Research on Judgment and Policy, director of the Emotion, Decision, Judgment, and Intuition (EDJI) lab, and Associate Editor of the *Journal of Personality and Social Psychology*. Professor Van Boven has received multiple grants from the National Science Foundation and was awarded the outstanding dissertation research award in Positive Psychology for his work demonstrating that investing in life experiences makes people happier than investing in material possessions—a finding that has been widely replicated and used to help many people make better life decisions. Broadly, Professor Van Boven's research examines the interrelation of emotion, judgment, and decision-making in people's everyday lives. He is particularly interested in how people bridge the gap between their immediate experiences, their temporally distal experiences, and other people's experiences. Professor Van Boven's research has been widely covered by the popular media. Beyond his research on experiential versus material investments, he is also known for his research indicating that people underestimate the power of emotions to shape their own and other people's behavior, (as discussed in an interview with Colorado Public Radio), and, more recently, for research suggesting that people exaggerate political polarization in America, as described in several Op-Ed pieces on the topic of political psychology, appearing in *The New York Times*, the *Denver Post*, and NPR's *Academic Minute*.

Eugene Caruso is an Associate Professor of Behavioral Science at The University of Chicago Booth School of Business. Professor Caruso's research aims to understand the abilities that enable people to transcend their present circumstances to consider situations and perspectives different from their current one. This research spans two broad areas: temporal perspective taking (understanding other times) and social perspective taking (understanding other minds). People can move beyond their present temporal perspective to remember past events and to imagine future ones, and can move beyond their own personal perspective to understand what other people are thinking, feeling, and doing. Inferences about other times and other people are challenging because these perspectives are not immediately at hand. Yet many consequential judgments and decisions rely critically on just such inferences. Professor Caruso's research explores the basic psychological processes that guide these types of judgments, with a particular focus on the moral and ethical consequences that result when people consider times other than the present and people other than the self. He explores the implications that this work has for various populations, from individuals attempting collaboration with others to legal systems designed to render impartial judgments.

Drawing on the Past to Navigate the Future: Neural, Cognitive, and Affective Mechanisms of Prospection

Principal Investigators:
Samuel M. McClure, Ph.D., *Department of Psychology and Neurosciences Program, Director, Decision Neurosciences Lab, Stanford University*
Anthony D. Wagner, Ph.D., *Department of Psychology and Neurosciences Program, Director, Stanford Memory Laboratory, Co-director, Stanford Center for Cognitive and Neurobiological Imaging, Stanford University*

The ability to prospect, flexibly anticipate, and plan for the future is critical for achieving beneficial health, educational, social, and financial life outcomes. In many real-world settings, the ability to engage in prospective thought may be strongly influenced by stress. Indeed, major life stressors, such as economic, health, or social challenges, may have a particularly deleterious impact on the ability to flexibly plan for and improve our future. The proposed research will examine how psychological stress influences the cognitive and neural mechanisms underlying prospection. Given that prospection is a subjective phenomenon, the measurement of prospective thought is a fundamental challenge in prospection science. We will establish a novel approach to overcoming this challenge, developing an immersive virtual navigation paradigm and the use of advanced multivariate functional MRI (fMRI) analyses to measure prospection.

Our research will address two specific aims. Aim 1 will use novel neural measures to quantify the degree to which people engage in prospective planning, and will examine whether and how acute psychological stress restricts the complexity of prospection during planning. Aim 2 will quantify prospection during goal-directed action, and will test whether stress limits the temporal scope of prospective thought, ultimately leading to more rigid behavior that relies on habit-based memories. By addressing these aims, the proposed research will make a critical first step toward understanding the psychological and neural mechanisms through which stressors limit our ability to draw on our past to effectively plan for the future.

Biographies

Samuel McClure has been studying the brain basis of reward learning and decision making for nearly two decades. He began as a Ph.D. student in Neuroscience at Baylor College of Medicine, where he combined computational modeling with fMRI to show how brain regions associated with the human dopamine system mediate reward learning. In 2003, McClure began a Postdoc in the Psychology Department at Princeton University. His work at Princeton focused on how people evaluate future rewards, and particularly on the role of the prefrontal cortex in this valuation process. McClure has been an Assistant Professor in the Psychology Department at Stanford University since 2007 where he directs the Decision Neuroscience Lab. He continues to combine computational modeling, behavioral, and neuroimaging experiments to study how planning for the future combines with immediate reward expectation to guide behavior. At Stanford, McClure is affiliated with the Neuroscience Program, the Symbolic Systems Program, the Center for Longevity, and the Stanford Center for Healthy Weight. Through these affiliations McClure applies findings from his laboratory to broader societal problems.

Anthony Wagner is a Professor of Psychology and Neuroscience at Stanford, where he directs the Stanford Memory Laboratory (http://memorylab.stanford.edu/) and is the co-director of the Stanford Center for Cognitive and Neurobiological Imaging (http://cni.stanford.edu/). His research focuses on the psychology and neurobiology of learning, memory, and executive function in healthy individuals and, through collaboration, in clinical populations (schizophrenia; MCI and Alzheimer's disease). His lab uses a variety of imaging techniques, including functional MRI and electroencephalography, to understand how the brain builds and retrieves memories and to examine the processes that enable goal-directed behavior. He received his Ph.D. from Stanford in 1997, was a post-doctoral fellow at Harvard University and at the Massachusetts General Hospital's brain imaging facility, and was on the faculty at MIT from 2000-2003. In 2003, he returned to the Stanford Psychology Department, as well as the Neurosciences Program, the Symbolic Systems Program, and the Stanford Center for Longevity. In addition to his basic science and translational research, he examines the implications of neuroscience for the law as a member of the MacArthur Foundation's Research Network on Law and Neuroscience.

Promoting Cooperation with our Future Selves

Principal Investigator:
David G. Rand, Ph.D., *Assistant Professor of Psychology, Economics, and Management, Director, Human Cooperation Laboratory, Yale University*

Making sacrifices today for the good of tomorrow is central to human existence, and prospection lies at the heart of this issue. Acting with the future in mind is key for both one's own well-being and the well-being of society as a whole. Yet despite the importance of such future-mindedness, we are notoriously focused on the present. Most of us eat too much and save too little, and our nations are rapidly depleting our environmental and fiscal resources. In this project, we explore how findings related to promoting inter-personal cooperation can be leveraged to promote paying costs today to benefit the "you" that will exist tomorrow (intra-personal cooperation). The first aim of the project asks whether (and when) people truly see their future selves as other people. The second explores how numerous findings related to increasing interpersonal cooperation can be used to increase cooperation with this "other" person (the future self). The third examines the effect of recasting the act of helping one's future self as a public good with consequences for others (rather than a mere personal responsibility), and harnessing the power of reputation by making intertemporal decisions observable to others. The fourth examines the role of intuition in intertemporal choice. Together, the studies outlined here will advance our understanding of prospection by investigating various individual, cultural and institutional practices that can shape intertemporal choice, promote future-orientation, and better align people's present-day decisions with their future goals and desires.

Biography

David Rand is an assistant professor of psychology, economics, and management at Yale University, and the director of Yale University's Human Cooperation Laboratory. He is also a member of the Yale University Cognitive Science Program, and the Yale Institute for Network Science. He received his B.A. in computational biology from Cornell University in 2004 and his Ph.D. in systems biology from Harvard University in 2009, and was a post-doctoral research in Harvard University's psychology department from 2009 to 2013. David's research combines a range of theoretical and experimental methods in an effort to understand human behavior and decision-making. He is particular interested in explaining the high levels of cooperation that typify human societies, and to uncovering ways to promote cooperation in situations where it is lacking. David's work has been published in journals including *Nature, Science, Proceedings of the National Academy of Science, American Economic Review, Psychological Science*, and the *Journal of Experimental Psychology: General*, and has received widespread attention from a range of media outlets, including NPR, the BBC, *The Economist, Scientific American, Wired, New Scientist, London's Daily Telegraph, The Washington Post, Rolling Stone, Discover, Financial Times,* and the *Los Angeles Times*. He has also written popular press articles for *Wired, New Scientist*, and the *Psychological Observer*. He was named to *Wired* magazine's Smart List 2012 of "50 people who will change the world," and chosen as a 2012 PopTech Science Fellow.

Jillian Jordan (presenter) is a graduate student in the Department of Psychology at Yale University. She primarily works in the Human Cooperation Lab, advised by Dr. David Rand. Jillian's research integrates approaches from psychology, experimental economics, and evolutionary game theory to investigate human decision-making, cooperation and morality. She is funded by a National Science Foundation Graduate Research Fellowship.

Prospection, Counterfactual Thinking, and Agency

Principal Investigator:
Adina Roskies, Ph.D., *Professor, Department of Philosophy, Center for Cognitive Neuroscience, Dartmouth College*

Prospection, as well as related forms of thought such as hypothetical and counterfactual thinking, is theorized to be important for central aspects of free will and agency. Despite the centrality that these forms of thought play in our lives, little is yet understood about their neural basis or representational structure. We will conduct neuroimaging experiments which require subjects to either 1) analyze sentences or 2) constructively visualize scenarios that vary along temporal dimensions (the factual present or past, counterfactual past, and possible futures) as well as along perspectival dimensions (such as between neutral or impersonal, third-personal, and self-related perspectives). We will analyze the fMRI data with cutting-edge multivariate techniques that will enable us to determine not only the brain regions involved in processing these various aspects of stimuli (temporal, modal, perspectival, and format-related aspects), but will also give insight into the nature of the representations the brain uses in these various related forms of thinking.

Biography

Adina Roskies is Professor of Philosophy at Dartmouth College. She received a Ph.D from the University of California, San Diego in Neuroscience and Cognitive Science in 1995, a Ph.D. from MIT in philosophy in 2004, and an M.S.L. from Yale Law School in 2014. From 1995-1997 she held a postdoctoral fellowship in cognitive neuroimaging at Washington University with Steven Petersen and Marcus Raichle, and was Senior Editor of the neuroscience journal *Neuron* between 1997-1999. Dr. Roskies' philosophical research interests lie at the intersection of philosophy and neuroscience, and include philosophy of mind, philosophy of science, and ethics. Her recent work focuses on free will and responsibility. She was a member of the McDonnell Project in Neurophilosophy and the MacArthur Law and Neuroscience Project. She has published many articles in both philosophy and the neurosciences, among which are several devoted to exploring and articulating issues in neuroethics. She recently published *A Primer on Criminal Law and Neuroscience* with Stephen Morse. Recent awards include the William James Prize and the Stanton Prize, awarded by the Society of Philosophy and Psychology, the Laurance S. Rockefeller Visiting Faculty Fellowship from the Princeton University Center for Human Values, and a Mellon New Directions fellowship.

Understanding the Uniqueness of Prospective Thought in Psychological and Neural Terms

Principal Investigator:
Jonathan Smallwood, Ph.D., *Reader, Psychology Department, York Neuroimaging Centre, University of York, England, United Kingdom*

Conscious thought provides the freedom to consider events through the lens of imagination, and a primary benefit of this capacity is the ability to think about how events might unfold in the future. This project explores whether a primary benefit of naturally occurring future thought arises through the capacity to generate creative

and original thought that is necessary to navigate the complex social environments in which they exist. With a large cohort of participants we will use experience sampling, as well as the tools of cognitive neuroscience, to explore the trait like aspects of naturally occurring prospection. Participants will participate in two laboratory sessions that will measure experience, behavior and neural dynamics and so determine: (i) The unique phenomenological features of prospection that delineate the experience as a distinct class of human thought, (ii) The psychological attributes that determine the unique capacities that future thinking brings and (iii) The underlying neural mechanisms that support this core aspect of cognition. This project will realize novel methods of exploring prospection, and develop a mechanistic account of future thinking aimed at explaining its value to the human condition. By achieving these core aims this project will provide the foundations for a science of prospection that will ensure that this exceptional feature of the human mind forms the focus of psychological and neuro scientific research over the coming decades.

Biography

Dr. Jonathan Smallwood's scientific career has been devoted to understanding how the mind generates thoughts that do not arise from current perceptual input (such as when we imagine the future) and exploring the role these experiences play in our daily lives. Common examples of these experiences include mind-wandering and daydreaming. Jonathan's work has shown that a primary aspect of these experiences is a focus on the future, suggesting that this is an important way that individuals engage in the act of prospection. He began studying these experiences during his Ph.D., which was completed in November 2002, and since then has worked as a cognitive psychologist in the following international institutions: the University of British Columbia (UBC), Vancouver, Canada; The University of California, Santa Barbara, (UCSB); and the Max Planck Institute of Human Cognitive Brain Science's in Leipzig, Germany. He is currently a Reader in the Psychology Department / York Neuroimaging Centre at the University of York, UK, where he manages a group of three outstanding Ph.D. students and several master's students. In his work Jonathan uses state-of-the-art tools of both psychology (such as experience sampling) and cognitive neuroscience (such as functional magnetic resonance imaging) to develop theoretical accounts of how the mind escapes from the constraints of the moment with the aim of ultimately producing a unified account of both the mental and experiential domains.

The Neurochemistry and Enhancement of Time-Based Prospective Memory

Principal Investigators:
Roi Cohen Kadosh, Ph.D., *University Research Lecturer, Department of Experimental Psychology, University of Oxford*
Devin B. Terhune, Ph.D., *Marie Sklodowska-Curie Fellow, Department of Experimental Psychology, University of Oxford*

The ability to accurately estimate the passage of time prior to performing a specific action (time-based prospective memory [TBPM]) represents a fundamentally important human ability. TBPM enables one to remember to take their medication and to pick up their children from school and is thereby essential for healthy functioning. Although considerable knowledge has been gained about the characteristics and mechanisms of TBPM, relatively little is known about its neurochemical basis and how it can be enhanced. Here we propose a two-phase project motivated by the hypothesis that local cortical inhibition in brain regions supporting time perception suppresses timing-specific brain activation and thus individual differences in TBPM are due to variability in cortical inhibition. In Phase 1, we will use magnetic resonance spectroscopy to measure inhibitory (GABA) and excitatory (glutamate)

neurochemicals in brain regions subserving TBPM to test the prediction that elevated GABA (increased inhibition) or lower glutamate (decreased excitation) is associated with poorer TBPM. Phase 2 will attempt to build upon the results of Phase 1 by investigating whether TBPM can be enhanced by cognitive training coupled with transcranial electrical stimulation, a non-invasive brain stimulation method known to alter local GABA and glutamate levels. We expect that cognitive training combined with brain stimulation will enhance TBPM to a greater extent than training coupled with sham (placebo) stimulation. This project has the potential to yield novel insights into the neural basis of TBPM and its enhancement and thus may provide significant implications for both basic and translational research on TBPM.

Biographies

Roi Cohen Kadosh, Ph.D. is an experimental psychologist whose interests are the psychological and biological factors that shape learning and cognitive achievement. His research has studied a wide range of cognitive functions including mathematical cognition, episodic memory, and attention as well as a diverse set of populations (children, young adults, elderly, individuals with developmental dyscalculia, and synaesthetes). Roi's methods encompass a wide range of techniques including cognitive assessment, neuroimaging (MRS, structural and diffusion MRI, functional MRI, electroencephalography, and near-infrared spectroscopy), and non-invasive brain stimulation (tES and transcranial magnetic stimulation). Roi has pioneered the use of tES to modulate neuroplasticity during cognitive training for the improvement of learning and he is a leading voice in discussions of the neuroethical implications of such research. His research has translational impact for cognitive enhancement for restorative purposes and in healthy individuals without cognitive deficits. He has consistently published his research in high-impact psychology and neuroscience journals and his work has been widely covered in the media (e.g., *BBC*, *The New York Times, Time Magazine*). For his pioneering research, he has received prestigious awards including the Career Development Award (2010, Society for Neuroscience), the Paul Bertelson Award (2012, European Society of Cognitive Psychology), and the Spearman Medal (2014, British Psychological Society).

Devin B. Terhune, Ph.D. is a cognitive neuroscientist with interests in the cognitive and neural mechanisms of time perception, sustained attention, and states of consciousness. His research concerns the neurochemical predictors of interval timing, the role of timing-specific mechanisms in TBPM, and the relationship between attention and time perception. He has also sought to use hypnosis to study distortions in metacognition and agency and to experimentally model different conditions such as synaesthesia, amnesia, and atypical attention in order to glean insights into their impact on cognition. Devin has used a range of neuroimaging methods including resting state electroencephalography, magnetoencephalography, functional and structural MRI, and MRS and multiple brain stimulation techniques including tES and transcranial magnetic stimulation. Devin has strong knowledge of response time modeling methods and psychophysics and has expertise in a range of advanced statistical methods including bootstrap resampling, latent variable modeling, and Bayesian statistics. He has published his work in multiple high-impact journals and his research has garnered considerable media attention. He has received multiple awards for his research including the Young Investigator Award from the Swedish National Committee for Psychological Sciences (2011, Royal Swedish Academy of Sciences).

Hippocampal Sequences as Prospection

Principal Investigator:
Matthijs (Matt) van der Meer, Ph.D., *Assistant Professor, Department of Psychological Brain Sciences, Dartmouth College*

A distinguishing feature of prospection is its constructive character: we can mentally simulate possible futures which are not simply a replay of previous experience, but instead can include inferences about never-experienced scenarios. Prospection is a major influence on decision-making and interacts with affective states, but we lack an adequate working model of what factors determine the content of prospective episodes, how prospection is translated into action, and what properties of the underlying neural circuits are responsible for its generation.

Human studies have shed light on the brain areas and functional networks that support prospection, but it has proven challenging to access the content of individual prospection episodes. Similarly, only limited tools are available to probe the relationship with neural circuitry. To address these challenges, we propose to study prospection in an animal model: rats solving spatial navigation problems. Remarkably, rats not only replay previous trajectories, but also mentally construct novel paths towards desired goals.

By recording neural activity from the rat hippocampus as they navigate various "shortcut" mazes, we will test first, whether such constructed trajectories can span never-experienced shortcuts. Second, we will test the influence of different factors on the content of constructed trajectories, distinguishing behavioral relevance from novelty and hardwired spatial structure. The complementary strengths of studies in animals and humans, together with the similarities in the neural mechanisms for prospection, suggest that this work will accelerate our understanding of prospection in a manner inaccessible by human studies alone.

Biography

Dr. Matthijs (Matt) van der Meer is Assistant Professor in the Department of Psychological and Brain Sciences at Dartmouth College (starting 01/2015). His research interests center on the interplay between memory and decision-making, in particular how neural circuits generate predictions about possible futures that can inform deliberation between alternative options. Dr. van der Meer received a M.Sc. in Informatics and a Ph.D. in Neuroinformatics from the University of Edinburgh (United Kingdom). Following a post-doctoral fellowship in Neuroscience at the University of Minnesota with Prof. A. David Redish, Dr. van der Meer established his laboratory at the University of Waterloo, where he held a Canada Research Chair in Neuroscience and an Ontario Early Researcher Award. Dr. van der Meer is currently an HFSP Young Investigator.

The Role of Prospective Altruism in Stem Cell Donation

Principal Investigator:
Abigail Marsh, Ph.D., *Associate Professor, Department of Psychology, Georgetown University*

This project will investigate prospective altruism in unrelated allogeneic (altruistic) stem cell donors. Stem cell registries link patients with blood cancers and related disorder to altruistic stem cell donors. But as many as half of all registry members do not agree to donate when re-contacted on behalf of a patient one or more years later. This may represent a failure of prospective altruism: registrants who opt out fail to prospect accurately about their future altruistic behavior. Such failures result in lost resources, time, and lives. Investigators with expertise in psychology (Marsh), sociology (Switzer), policy (Rogers), and stem cell registries (Smith) aim to identify factors that contribute to failures in prospective altruism in stem cell donors. Participants will be assessed within 12 weeks of registration (Phase I, N = 500) and before confirmatory typing (CT), the stage at which maximal attrition occurs (Phase II, N = 250). They will complete online measures assessing prospective altruism, construals of donation, episodic imagery, evaluations of the costs and benefits of donation, and ambivalence about donation. Responses will be analyzed to identify variables associated with intention to donate in Phases I and II, that differ across Phases I and II, and/or that are differentially related to intention to donate and actual CT decisions. Results are anticipated to improve understanding of both prospection as it operates in a real-world context, and of the dynamics of altruistic stem cell donation, with the aim of identifying ways of reducing future failures of prospective altruism among stem cell donors.

Biography

Abigail Marsh is an Associate Professor of Psychology at Georgetown University. She received her M.A. and Ph.D. in Social Psychology from Harvard University in 2001 and 2004, respectively, and completed her post-doctoral training in cognitive neuroscience at the National Institutes of Mental Health. Her research focuses on the cognitive, emotional, and neural bases of empathy, aggression, and altruism in adults and adolescents. Her recent work has focused on psychosocial and neurobiological variables that distinguish altruistic kidney donors from other adults, funded by the Positive Neuroscience Project at the University of Pennsylvania and the John Templeton Foundation. This work continues her longstanding interest in the biological basis of human altruism, which began with her dissertation work aimed at identifying variables that predict individual differences in altruistic behavior in the laboratory. Her work has been published in interdisciplinary journals including *Psychological Science, JAMA Psychiatry, American Journal of Psychiatry, Journal of Personality & Social Psychology*, and *Emotion*. At Georgetown University, a Jesuit university dedicated to instructing students to be reflective lifelong learners, responsible and active participants in civic life, and to live generously in service to others, Marsh teaches courses that include Empathy, Altruism, & Aggression and Social & Affective Neuroscience.

Adapting Cognitive Bias Modification to Train Healthy Prospection

Principal Investigator:
Bethany A. Teachman, Ph.D., *Professor of Psychology, Director of Clinical Training, University of Virginia*

Imagine tomorrow is the day of a big race. We all know people who picture themselves leaping across the finish line triumphantly, envisioning a glorious future. But what about the person who pictures not only losing the race, but also falling flat on his face and breaking his leg? Can we help this person have healthier views of his future and avoid these extreme negative representations? We propose to use an adapted Cognitive Bias Modification (CBM) program to train prospection to favor the generation of healthy positive (relative to extremely negative) representations of possible future states. The 4-session, web-based intervention will train participants to expect and visualize reasonably positive future outcomes by resolving the emotional ambiguity in scenarios that set up uncertainty about one's future state. We will select individuals who have a baseline bias toward envisioning very negative outcomes, because these individuals can clearly benefit from improving their prospection, given the health benefits expected to follow more positive prospection. Individuals will be randomly assigned to receive either CBM that promotes positive prospection, CBM that both negates negative prospection and promotes positive prospection, or one of two control conditions. Following training, we will evaluate how training alters future thinking, affective and behavioral forecasting, and actual avoidance behavior and affect during a social stressor. Thus, this project tests a cognitive strategy to improve prospection, based on the idea that repeated practice envisioning positive future, self-relevant outcomes will train healthier prospection, and in turn, enhance affect and behavioral engagement.

Biography

Bethany A. Teachman is a Professor of Psychology and the Director of Clinical Training at the University of Virginia. She received her Ph.D. from Yale University and B.A. from the University of British Columbia. Her research focuses on biases in cognitive processing that contribute to the development and maintenance of anxiety disorders and other forms of emotion dysregulation, with a particular interest in investigating how automatic cognitive processes can be modified. In addition, she teaches undergraduate and graduate level courses in psychopathology, and trains graduate students learning to do therapy. Dr. Teachman is a licensed clinical psychologist with over 100 publications, including the books *Treatment Planning in Psychotherapy: Taking the Guesswork Out of Clinical Care* (2002, Guilford Press) and *Helping Your Child Overcome an Eating Disorder: What You Can Do at Home* (2003, New Harbinger). Dr. Teachman is associate editor for the journal *Perspectives on Psychological Science*, a Fellow of the Association for Psychological Science, and winner of the 2012 American Psychological Association (APA) Distinguished Scientific Award for Early Career Contribution to Psychology and the 2014 Association for Behavioral and Cognitive Therapies Outstanding Mentor Award. She is Director of the website Project Implicit Mental Health, and the current President of the Society for a Science of Clinical Psychology. Lab Webpage: www.teachman.org

Prospection and the Origins of Prosociality

Principal Investigator:
Felix Warneken, Ph.D., *Associate Professor, Department of Psychology,*
Director, Social Cognitive Development Group, Harvard University

The goal of the proposed project is to investigate how prospection expands human potential for prosocial behavior — our tendency to act on behalf of others. One major factor limiting prosociality is a myopic view of the here and now, leading individuals to choose outcomes that are personally beneficial in the immediate context over prosocial outcomes providing opportunities for larger, more long-term social benefits. However, humans overcome this constraint with prospection — the ability to transcend the immediate situation and think about future events. Therefore, I aim at investigating prospection as a critical capacity fundamental to the expression of human prosocial behavior.

I use a developmental psychological approach because by studying young children, we can witness the birth of prospection and assess its effects on prosocial behavior. What does prosocial behavior look like before children are able to prospect the future? What new forms of prosocial behavior emerge when children use prospection? Aim 1 is to measure the developmental trajectory of prospection and prosocial behavior in children by using novel experimental paradigms. Aim 2 is to test the hypothesis that higher levels of prospection are correlated with greater prosocial behavior by investigating individual differences in prospection and prosociality across children. Aim 3 is to test the hypothesis that greater prospection leads to greater prosocial behavior by directly increasing children's prospection skills and measuring its effects on prosocial behavior. By conducting the first comprehensive investigation of children's developing skills for prospection, we will gain important insights into the foundation of human prosociality.

Biography

Dr. Felix Warneken is an Associate Professor and Director of the Social Cognitive Development Group in the Psychology Department at Harvard University. Trained as a developmental and comparative psychologist, he conducts research on cooperation and social cognitive development in children and great apes. He studied in Germany and the United States, receiving his doctoral degree from the Universität Leipzig while working at the Max Planck Institute for Evolutionary Anthropology as a graduate student and postdoctoral fellow. He joined the Harvard Psychology Department in 2009. His most significant contributions have been on the origins of cooperative behaviors in young children and chimpanzees. His study demonstrating altruistic helping in children and chimpanzees was named one of the 100 most important science stories in 2007 by *Discover Magazine*. Dr. Warneken has received several awards, most recently an Early Career Research Award from the Society for Research in Child Development, the Janet Taylor Spence Award for Transformative Early Career Contributions from the American Psychological Society, and a National Science Foundation CAREER award, all in 2013. His research has received support from the European Commission, NSF, and the John Templeton Foundation.

Linguistic Hints to Causal Models of the Future

Principal Investigators:
Phillip Wolff, Ph.D., *Associate Professor, Department of Psychology, Director, Program in Linguistics, Emory University*
Eugene Agichtein, Ph.D., *Associate Professor, Department of Math and Computer Science, Director, Emory Intelligent Information Access Laboratory (IR Lab), Emory University*
Bridget Copley, Ph.D., *Senior Researcher, Structures Formelles du Language Laboratory, Centre Nationale de la Recherche Scientifique, Université Paris 8*

Future-oriented thinking has been found to be associated with a range of positive characteristics, such as higher levels of happiness, life satisfaction, health, social behavior, and academic performance. A close analysis of future-oriented language may help explain why such benefits are present. It has long been known that languages provide a wide range of ways of talking about the future. Recent work suggests that these different ways of talking about the future are related to the causal properties of a situation, in particular, to the properties of internal and external control, intentionality, and obligation. The current research examines how these properties of causation might give rise to the positive benefits that have been observed previously in the literature. This will be accomplished through the development of techniques for the automatic extraction of future-orientated language, which will allow a large-scale comparison of future-oriented thinking and various emotions and behavioral practices. The current research will extend the use of these automated extraction techniques to analyses of the future orientation at the cultural level through large-scale mining of text in Twitter feeds. The proposed research will also examine how such orientation can be affected by the occurrence of major events (e.g., mass shootings; major sporting events), as reflected in changes in the expression of the future in tweets after such an event (mass shootings; major sporting events). Lastly, the proposed research will examine future orientation as it may change over time through an analysis of historical corpuses (e.g., The Oxford English Dictionary).

Biographies

Dr. Phillip Wolff is an Associate Professor in Psychology and Director of the Program in Linguistics at Emory University. Phillip's research focuses on the representation and organization of relational concepts and their role in higher-order reasoning as well as on the interface between language and cognition. He has conducted research on the semantics of verbs and prepositions and how cross-linguistic differences in meaning might reflect differences in thought, including differences in causal reasoning, event segmentation, and object perception. Dr. Wolff's research involves a range of methodologies, including behavior experimentation, computational linguistics, computer visualization, computational modeling, and cross-linguistic comparisons. Dr. Wolff has co-edited three books, including one with Dr. Barbara Malt entitled *Words and the Mind* which examines the interface of language and thought across languages. In addition to serving on several editorial boards and serving as the Director of the Program in Cognition and Development, Dr. Wolff has served as associate editor of the journal *Cognitive Science* and has served as faculty at the 2007 Summer Institute of Linguistics at Stanford University. He has over 2100 citations total in Google Scholar as of June 2014.

Dr. Eugene Agichtein is an Associate Professor in the Math & CS department at Emory University, where he leads the Emory Intelligent Information Access Laboratory (IR Lab). Eugene's laboratory works on mining searcher behavior and interaction data for improving web search, modeling social content creation and sharing, and

applications to medicine and life sciences. Dr. Agichtein received a Ph.D. in Computer Science from Columbia University, and did a Postdoc at Microsoft Research. In collaboration with colleagues and students, Eugene has published over 90 articles on web search, information retrieval, and web and data mining. Dr. Agichtein is an A. P. Sloan research fellow, and was a member of the 2011 DARPA Computer Science Study group. Dr. Agichtein's work has been supported by DARPA, NSF, NIH, Microsoft, Google, and Yahoo!, and has been recognized with multiple awards, including the "best paper awards" at WSDM 2014, SIGIR 2011, SIGMOD 2006, and ICDE 2003, and most recently by the 2013 Karen Sparck Jones (KSJ) Award from the British Computer Society.

Dr. Bridget Copley is a Senior Researcher at the laboratory Structures Formelles du Langage, jointly affiliated with the Centre Nationale de la Recherche Scientifique and the Université Paris 8. Working from a formal semantic perspective, Dr. Copley is particularly interested in how we talk about what happens next, focusing on future reference, conditionals, and possibilities, as well as on the linguistic expression of related phenomena such as causation, agency, ability, and dispositions. Dr. Copley's research takes the view that meaning is contributed both at a generative, syntax-visible, semantic level (i.e., logical form), as well as at a non-generative, conceptual level, and that the division of labor between these levels is testable using the methods of syntactic theory, model-theoretic semantics, and cognitive psychology. Her work thus provides an important and much-needed bridge between recent advances made at the syntax-semantics interface and the growing domain of research on the semantics-cognition interface. Dr. Copley received her Ph.D. in Linguistics and Philosophy in 2002 from the Massachusetts Institute of Technology, and reviews for many top journals and conferences in the field of Linguistics. She is the author of *The Semantics of the Future* (Routledge), and editor (with Dr. Fabienne Martin) of the upcoming volume *Causation in Grammatical Structures* (Oxford).

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