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The Institute Letter

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The Prisoner's Dilemma

BY FREEMAN DYSON

The *Evolution of Cooperation* is the title of a book by Robert Axelrod. It was published by Basic Books in 1984, and became an instant classic. It set the style in which modern scientists think about biological evolution, reducing the complicated and messy drama of the real world to a simple mathematical model that can be run on a computer. The model that Axelrod chose to describe evolution is called "The Prisoner's Dilemma." It is a game for two players, Alice and Bob. They are supposed to be interrogated separately by the police after they have committed a crime together. Each independently has the

choice, either to remain silent or to say the other did it. The dilemma consists in the fact that each individually does better by testifying against the other, but they would collectively do better if they could both remain silent. When the game is played repeatedly by the same two players, it is called "Iterated Prisoner's Dilemma." In the iterated game, each player does better in the short run by talking, but does better in the long run by remaining silent. The switch from short-term selfishness to long-term altruism is supposed to be a model for the evolution of cooperation in social animals such as ants and humans.

Mathematics is always full of surprises. The Prisoner's Dilemma appears to be an absurdly simple game, but Axelrod collected an amazing variety of strategies for playing it. He organized a tournament in which each of the strategies plays the iterated game against each of the others. The results of the tournament show that this game has a deep and subtle mathematical structure. There is no optimum strategy. No matter what Bob does, Alice can do better if she has a "Theory of Mind," reconstructing Bob's mental processes from her observation of his behavior.

William Press, Professor at the University of Texas at Austin, is the author of *Numerical Recipes*, the cookbook for people who do serious scientific computing. He is the Julia Child of numerical cuisine. He recently invented a new class of Prisoner's Dilemma strategies and tried them out numerically to see how they performed. He found that they behaved weirdly. They had a bad effect on his computer program, causing it to

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Groups lacking cooperation are like dodos, losing the battle for survival collectively rather than individually.

History and Peacemaking

BY MICHAEL VAN WALT VAN PRAAG

Human beings have waged war or engaged in violent conflict with each other since ancient times, an observation that prompted a Member at the Institute to suggest in the course of a casual conversation that surely it was a waste of time and resources to try to prevent or resolve armed conflicts, since there will always be others.

War, by any name,* does

indeed seem to be a permanent feature of human society, as is disease for that matter. We do not consider the efforts of physicians to cure patients or the research that goes into finding cures for illnesses a waste of time, despite this. Both phenomena, armed conflict and disease, change over time as circumstances change and as human beings develop ways to prevent or cure some kinds of ills. A doctor treats a patient for that patient's sake without necessarily having an impact on the propensity of others to fall ill. Mediators and facilitators seek to help resolve conflicts to bring an end to the suffering of those caught in their violence and destruction. Researchers in both fields hope to contribute in a broader and perhaps more fundamental way to understanding and addressing causes of these human ills and to finding new or improved remedies for them.

The vast majority of violent conflicts in the world today are intrastate, i.e., within states rather than between them. Those I have been engaged in preventing or resolving as a mediator,

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The Mathematics of Beauty

BY MINA TEICHER

It is known that mathematicians see beauty in mathematics. Many mathematicians are motivated to find the most beautiful proof, and often they refer to mathematics as a form of art. They are apt to say "What a beautiful theorem," "Such an elegant proof." In this article, I will not elaborate on the beauty of mathematics, but rather the mathematics of beauty, i.e., the mathematics behind beauty, and how mathematical notions can be used to express beauty—the beauty of manmade creations, as well as the beauty of nature.

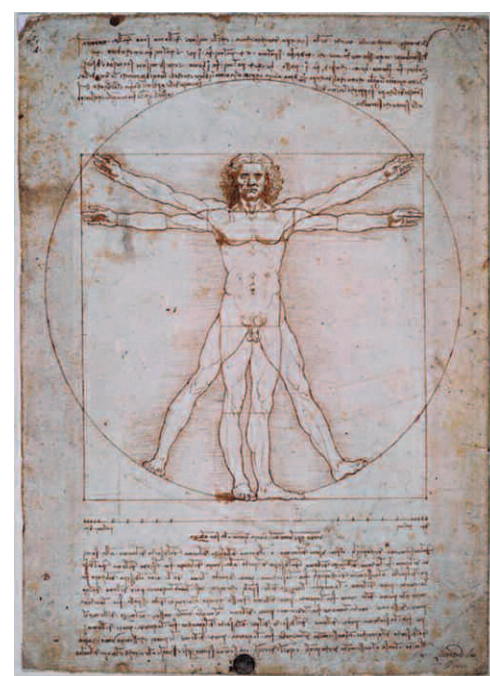
I will give four examples of beautiful objects and will discuss the mathematics behind them. Can the beautiful object be created as a solution of a mathematical formula or question? Moreover, I shall explore the general question of whether visual experience and beauty can be formulated with mathematical notions.

I will start with a classical example from architecture dating back to the Renaissance, move to mosaic art, then to crystals in nature, then to an example from my line of research on braids, and conclude with the essence of visual experience.

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War-displaced ethnic Tamil civilians wait for rations at a resettlement village in Batticaloa, Sri Lanka.



Leonardo da Vinci's Vitruvian Man, ca. 1487

News of the Institute Community

ANGELOS CHANIOTIS, Professor in the School of Historical Studies, has been awarded an honorary doctorate by the International Hellenic University in Thessaloniki, Greece.

The *Nativist Prophets of Early Islamic Iran: Rural Revolt and Local Zoroastrianism*, by PATRICIA CRONE, Andrew W. Mellon Professor in the School of Historical Studies, has been published by Cambridge University Press. The book explores Iranian responses to the Muslim penetration of the Iranian countryside, revealing a complex of religious ideas that has demonstrated remarkable persistence in Iran across two millennia. Crone also has been selected to receive an honorary degree from Leiden University in the Netherlands.

Fifteen scholars currently affiliated with the Institute have been named Fellows of the American Mathematical Society for 2013, the inaugural year of the program. Among the 1,119 Fellows who were recognized for their outstanding contributions to creating, explaining, advancing, and using mathematics are ROBERT DIJKGRAAF, Director of the Institute and Leon Levy Professor; Professors PHILLIP A. GRIFFITHS, HELMUT HOFER, ROBERT P. LANGLANDS, RICHARD TAYLOR, and EDWARD WITTEN; Trustee BENEDICT H. GROSS; and Members and Visitors JÜRIG M. FRÖHLICH, MARK GORESKY, ROBERT M. GURALNICK, DIETER KOTSCHICK, GREGORY MOORE, GOPAL PRASAD, CHRISTOPHER SKINNER, and EDUARD ZEHNDER.

DIDIER FASSIN, James D. Wolfensohn Professor in the School of Social Science, has edited *A Companion to Moral Anthropology* (Wiley-Blackwell, 2012). It represents the first comprehensive effort to bring together the various currents, approaches, and issues in the emerging domain of the anthropological study of moral and ethical questions, from humanitarianism to violence, from inequality to finance. *Les Nouvelles Frontières de la Société Française* (Editions La Découverte, 2010), also edited by Fassin, has been reissued in a second edition with a new preface.

PATRICK J. GEARY, Professor in the School of Historical Studies, has received the Alexander von

Humboldt Foundation's Anneliese Maier Research Award, which honors outstanding achievement in the humanities and social sciences and seeks to strengthen German scholarship's international ties. The award was presented in Heidelberg on September 13 by Annette Schavan, the German Federal Research Minister. Geary, one of seven recipients of the award in 2012, will use the prize to intensify his collaboration with German and other European scholars in transcultural and genetic history.

JONATHAN ISRAEL, Professor in the School of Historical Studies, has received the Frans Banninck Cocq Medal from the City of Amsterdam. The Mayor of Amsterdam, Eberhard van der Laan, presented the medal on November 25 in recognition of Israel's contributions to the history of the city and of the Enlightenment.

JOAN WALLACH SCOTT, Harold F. Linder Professor in the School of Social Science, has been awarded an honorary degree from the Université du Québec à Montréal.

Empires in *Collision in Late Antiquity*, by GLEN W. BOWERSOCK, Professor Emeritus in the School of Historical Studies, has been published by Brandeis University Press. The book examines political developments in the Arabian Peninsula on the eve of the rise of Islam, using close readings of surviving texts to shed new light on the complex causal relationships among the Byzantine, Ethiopian, Persian, and emerging Islamic forces.

FREEMAN J. DYSON, Professor Emeritus in the School of Natural Sciences, was awarded the Henri Poincaré Prize at the International Congress on Mathematical Physics in August. The award recognizes Dyson's "many decisive contributions to physics and mathematical physics," including the study of quantum electrodynamics, the stability of matter, and random matrix theory, as well as his "inspiration to generations of scientists." Past recipients of the prize include Edward Witten, Charles Simonyi Professor in the School.

Harvard University Press has published Volume VI, Books 28–39, of *The Histories* by Polybius (Loeb Classical Library, 2012), edited by CHRISTIAN HABICHT, Professor Emeritus in the School of Historical Studies, and F. W. Walbank, and translated by W. R. Paton. This is the final volume of the work.

The Global Development and Environment Institute at Tufts University has announced that ALBERT O. HIRSCHMAN, Professor Emeritus in the School of Social Science, who died on December 10, is the recipient of the 2013 Leontief Prize for Advancing the Frontiers of Economic Thought. The award recognizes Hirschman's critical role in crossing disciplines to forge new theories and policies to promote international development. A tribute to Hirschman will be published in the spring issue.

ARNOLD J. LEVINE, Professor Emeritus in the School of Natural Sciences, was awarded the Lars Onsager Medal and gave the Lars Onsager Lecture at the Norwegian University of Science and Technology in September. He has also been awarded the Vallee Visiting Professorship by the Bert L. and N. Kuggie Vallee Foundation and has been named a Simons Distinguished Visiting Scientist at the Kavli Institute for Theoretical Physics at the University of California, Santa Barbara.

AVISHAI MARGALIT, former George F. Kennan Professor (2006–11) in the School of Historical Studies, has received the 2012 Philosophical Book Award from the Hannover Institute of Philosophical Research for *On Compromise and Rotten Compromises* (Princeton University Press, 2009). The award is given every three

years for the best new book on a controversial problem in practical philosophy. Margalit is an Honorary Fellow at the Van Leer Jerusalem Institute.

MA RTIN REES, a Trustee of the Institute for Advanced Study and a former Member (1969–70, 1973, 1975, 1982, 1992–93, 1996) in the School of Natural Sciences, has been awarded the 2012 Isaac Newton Medal of the Institute of Physics. The award recognizes Rees's paradigm-shifting contributions to relativistic astrophysics and cosmology, as well as his mentorship of scientists, his leadership in the scientific community, and the impact of his nontechnical writings on public understanding of science. Rees is Professor Emeritus of Cosmology and Astrophysics and a Fellow of Trinity College at the University of Cambridge. Previous winners of the medal include Edward Witten, Charles Simonyi Professor in the School.

MARINA v.N. WHITMAN, an Institute Trustee, has published a memoir, *The Martian's Daughter* (University of Michigan Press, 2012). Whitman describes her upbringing as the daughter of JOHN VON NEUMANN, one of the Institute's first Professors (1933–57), and the influence it has had on her career as a leading academic, economic adviser, and business leader. Whitman is Professor of Business Administration and Public Policy at the University of Michigan.

JOH N J. HOPFIELD, Martin A. and Helen Chooljian Visiting Professor in Biology in the Simons Center for Systems Biology in the School of Natural Sciences, has been awarded the 2012 Society for Neuroscience Swartz Prize for Theoretical and Computational Neuroscience. The prize recognizes Hopfield's exceptional contributions to the field of computational neuroscience, including "rigorous and elegant" models of neural networks.

KAUSHIK BASU, former Member in the School of Social Science (1985–86), has been named Chief Economist and Senior Vice President at the World Bank. Basu is C. Marks Professor of International Studies and Professor of Economics at Cornell University.

LAKHDAR BRAHIMI, former Director's Visitor (2006–08), was named Joint Special Representative of the United Nations and League of Arab States in Syria in August. He succeeds former UN Secretary-General Kofi Annan in the role.

MARIA CHUDNOVSKY, former Member in the School of Mathematics (2003–05), is one of twenty-three scholars, artists, and scientists named to the 2012 class of MacArthur Fellows. Fellows receive unrestricted five-year grants from the MacArthur Foundation to pursue their creative endeavors. Chudnovsky is an Associate Professor at Columbia University.

NICHOLAS DIRKS, former Member (1989–90) in the School of Social Science, has been selected to serve as the next Chancellor of the University of California, Berkeley. The appointment will begin June 1, 2013. Dirks is currently Executive Vice President and Dean of the Faculty of Arts and Sciences, as well as Franz Boas Professor of Anthropology and History, at Columbia University.

CAROLE PATEMAN, former Member (1986–87) in the School of Social Science, has been awarded the 2012 Johan Skytte Prize in Political Science in recognition of outstanding contributions to the discipline. The prize committee cited her "thought-provoking" challenges to established ideas about participation, sex, and equality. Pateman is Distinguished Professor Emerita at the University of California, Los Angeles.

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The Most Successful Route Often Begins with a Short Step to the Side

I am honored and heartened to have joined the Institute for Advanced Study this summer as its ninth Director. The warmth of the welcome that my family and I have felt has surpassed our highest expectations. The Institute certainly has mastered the art of induction.

The start of my Directorship has been highly fortuitous. On July 4, I popped champagne during a 3 a.m. party to celebrate the LHC's discovery of a particle that looks very much like the Higgs boson—the final element of the Standard Model, to which Institute Faculty and Members have contributed many of the theoretical foundations. I also became the first Leon Levy Professor at the Institute due to the great generosity of the Leon Levy Foundation, founded by Trustee Shelby White and her late husband Leon Levy, which has endowed the Directorship. Additionally, four of our Professors in the School of Natural Sciences—Nima Arkani-Hamed, Juan Maldacena, Nathan Seiberg, and Edward Witten—were awarded the inaugural Fundamental Physics Prize of the Milner Foundation for their path-breaking contributions to fundamental physics. And that was just the first month.

Nearly a century ago, Abraham Flexner, the founding Director of the Institute, introduced the essay “The Usefulness of Useless Knowledge.” It was a passionate defense of the value of the freely roaming, creative spirit, and a sharp denunciation of American universities at the time, which Flexner considered to have become large-scale education factories that placed too much emphasis on the practical side of knowledge. Columbia University, for example, offered courses on “practical poultry raising.” Flexner was convinced that the less researchers needed to concern themselves with direct applications, the more they could ultimately contribute to the good of society.

Looking back, we can only be impressed with the clarity of Flexner's vision. All the ingredients he thought necessary to foster a creative atmosphere have gained in relevance: the need for true academic freedom; an institution of relative small size; an integrated academic community; flexibility in research and organization; and a light hand in administration. Of course, many of these principles are widely shared inside and outside the academic world, but the Institute is in a unique, privileged position where it can act according to these fundamental values and embody them in a world often pressed into uncomfortable compromises.

Flexner had thoroughly researched his position and articulated it carefully, always aware that reality can bite back. Yet, even he was astonished that the Institute worked as he had envisaged. When the first five Faculty members arrived, he wrote to the Trustees that “they are as happy as birds, doing precisely the things which they



have wanted to do.”

It is remarkable that Flexner's idea of concentrating on “useless knowledge”—the deep ideas behind interesting questions—has proven so effective. The biggest technological and social changes originate in conceptual breakthroughs. In 1930, only a few theoretical physicists cared about quantum mechanics; now it is estimated that 50 percent of industry is based on it.

Finding answers to difficult questions is far from straightforward. The shortest route from A to B is a straight line, but what do you do if you don't know where B is located or what it looks like? History shows

that the most successful route often begins with a short step to the side, often in a light spirit. When I speak with young researchers about their dreams and frustrations, my advice to them is always to keep an open mind. Give chance a chance. Color outside the lines. Surprise yourself.

Nobel Prize-winner Frank Wilczek, a former Professor in the School of Natural Sciences, was a twenty-one-year-old student when he discovered how quarks are held together in a nuclear particle. When he was recently asked to sum up his philosophy of life in three words, his apt reply was “Think, Play, Repeat.” It is indeed an endless cycle of imagination and concentration, of divergence and convergence, of playing and thinking that determines the rhythm of science and scholarship. The Institute is devoted to creating and supporting these experiences and the resulting, often surprising, advancements in knowledge.

In fact, the greatest challenge to the Institute is to embody the same qualities we would like to encourage in our Faculty and Members: be flexible (“plastic,” Flexner would say), open, and imaginative. Just as life as a scholar or scientist at the Institute might be described as being devoid of excuses, there are also no excuses for the Institute and its Director. We must pursue new directions and ways of academic research and strengthen the Institute's important message to the world, as relevant now as it was in Flexner's days. As the Red Queen said to Alice in *Through the Looking-Glass*: “Now, here, you see, it takes all the running you can do, to keep in the same place...”

Robbert Dijkgraaf
Director and Leon Levy Professor

Recommended Viewing: A video of a recent talk at IAS by Robbert Dijkgraaf is available at <http://video.ias.edu/dijkgraaf-lecture-10-12>.

PRISONER'S DILEMMA (Continued from page 1)

crash. He sent me an email asking whether I could understand what was going on. He is a modern calculator who works with numerical programs, while I am an ancient calculator who works with equations. So I wrote down the equations and did the math the old-fashioned way. I found a simple equation that told us when the behavior would be weird. I started a new career as a self-proclaimed expert in the theory of games. Press and I published a paper, “Iterated Prisoner's Dilemma Contains Strategies that Dominate Any Evolutionary Opponent,” in the *Proceedings of the National Academy of Sciences*, May 22, 2012. This created quite a stir in the world of theoretical biology. As usual when you discover something new, the response comes in three waves. First, this is nonsense. Second, this is trivial. Third, this is important, and we did it before you did.

The most interesting of Press's new strategies are the ones that he calls extortion strategies. As usual in the mathematical discussion of games, he uses a numerical payoff scheme to represent the value to Alice and Bob of talking to the police or remaining silent. If Alice uses an extortion strategy, she can arrange things so that, no matter what Bob does and no matter how much payoff he gets, she will get three times as much. The only way for Bob to get even is to accept zero payoff, in which case Alice also gets zero. If Bob acts so as to maximize his own payoff, Alice's payoff is automatically maximized three times more generously. In a commentary published on the Edge website, William Poundstone, author of a book on the Prisoner's Dilemma, summarized our work as follows: “Robert Axelrod's 1980 tournaments of iterated prisoner's dilemma strategies have been condensed into the slogan, Don't be too clever, don't be unfair. Press and Dyson have shown that cleverness and unfairness triumph after all.”

I am interested in a bigger question, the relative importance of individual selection and group selection in the evolution of cooperation. Individual selection is caused by the death of individuals who make bad choices. Group selection is caused by the extinction of tribes or species that make bad choices. The fashionable dogma among biologists says that individual selection is the driving force of evolution and group selection is negligible. Richard Dawkins is especially vehement in his denial of group selection. The Prisoner's Dilemma is a model of evolution by individual selection only. That is why

believers in the fashionable dogma take the model seriously.

I do not believe the fashionable dogma. Here is my argument to show that group selection is important. Imagine Alice and Bob to be two dodos on the island of Mauritius before the arrival of human predators. Alice has superior individual fitness and has produced many grandchildren. Bob is individually unfit and infertile. Then the predators arrive with their guns and massacre the progeny indiscriminately. The fitness of Alice and Bob is reduced to zero because their species made a bad choice long ago, putting on weight and forgetting how to fly. I do not take the Prisoner's Dilemma seriously as a model of evolution of cooperation, because I consider it likely that groups lacking cooperation are like dodos, losing the battle for survival collectively rather than individually.

Another reason why I believe in group selection is that I have vivid memories of childhood in England. For a child in England, there are two special days in the year, Christmas and Guy Fawkes. Christmas is the festival of love and forgiveness. Guy Fawkes is the festival of hate and punishment. Guy Fawkes was the notorious traitor who tried to blow up the King and Parliament with gunpowder in 1605. He was gruesomely tortured before he was burnt. Children celebrate his demise with big bonfires and fireworks. They look forward to Guy Fawkes more than to Christmas. Christmas is boring but Guy Fawkes is fun. Humans are born with genes that reward us with intense pleasure when we punish traitors. Punishing traitors is the group's way of enforcing cooperation. We evolved cooperation by evolving a congenial delight in punishing sinners. The Prisoner's Dilemma did not have much to do with it. ■

Freeman Dyson, Professor Emeritus in the School of Natural Sciences, first came to the Institute as a Member in 1948 and was appointed a Professor in 1953. His work on quantum electrodynamics marked an epoch in physics. The techniques he used form the foundation for most modern theoretical work in elementary particle physics and the quantum many-body problem. He has made highly original and important contributions to an astonishing range of topics, from number theory to adaptive optics.

Nova Aquilae and Extraterrestrial Intelligence that We May Not See

In the year 1918 a brilliant new star, called by astronomers Nova Aquilae, blazed for a few weeks in the equatorial sky. It was the brightest nova of this century. The biologist [J. B. S.] Haldane was serving with the British Army in India at the time and recorded his observation of the event:

Three Europeans in India looking at a great new star in the Milky Way. These were apparently all of the guests at a large dance who were interested in such matters. Amongst those who were at all competent to form views as to the origin of this cosmoclastic explosion, the most popular theory attributed it to a collision between two stars, or a star and a nebula. There seem, however, to be at least two possible alternatives to this hypothesis. Perhaps it was the last judgment of some inhabited world, perhaps a too successful experiment in induced radioactivity on the part of some of the dwellers there. And perhaps also these two hypotheses are one, and what we were watching that evening was the detonation of a world on which too many men came out to look at the stars when they should have been dancing.

A few words are needed to explain Haldane's archaic language. He used the phrase "induced radioactivity" to mean what we now call nuclear energy. He was writing fifteen years before the discovery of fission made nuclear energy accessible to mankind. In 1924, scientifically educated people were aware of the enormous store of energy that is locked up in the nucleus of uranium and released slowly in the process of natural radioactivity. The equation $E=mc^2$ was already well known. But attempts to speed up or slow down natural radioactivity by artificial means had failed totally. The nuclear physicists of that time did not take seriously the idea that "induced radioactivity" might one day place in men's hands the power to release vast quantities of energy for good or evil purposes. Haldane had the advantage of being an outsider, a biologist unfamiliar with the details of nuclear physics. He was willing to go against the opinion of the experts in suggesting "induced radioactivity" as a possible cause of terrestrial or extraterrestrial disasters.

The example of Nova Aquilae raises several questions which we must answer before we can begin a serious search for evidence of intelligent life existing elsewhere in the Universe. Where should we look, and how should we recognize the evidence when we see it? Nova Aquilae was for several nights the second brightest star in the sky. One had to be either very blind or very busy not to see it. Perhaps it was an artifact of a technological civilization, as Haldane suggested. How can we be sure that it was not? And how can we be sure that we are not now missing equally conspicuous evidence of extraterrestrial intelligence through not understanding what we see? There are many strange and poorly understood objects in the sky. If one of them happens to be artificial, it might stare us in the face for decades and still not be recognized for what it is.

—Freeman Dyson, *Professor Emeritus in the School of Natural Sciences, in Disturbing the Universe (Basic Books, 1979)*

Life on Other Planets

BY DAVID S. SPIEGEL

Until a couple of decades ago, the only planets we knew existed were the nine in our Solar System. In the last twenty-five years, we've lost one of the local ones (Pluto, now classified as a "minor planet") and gained about three thousand candidate planets around other stars, dubbed exoplanets. The new field of exoplanetary science is perhaps the fastest growing subfield of astrophysics, and will remain a core discipline for the foreseeable future.

The fact that any biology beyond Earth seems likely to live on such a planet is among the many reasons why the study of exoplanets is so compelling. In short, planets are not merely astrophysical objects but also (at least some of them) potential abodes.

The highly successful Kepler mission involves a satellite with a sensitive telescope/camera that stares at a patch of sky in the direction of the constellation Cygnus. The goal of the mission is to find what fraction of Sun-like stars have Earth-sized planets with a similar Earth-Sun separation (about 150 million kilometers, or the distance light travels in eight minutes). During its half-decade mission lifetime, Kepler will be monitoring 150,000 stars, looking for slight periodic dips in starlight that occur if an exoplanet's orbital plane is oriented precisely along our line of sight. In this geometrical configuration, the planet moves directly between us and its parent star once per orbit, blocking a tiny fraction of the light from the star. Kepler has identified more than two thousand planet candidates so far, most of which are probably real. Early results suggest that somewhere between 5 percent and 50 percent of Sun-like stars probably have an approximate Earth-analog!

So, we are starting to realize that potential homes for life are probably common in our Galaxy. Among the several hundred billion stars, there might be tens of billions of rocky planets located in the "habitable zones" of their stars—the regions where they would have roughly Earth-like temperatures. With so many possible places where life might flourish, how much life can we expect is out there? This question might seem to invite nothing but wild speculation. However, there is a potential avenue for making an estimate.

As an analogy, consider someone who wants to know what fraction of the time there is a deer visible outside her window. One way to estimate this would be to sit by the window, looking out, and see how long she has to wait for the first deer to walk into sight. In Manhattan, the expected wait might be decades, and one could rightly infer that the fraction of the time that there is a deer in sight is very close to zero. In Fuld Hall at IAS, one probably wouldn't have to wait more than a few hours, and could rightly infer that deer are pretty frequently visible outside the window.

Similarly, we can look through the Earth's geological history to see when life appeared in Earth's history. How long, in other words, did Earth have to wait before life "walked into sight"? Earth was born about 4.5 billion years ago, but for the first half billion years of its existence, it was bombarded by impactors that probably sterilized it. For the past four billion years, though, the Earth has been essentially continuously habitable (meaning, it

has had conditions suitable for liquid-water-based life). There is some evidence that the earliest living organisms had developed by 3.8 billion years ago, or within the first two hundred million years of the habitable history of the Earth. A common line of reasoning in the origin of life community argues that since abiogenesis (the process of life arising from abiotic conditions) occurred so early in the geological time scale of the Earth, it must be a reasonably probable process.

This argument is appealing, and it's certainly true that the early emergence of life on Earth provides some reason for optimism for an enthusiast of extrasolar life. However, together with Professor Edwin Turner of Princeton Uni-

versity, I recently critically reevaluated this argument (in the *Proceedings of the National Academy of Sciences*, vol. 109, issue 2) and found that we have less reason to expect that the Galaxy is full of life than is sometimes assumed. One important reason is that there is a powerful selection effect in operation that is absent in the deer analogy. Specifically, what we know is more than simply that life showed up early; we also know that we are aware that life showed up early. Put differently, in order for us to exist, enough time had to

have elapsed after abiogenesis occurred such that creatures could evolve who are capable of contemplating the frequency of inhabited planets. We don't know what the minimum evolutionary time scale is (in our case, it was about 3.8 billion years), but if, for instance, this minimum time scale is 3.5 billion years, then it would be impossible for us to find ourselves on a planet with late abiogenesis no matter how rare the abiogenesis process is.

Thankfully, we will soon be able to empirically test the hypothesis that our Galaxy is teeming with life. Even a single example of life that had a different

abiogenesis event would count much more strongly toward the conclusion that life is common, given the right conditions. Possible examples of life with an independent origin include:

- so-called "shadow life" here on Earth (i.e., life that arose entirely separately from the tree of life, springing from a single root that is believed to encompass all currently known species);

- life elsewhere in our Solar System (e.g., on Mars or Jupiter's moon Europa), if we were confident that there was no panspermia in either direction (i.e., that we didn't seed, for example, the Martian life via asteroids transporting material from Earth to Mars, nor they us);

- or life on an exoplanet.

Within the next several decades, with rapid progress in biology, with new space missions, and with large and sensitive new telescopes that are planned, it is conceivable that we might find any of these three kinds of independent life. In this way, we will be able to make a much more informed estimate of the frequency of life in the Universe. ■

David S. Spiegel, Friends of the Institute for Advanced Study Member (2012–13) in the School of Natural Sciences, is focusing his research on theoretical studies of the climates of, and radiative transfer in, exoplanetary atmospheres; habitability models of terrestrial exoplanets; and radiation-dynamical models of gas giant planets.



Sighting a deer outside of Fuld Hall; how long did Earth have to wait before life "walked into sight"?

What we know is more than simply that life showed up early; we also know that we are aware that life showed up early.

Exploring the Relationship between Borders and Boundaries

BY DIDIER FASSIN

In the introduction of a collective volume on *Border Identities*, published a little more than a decade ago, the editors Thomas Wilson and Hastings Donnan expressed what they saw as a common opinion of their time, including among scholars. According to this view, “International borders are becoming so porous that they no longer fulfill their historical role as barriers to the movement of goods, ideas, and people, and as markers of the extent and power of the state. This withering away of the strength and importance of international borders is linked to the predicted demise of the nation-state as the preeminent political structure of modernity.” Very few observers would sustain such a position today, in a world increasingly characterized by intensive border control involving the deployment of sophisticated screening technologies, the edification of walls between countries to limit migratory flows, the multiplication of detention centers exclusively devoted to unwanted aliens, and the banalization of massive deportations of undocumented immigrants. Borders have thus become, within a few decades, a major issue in public policies and public debates worldwide.

To reflect on this contemporary phenomenon and account for historical as well as geographical perspectives, a conference titled “On Borders” was held at the Institute in June. It was part of a series of events co-organized by the Institute and the Collège de France and alternately hosted in Princeton and Paris; last year’s meeting took place in France and focused on “Secularism and Politics.” These institutions have much in common: both comprise a body of professors belonging to a wide range of disciplines, from mathematics and the natural sciences to history and the social sciences, which is unique in their national environment. The purpose of the conferences is to convene a small group of approximately fifteen to twenty scholars for a two-day exchange on a topic with scientific as much as social relevance. The objective is to contribute ideas, challenge approaches, and build links across national and disciplinary frontiers. “On Borders” brought together political theorists, historians, sociologists, anthropologists, and economists from both sides of the Atlantic, including Professors from the Schools of Social Science and Historical Studies and scholars from various universities: Princeton, Yale,

Participants in the “On Borders” conference organized by the Institute and the Collège de France were Danielle Allen, School of Social Science; Seyla Benhabib, Yale University; François Bourguignon, Paris School of Economics; Barry Chiswick, George Washington University; Catherine Colliot-Thélène, Université de Rennes I; Philippe Descola, Collège de France; Nicola Di Cosmo, School of Historical Studies; Didier Fassin, School of Social Science; Patrick Geary, School of Historical Studies; Josiah Heyman, University of Texas; Henry Laurens, Collège de France; Daniel Nordman, Centre National de la Recherche Scientifique; Alejandro Portes, Princeton University; Pierre Rosanvallon, Collège de France; Joan Wallach Scott, School of Social Science; and Michael Walzer, School of Social Science.



A young Afghan migrant climbs over a security fence surrounding the Greek port of Patras.

George Washington, Texas, and Rennes. Although most presentations and discussions concerned Western Europe and North America, they also pertained to the Middle East, Asia, and Latin America.

A crucial theoretical issue involved the articulation between, on the one hand, territorial and juridical borders defined by sovereignty and citizenship, and, on the other, racial, ethnic, religious, or linguistic boundaries delimiting social and cultural groups. Both are human artifacts and global contemporary trends, and social scientists are obliged to account for their relations. The transatlantic conversation is of particular interest. The United States has a long history of acknowledging and enforcing racial and ethnic categorization but only recently began considering immigration as a problem, whereas France has severely restricted migratory flows for almost four decades but recognized the existence of racial discrimination and ethnic identification just a few years ago. Borders are a late discovery in the first case as are boundaries in the second one. In both, the religious frontier is now crystallizing with tensions about Islam. The conference began with a presentation of the sociology and the economics of migration. Its costs and benefits were discussed, and more generally its impact on the host society. Then, historians and anthropologists provided a temporal, spatial, and even ontological depth to the construction of borders and boundaries, via case studies from France, Germany, Palestine, China, and Ecuador, showing how, in these various contexts, political entities or social groups were defined and delimited in exclusive or inclusive ways, which could extend as far as the integration of humans and nonhumans in certain traditional worldviews. The final session was devoted to the examination of contemporary issues raised by the consolidation of borders and hardening of boundaries, with interrogations about the growing demand for securitization but also the emergent forms of cosmopolitanism. ■

Recommended Reading: A list of papers that were provided by participants prior to the conference may be found at www.sss.ias.edu/seminars/on-borders-readings.

Didier Fassin, James D. Wolfensohn Professor in the School of Social Science, is an anthropologist and a sociologist who has conducted field studies in Senegal, Ecuador, South Africa, and France. Initially trained as a physician, he practiced internal medicine and public health before turning to the social sciences at the University of Paris North and the École des Hautes Études en Sciences Sociales. He is currently conducting research on the anthropology of the state, exploring the political and moral treatment of disadvantaged groups, including immigrants and refugees, through an ethnography of police, justice, and prison.

Tracing the “Traffic in Women”: Moral and Political Economies of Sexual Labor

BY ELIZABETH BERNSTEIN

In recent years, the trafficking of women and children into the sex sector has become the focus of a steady spate of media coverage, the subject of abundant policy interventions, and the target of local, national, and transnational activist campaigns uniting highly diverse constituencies. From the political left to the far right, from secular feminists to evangelical Christians, sex trafficking is frequently described as “modern day slavery” and is considered to be a moral question that is “beyond politics,” something no one could possibly claim to be “for.” This unity is all the more striking given the fact that definitions of the term remain murky, with many states and activists applying it not only to forced but also to voluntary forms of sexual labor. Despite this ambiguity, sex trafficking has risen to a position of cultural and political prominence that it has not held since the “white slavery” panic similarly circled the globe at the turn of the last century.

This surge of interest presents sociologists and other scholars with some vexing social and historical questions. If prostitution is the “oldest profession,” why the resurgence of interest in it now? How has the issue of sex trafficking come to unite constituencies that otherwise have opposing politics and interests, especially in relation to matters of sex and gender (as ongoing political controversies over gay marriage and abortion powerfully reveal)?

No doubt, the globalization, expansion, and diversification of sexual commerce in recent decades have been relevant factors in fostering this consensus. It was for this reason that my own interest in this question first emerged over a decade ago, leading me to conduct ethnographic research on the globalization and structural transformations of sexual labor.¹ In the mid-1990s, I began researching the complex dynamics of sexual com-



“Rescued” sex workers in lockdown in Phnom Penh, Cambodia

merce and its regulation, focusing in particular on three cities—San Francisco, Stockholm, and Amsterdam. These were cities of similar size and with comparable political-economic profiles, but they were on the cusp of adopting three different regulatory models: decriminalization, criminalization, and legalization. Trained as an ethnographer, I spent a number of years getting to know communities of sex workers, clients, and state agents, as well as visiting brothels, street-walking strolls, and holding tanks for arrested sex workers.

In addition to understanding the changing structural and experiential contours of new global markets in sexual labor, I used ethnographic research to illuminate the sometimes unintended consequences of new regulatory policies in each of these cities. Like

Abraham Flexner, the Institute’s founding Director, who researched policies pertaining to prostitution in the early 1900s, I found some unexpected things.² For example, I found that in San Francisco, a new de facto decriminalization policy actually led to more arrests of sex workers (particularly those who worked on the streets), but for crimes other than prostitution, such as littering, disorderly conduct, and public nuisance violations. In Amsterdam, I found that the legalization of brothel keeping in the year 2000 actually led to a decline in the size of the sex industry and to the vacating of brothels in the red-light district. With regulations that were costly to enforce, many of the smaller enterprises

(Continued on page 8)

Elizabeth Bernstein, Member (2011–12) in the School of Social Science, is Associate Professor of Women’s, Gender, & Sexuality Studies and Sociology at Barnard College, Columbia University. Her current book manuscript, “Brokered Subjects: Sex, Trafficking, and the Politics of Freedom,” will be published by the University of Chicago Press.

Truth and Beauty at the Institute for Advanced Study

BY IRVING LAVIN AND MARILYN ARONBERG LAVIN

*"Beauty is truth, truth beauty,"—that is all
Ye know on earth, and all ye need to know.
—final couplet of John Keats's
"Ode on a Grecian Urn"*

Almost as soon as I arrived at the Institute in 1974 and saw the official seal, I was intrigued by the poetic beauty and formal simplicity of this eminently pictorial image, quite unlike the abstract epigraphic tradition of academic heraldry. In a circular format, the quiet, elegant, and classical Art Deco composition depicts two graceful young women, one nude and one clothed, standing on opposite sides of a leafy tree that bears abundant fruit. Their poses are complementary, one looking out toward the spectator, the other looking down, avoiding eye contact. The figures are named in large letters sans serif, TRUTH to the left, BEAUTY on the right. Truth holds a mirror that overlaps the circular frame to reflect reality. On the exergue, at the bottom of the circle, in smaller letters, is the artist's signature, P. TURIN. What struck me most was the extraordinary intellectual acumen that underlay the evident allusion, in both the conceit and the design of the emblem—conveying the essence of the mission of the Institute for Advanced Study—to the famous final couplet of John Keats's "Ode on a Grecian Urn." With a mind to study the genesis and significance of this remarkable image, I subsequently spoke with Harry Woolf, the Director at the time, who gave me access to a file of letters and other documents pertaining to the seal, which I carefully stashed away. They languished for more than thirty years thereafter as other projects intervened, until it became, now or never. . . .

In its final form, the study is divided into separately written parts: Marilyn Aronberg Lavin begins with the history of the project to invent and bring into physical form what remains the official seal of the IAS. My analysis then follows, setting the imagery of the seal and its meaning into the context of the ideas that brought the Institute into being. —IL

At the end of 1929, two years after he had delivered his three controversial Rhodes Trust Memorial Lectures at Oxford University criticizing the sorry state of education in English, German, and American universities, Abraham Flexner was approached by two agents of the Bamberger family who wished to find "uses to which a considerable sum of money might be placed." Flexner said immediately that his competency was limited to the educational field and

that in this field it seemed to me that the time was ripe for the creation in America of an institute in the field of general scholarship and science, resembling the Rockefeller Institute in the field of medicine—developed by my brother Simon—not a graduate school, training men in the known and to some extent in methods of research, but an institute where everyone—faculty and members—took for granted what was known and published, and in their individual ways endeavored to advance the frontiers of knowledge.

After two months of reflection on a plan drafted by Flexner, Louis Bamberger and his sister, Carrie (Mrs. Felix Fuld), announced that they were resolved to endow such an institute with the condition that Flexner, who considered himself retired, would undertake the organization. Flexner responded that for such a decision he had to consult with his wife, Anne Crawford Flexner. He describes her reaction to the Bamberger offer thus:

Quick as a shot she rejoined, "You will have to do it. You have spent your life criticizing other people. You can't refuse to give them a chance to criticize you."

Thus he accepted the position.

One of the first things he turned his attention to, even before the preliminary financial and practical arrangements were in place, was the need to represent the Institute graphically with an official seal. He writes:

The new Institute for Advanced Study has got to have a seal, and I have been asked to procure a sketch—something very simple and characteristic. The notes that I would like struck are Truth and Beauty—not Truth alone, for I agree with you that both are elements in a national culture. I should also like English, not Latin or Greek used. Could you make a little sketch which would convey this idea?

Flexner was calling for help with the seal's design from his good friend William Welles Bosworth, a prominent American architect with a long list of important buildings to his credit. . . . Bosworth, who was also a more-than-competent artist, responded with enthusiasm:

I was delighted to have you call on me about the seal, and I would even go so far as to suggest that . . . after we have agreed on a design—the thing should be modeled and cut by a great artist over here named Turin. . . .

The extraordinary motto Truth and Beauty borrowed from Keats's "Ode on a Grecian Urn," apart from its appropriateness for the idea of the Institute (which Flexner called his

"dream"), had great personal significance for Flexner and his wife Anne. In his introduction to the 1960 edition of Flexner's autobiography, his close friend Allan Nevins (1890–1971), American historian and journalist, reports that Abraham loved to recite this poem at private social gatherings, which he did, of course, from memory. Mrs. Flexner, Anne Crawford Flexner, who was a quite successful Broadway playwright (*Mrs. Wiggs of the Cabbage Patch* was her greatest success), in this period did much research on Keats and then wrote and produced the play *Aged 26: A Play about John Keats*. —MAL

We have no idea if Flexner had any idea what the seal he requested was to look like. But no less remarkable than Flexner's thought was what happened when Bosworth received the request and Turin responded to it. . . .

Bosworth, with Turin's agreement, introduced a third element according to what he called "the law of three."

(Turin) agreed with me that to make a good-looking Seal, we ought to have three things instead of two. In other words, the Tree of Knowledge growing out of Truth and Beauty, as the third, uniting the two.

The next time I see you, I will give you a long lecture on the law of three—in all things visual. I am hoping that you will agree that the fruit of pursuing "Truth and Beauty", in your Institution, is "Knowledge"; and that the force of the "Truth and Beauty" idea, is rather strengthened than weakened, by letting it figure as a fruit-bearing tree, beside which they stand.

It is important to realize that the Law (or Rule) of Three is not the same as Symmetry, for it involves not just the juxtaposition of the parts but also the relationships between them:

$$\frac{A}{B} = \frac{C}{X} \quad X = \frac{B \times C}{A}$$

Bosworth's tertium quid between Truth and Beauty was none other than the Tree of Knowledge—Knowledge as such, as it were—precisely the concept subtended by the oracular urn in the last line of Keats's Ode to the equation of the two in the preceding line. In my opinion, Bosworth, Turin, and Flexner understood the poem in this way, and thus captured its meaning more profoundly and concisely than any of the commentators I have read. Truth and Beauty are equal, inseparable, and ultimately indistinguishable paths toward one end, Knowledge, which is indeed all we can or need to know on earth, and the pursuit of which is exactly the kind of research Flexner envisioned for his new Institute.

In a way, I think the Tree of Knowledge bearing apple-like fruit was the boldest invention of all. Placed between the two figures according to the Rule of Three, it inevitably evokes, and I suspect was deliberately intended to do so, the traditional portrayal of the Temptation of Adam and Eve, to whom the fruit revealed the knowledge of good and evil, whence they were expelled from Paradise into this world, where they were condemned to labor for their sustenance. The labors required by the Institute's Tree were the pursuit of Truth and Beauty, and the Knowledge that on earth they are identical and sufficient.

While the association of Truth and Beauty with the program of the Institute may seem obvious and natural to us today, it certainly was not when Flexner made the association. Flexner's knowledge and appreciation of the Ode were profound; his wife Anne did serious and extensive research for the play—*Aged 26*—she wrote and produced about the poet's death. But the linkage between the Ode and the Institute required a fundamental leap of the imagination, which sprang, I think, from Flexner's much earlier, indeed lifelong, and much broader concern with problems of education and intellectual endeavor, most especially in modern America. . . .

The radical nature of Flexner's twinning of science and humanism with truth and beauty arose in part from the radical nature of his concept for a "modern" university by which he meant a university devoted exclusively to the pursuit of higher learning for its own sake and without regard to practical value. . . . Science and the humanities—these polar extremes that touch—were at the forefront of Flexner's mind when he formulated the Institute's logo, commemorating the paradoxical conjunction of opposites in the Institute's mission with the paradoxical closing lines of the "Ode on a Grecian Urn," where the extremes of Truth and Beauty touch in their common search for knowledge. —IL ■

Irving Lavin, Professor Emeritus in the School of Historical Studies, is one of America's most distinguished art historians. He has written extensively on the history of art from late antiquity to modern times. His interests have focused primarily on the correlation between form and meaning in the visual arts. Marilyn Aronberg Lavin is one of America's leading scholars in the field of Italian Renaissance painting and a pioneer in the use of electronic technology for the study of art history.

Recommended Reading: A longer study by the Lavins on the history and significance of the Institute seal from which this text was excerpted is available online at www.ias.edu/files/pdfs/publications/ias-seal.pdf.



PHOTOS: BRUCE M. WHITE



In the nineteenth century it was proven that, from a mathematical point of view, there are only seventeen possible symmetries in tiling. It was discovered that the mosaics in the Alhambra (above) represent all possible seventeen symmetries.

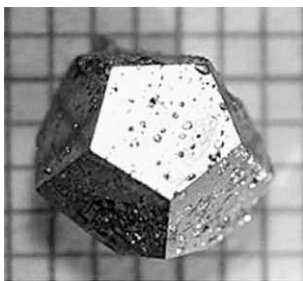
phenomena and constructions (e.g., the limit of the Fibonacci sequence). Leonardo da Vinci observed the golden section in well-proportioned human bodies and faces—in Western culture and in some other civilizations the golden-section ratio of a well-proportioned human body resides between the upper part (above the navel) and the lower part (below the navel).

Mosaic is an art form where solid pieces (wood, stone, glass, etc.) are assembled on a flat surface with no overlaps and no gaps. In its sophisticated form, the mosaic has recognizable patterns, which are repeated in two different directions, where no center, no boundary, no preferred direction, and no focus, is identified. The pattern of a mosaic work gives a sense of infinity.

In mathematical terms, mosaics are referred to as tiling. To form a tiling means to fully cover a two-dimensional plane with geometric forms (polygons or shapes bounded by curves) with no overlaps. A tiling is called symmetric if one can virtually rotate it or reflect it without causing the tiling picture to change. There are different angles of rotation (half twist, quarter twist, etc.) and different axes of mirror reflection (horizontal, vertical, diagonal, etc.). A rich mosaic represents a variety of tiling symmetries, which can be understood via the resulting geometry.

The most impressive mosaics in history were done by artists working in the Islamic World in the Middle Ages, and, in particular, those who created the beautiful, sophisticated mosaic of the Alhambra Palace in Spain. The Alhambra was built by the Moors in the beginning of the thirteen century, on a red-soil hill overlooking the old city of Granada. It is a showcase of Muslim architecture and design with an immense wealth of patterns, ornaments, calligraphy, and stone carvings. It includes virtual night-sky ceilings crafted from thousands of pieces of wood, as well as the most sophisticated, gorgeous, colorful mosaics.

The Dutch artist M. C. Escher paid two visits to the Alhambra to sketch and catalogue the ornate patterns that are found in the tilings throughout the palace and surrounding courtyards. Escher's tilings are not necessarily periodic, meaning that the tiles appear or occur at regular intervals. In the late nineteenth century it was proven that, from a mathematical point of view, there are *only* seventeen possible symmetries. In the early twentieth century, it was discovered that the tilings in the Alhambra represent *all* possible seventeen symmetries! Hundreds of years of skilled construction, tiling, a deep respect for symmetry (as a harmonious force), and the study and knowledge of geometry (for religion as well as for commerce) resulted in all seventeen possible symmetry groups being represented on the Alhambra walls! In 1944, the assertion that all seventeen symmetries could be found there was challenged, but lately, once flexibilities of colors and interlacing were introduced, it was verified again.



A quasicrystal, a solid structure in nature with order but with no periodicity, has a polygon with five edges in its pattern.

mathematically possible in the 1960s, but it was then believed that there were no solid structures in nature with order but with no periodicity. In 1982, Dan Shechtman, a Professor at the Technion in Israel, predicted the existence of nature-made aperiodic crystals, later known as quasicrystals. A quasicrystal should have a polygon with five edges in its pattern. The first such nature-made stones were found in a Russian mountainous

The shape of a perfect room was defined by the architects of the Renaissance to be a rectangular-shaped room that has a certain ratio among its walls—they called it the “golden section.” A rectangular room with the golden-section ratio also has the property that the ratio between the sum of the lengths of its two walls (the longer one and the shorter one) to the length of its longer wall is also the golden section, 1 plus the square root of 5 over 2. Architects today still believe that the most harmonious rooms have a golden-section ratio. This number appears in many mathematical

If a machine can express our visual experience at its best (including beauty) and communicate precise visual information, it needs (not exclusively) to use mathematical notions such as: proportion, symmetry, dimension, direction, perspective, center, axes, coordinates, reflection, rotation, half-twists, order, periodicity, scale, space, cycles, intersections, continuity, intensity, density, stability, noise, as well as smoothness, curvature, projections, three-fold, and more.

region. In 2009, this discovery was announced scientifically by Paul Steinhardt, a Professor at Princeton. In 2011, Shechtman received the Nobel Prize in Chemistry for his prediction.

Hair Braids are referred to in mathematics as three-strand braids. In mathematics, there are also two-strand braids, four-strand braids, five-strand braids and n -strand braids, i.e., any number of strand braids. Mathematicians study the properties of braids: How do braids relate to each other? How can braids be deformed? How can braids be ordered? How can a braid be factorized? What is the structure of the group of all braids? Some of these questions are still open. I have studied the structure of braids and its dynamics for applications to geometry of surfaces, neural computation, and cryptography. Together with my student, Eran Liberman, we proved that one braid cannot always be deformed to another by conjugation. This means that one cannot move from one complex braid to another without tearing it apart. (What does this result mean for hair braids? I guess that one needs to wash his/her hair in order to make a new braid.) Da Vinci has a series of drawings of hair braids and braided rivers,* which are very appropriate to the dynamic nature of braids in mathematics.



Leonardo da Vinci made a series of drawings of hair braids and braided rivers, which are very appropriate to the dynamic nature of braids in mathematics.

Machine vision can, ideally, replace human vision, in the sense that it can identify objects in a picture. Such a machine can be of utmost help to a blind person, but it is also applicable for medical diagnostics, distance medicine, automotive safety control in an assembly line, and for robotics in general (it is indeed the last frontier in robotics).

Building machine vision requires understanding of the essence of visual experience, advanced three-dimensional cameras, and more. One of the most difficult challenges for machine vision is face recognition, an essential development for administrative and legislative identification, homeland security, and the convenience of not needing to carry a key (as the home door will open automatically when approaching it—even with a hat, a smile, or sunglasses).

Face recognition is one of the highest brain functions. It involves not only the shape of the face, but also the captured expression, and much more. It is culture dependent. Maybe this is the reason that while

the occipital lobe of the brain is responsible for vision, face recognition is derived also with the temporal lobe.

Machine face recognition does not yet match the accuracy of human face recognition, although some new technologies do surpass the average human in some performance tests. Machine face recognition can also attempt to classify beautiful faces using basic symmetries and proportions.

If a machine can express our visual experience at its best (including beauty) and communicate precise visual information, it needs (not exclusively) to use mathematical notions such as: proportion, symmetry, dimension, direction, perspective, center, axes, coordinates, reflection, rotation, half-twists, order, periodicity, scale, space, cycles, intersections, continuity, intensity, density, stability, noise, as well as smoothness, curvature, projections, three-fold, and more. (Again, some of these notions were explored by da Vinci.*) In my research, I plan to use the theory of curves and surfaces embedded in a three-dimensional projective space to extract discrete invariants of the face and build supportive algorithms for face recognition.

Can mathematics always explain the origin and true nature of beauty? If not, is beauty in the eyes of the beholder? I would not say that all expressions of beauty can be expressed with mathematical formulas. Nevertheless, one can still assert that beauty is an absolute term (up to cultural, geographical, and historical dependence). ■

* Thanks to Irving Lavin, Professor Emeritus in the School of Historical Studies, for pointing this out to me.

Mina Teicher, Visitor in the School of Mathematics, is Professor in the Department of Mathematics and the Gonda Brain Research Center, and Director of the Emmy Noether Institute for Mathematics, at Bar-Ilan University. She is interested in line arrangements as well as the structure of the braid group and its application to cryptography. In parallel, she is interested in neural computations (including methods from geometry, graph theory, and statistics) for theoretical questions as well as brain imaging for applications to epilepsy and depression.

Measuring International Law through Piracy

BY EUGENE KONTOROVICH

My work uses the international response to piracy, both historical and contemporary, to assess the effectiveness of international criminal law and cooperation. Recent decades have witnessed the unprecedented growth of international criminal law and institutions. These developments are seen widely as signs of international law's maturation: it now directly regulates individuals and is backed by criminal sanctions. Scholars and activists now imagine a future in which a cosmopolitan international law will break through national self-dealing to bring "an end to impunity" for atrocious crimes, fostering a world based on norms rather than power. On the other hand, some worry that internationalization will come at the expense of accountability and democracy, or simply dress geopolitical vendettas in legal robes.

The current debates about international justice remain mostly normative and theoretical. To the extent that they invoke precedent and evidence, they are drawn from the small universe of international criminal cases in the past two decades. It is evident that the modern international criminal justice system is not fully developed. The much vaunted International Criminal Court, for example, has only convicted one defendant. Its future efficacy and consequences cannot be assessed or predicted from its present embryonic state. Piracy provides a unique study in the progress and potential of international criminal law. For hundreds of years it has been a universal jurisdiction crime—one which any nation can prosecute, even with no connection to the offense. Indeed, the modern regime of international criminal justice was inspired by the legal treatment of piracy. Studying the legal treatment of piracy allows one to see what a fully matured system of universal justice would look like.

Piracy is also very much a current challenge, as demonstrated by the unprecedented resurgence of robbery on the high seas in the Gulf of Aden. It offers a yardstick against which to measure the progress of international law from the nineteenth century to today. It provides a historical and empirical perspective on much debated questions, such as the limits and promise of universal jurisdiction, the willingness of nations to sacrifice their own treasure, soldiers, and sovereign prerogatives for the sake of global justice, and the extent to which international norms have been internalized by international actors.

Piracy is a perfect test case for the potential of modern international criminal law precisely because the latter has a much more ambitious agenda, dedicated primarily to punishing war crimes and violations of human rights by governments. International criminal law today seeks to go after national leaders and to insert itself into armed conflicts. This inevitably provokes significant opposition from the governments involved. Pirates by contrast are relatively isolated and vulnerable individuals, with no political



Capture of suspected pirates in the Gulf of Aden

agenda or sympathizers.

Yet international law, even today, has proven entirely inadequate to address ordinary sea robbery. After the outbreak of Somali piracy in 2007, the United Nations Security Council passed numerous resolutions, the UN issued many reports and studies, and international lawyers worked to create an international court to try the pirates. Yet the strong international effort, backed by broad treaty language authorizing strong measures against piracy, did nothing to stop the attacks.

As my research shows, only a tiny fraction of high seas pirates face international justice. Of those pirates captured, over 90 percent are released. While piracy is the original universal jurisdiction offense, only five countries in modern times have invoked this tool against sea robbery. Further, the European

nations most aggressive about expanding universal jurisdiction to war crimes and other high profile offenses have explicitly ruled out using it for piracy, which has far fewer political overtones than the more high profile crimes.

Nations are not motivated to prosecute piracy because doing so is costly and diverts scarce judicial resources to redress crimes that do not directly harm the prosecuting nation. But that is always true of universal jurisdiction—it is a kind of judicial foreign aid. Piracy shows that making something an international crime and subjecting it to universal jurisdiction does not guarantee any actual exercise of universal jurisdiction. The endorsement by nations of universal jurisdiction as an international legal norm seems almost entirely unrelated to their willingness to put it into practice. Moreover, the fact that nations are uninterested in prosecuting "ordinary" but apolitical international criminals (pirates), even as they pursue much more difficult cases against leaders of foreign governments for war crimes, suggests there is a heavy element of politics in the decision making of countries to exercise universal jurisdiction.

In the past year, Somali piracy has fallen considerably. This appears to be largely a function of the significant increase in the use of armed guards by shippers—previously, vessels transited the Gulf of Aden entirely defenseless. Ultimately force and private initiative have proven more important to reining in the paradigmatic international crime than the robust international legal regime designed to deal with such crimes. ■

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SEX TRAFFICKING (Continued from page 5)

went out of business. In addition, since legal residence in the Netherlands was now a requirement for sex workers, and more than 85 percent had been illegal migrants in the first place, many left for neighboring Belgium or Germany where their papers were less likely to be checked. In Stockholm, I found that feminist-led campaigns against purchasing sex, and its resultant criminalization, led to more dangers for street-based sex-workers, who now had fewer choices in choosing clients. As in the other two cases, the new Swedish law served primarily to push burgeoning markets behind closed doors or to other parts of the city. Crucially, all of these policies—decriminalization, legalization, and criminalization—were offered up as different kinds of enlightened, feminist-friendly solutions to the problem of prostitution and were framed in terms of "women's interests." Crucially, too, all three of these policies yielded similar effects: the removal of economically disenfranchised and racially marginalized streetwalkers from gentrifying city centers; the de facto tolerance of a small tier of predominantly white and relatively privileged indoor sex workers; and the increased policing of illegal migrant workers, pushing them further underground.

My current research on the politics of trafficking begins where my earlier research left off, temporally, empirically, and theoretically. In this new work, I am considering the various constituencies who have resurrected the issue of the "traffic in women," as well as the impact of this framework upon the sex workers it purports to help. One of the things that I have found is that the various constituencies who have pushed for the anti-trafficking frame have been united not only by a politics around gender and sexuality (i.e., a commitment to an ideal of amatively coupled heterosexual egalitarianism, one that cannot imagine a place for prostitution outside the scope of exploitation) but also by an unspoken commitment to a particular carceral agenda, in which the pursuit of "women's human rights" is envisioned primarily in terms of criminal justice. Crucially, the unspoken sexual and carceral assumptions that prevail among these well-intentioned social activists can often wind up doing more harm than good.

Contemporary anti-trafficking campaigns have been far more successful at criminalizing marginalized populations, enforcing border control, and measuring the compliance

of other countries with human rights standards based on the curtailment of prostitution than they have been at issuing any concrete benefits to victims. This is true both within the United States, where pimps can now be given 99-year prison sentences as sex traffickers and where sex workers are increasingly arrested and deported for the sake of their "protection," as well as elsewhere around the globe, where the U.S. tier-ranking of other countries in its annual *Trafficking in Persons Report*, and associated economic sanctions, have led to the tightening of borders internationally and to the passage of punitive anti-prostitution policies in numerous countries.³ The accelerated arrest of sex workers is particularly ironic, given that sex workers themselves are likely to describe prison, not prostitution, as tantamount to slavery. Increasingly, heightened policing, arrests, and incarceration have become the surprising political core of many activist agendas on behalf of "women's human rights."

My own research seeks to reveal such paradoxes, but also to do more. The sociological study of sexual labor reveals a more general methodological problem that has beset many social researchers. There is no "thing in itself" beyond how it is framed, because the discursive apparatus that surrounds the issue determines what you can see, how the problem is defined in the first place, and the possible moral and political responses that can emerge. For example, is the "problem" of trafficking one of sex, of migration, of criminal networks, or of global social inequalities? My project seeks to explain how particular frameworks arise and the kinds of solutions that get embraced, as well as the reasons that other possible interventions have often been foreclosed. In doing so, I aim not only to reframe the problem of "sex trafficking," but also to better understand the politically complex laws, policies, and social actors that together endeavor to stop it. ■

- 1 See Elizabeth Bernstein, *Temporarily Yours: Intimacy, Authenticity, and the Commerce of Sex*. Chicago: University of Chicago Press, 2007.
- 2 Abraham Flexner, *Prostitution in Europe*. Introduction by John D. Rockefeller Jr. New York: The Century Co., 1914.
- 3 See, for example, Richard Iserman, ed., *Rethinking Human Trafficking*. Woodrow Wilson International Center for Scholars Occasional Paper Series, Middle East Program and United States Studies, Summer 2010.

The Sound of Scholarly Serendipity

BY W. ANTHONY SHEPPARD

When I arrived at the Institute last September, I thought I knew exactly what I would accomplish as a Member in the School of Historical Studies—I would complete my book, *Extreme Exoticism: Japan in the American Musical Imagination*, and would launch a new project on vocal timbre in twentieth-century music. By January, having made reasonable progress, these goals still appeared attainable. However, through a chance encounter with a nineteenth-century musical artifact, my carefully crafted research schedule was completely derailed. This opportune encounter led me to make a series of discoveries concerning two of Puccini's operas and to develop insights into the global circulation of music over the past two centuries.

My wife and I had promised our children we would occasionally visit our home during the year. The distance between Pownal, Vermont, and Princeton, New Jersey, proved crucial to the direction my research would take. The drive is just long enough to invite stops at cultural and natural attractions in northern New Jersey. As graduate students at Princeton in the early 1990s, we had visited the Morris Museum in Morristown to view its collection of American art. I was aware that the museum had since dramatically expanded its holdings to include the Guinness Collection of mechanical musical instruments and automata, and so we decided to visit again last January. I soon discovered that scholarly serendipity may strike in surprising settings.

From a minute musical ring to the blaring of a mammoth orchestration, we experienced technological wonders at the Morris that somehow seemed more magical than the smart phones in our pockets. As we reached the room displaying music boxes, our children ran ahead to check out the self-playing banjo and the chair that emits tunes at each sitting. Alone in that room, the Chinese writing on the tune sheet of one particular box caught my eye. I recalled that Giacomo Puccini was known to have heard a “Chinese” music box in 1920 from which he borrowed melodies in composing his final opera *Turandot*. As I listened to a recording of several tunes from this ca. 1877 “harmoniphone”—a Swiss-made, six-tune cylinder music box with reed organ—I was bewildered. The four tunes the curator had selected for the audio wand included two I instantly recognized as sources for major themes in *Turandot*. This in itself was extraordinary. However, I also noted that another of these Chinese melodies was nearly identical to a major theme in Puccini's *Madama Butterfly* (1904–06), an opera set in Japan. I suddenly realized that Puccini must also have turned to a music box for exotic inspiration some eighteen years prior to the composition of *Turandot* (1924).

Musicologists have long sought the sources of two themes in *Madama Butterfly* that are most closely associated with the titular heroine. The assumption has been that these melodies—like others in the opera—have a Japanese origin or that Puccini composed them in imitation of Japanese music. However, it is now clear that Puccini's devotion to “exotic authenticity” has been somewhat exaggerated. The music box provided a Chinese answer to these two mystery tunes and led to conclusions reaching far beyond melodic identification, the opera, and even Puccini himself. Five months of intensive historical and analytical research at the Institute revealed that the Chinese melodies played by this box ultimately link a nineteenth-century Swiss watchmaker to several of the most important themes in *Madama Butterfly* and *Turandot* and to music heard in U.S. World War II propaganda films and at the 2008 Beijing Olympics.

Other surviving Swiss music boxes from the period include these melodies. However, the Guinness box crucially preserves its original tune sheet, listing the song titles in nonstandard transliteration and in Chinese characters. Thus, the Guinness box serves as something like a Rosetta stone for this historical project. The main melody associated with *Butterfly*, and heard at such moments as

the climax to her entrance and at the very end of Act I, is “Shiba mo,” or “The Eighteen Touches,” one of the most frequently banned erotic folk songs in China. The specific moments in which this tune appears in the opera suggest that Puccini was well aware of the song's erotic subject matter. This new knowledge reinforces the argument that Puccini's initial conception of *Butterfly* in its 1904 version was rather more cynical, critical, and comic than the more melodramatic 1906 version heard today. The second motif associated with *Butterfly*, heard particularly at moments in the opera when her deceased father is men-

tioned, occurs within two of the melodies on the Guinness box. One of these melodies was used as the Emperor's theme in *Turandot*; thus, there is a musical connection between these two Orientalist operas that has gone unnoticed until now and that the Guinness box helps to make clear. Furthermore, it is now evident that Puccini not only borrowed these melodies but attempted to emulate the tinkling sound of the cylinder and the reed organ section of the music box in his orchestrations. The tune sheet on the Guinness music box reveals that this box was exported from Switzerland and was offered for sale at a famous Shanghai department store. The stamp of a Rome repair shop indicates that the box was brought to Italy prior to 1912. This and other clues suggest that the Guinness box may very well be the one that Puccini heard as he set out to compose Act I of *Butterfly*.

I have discovered that the Chinese tunes appearing on Swiss music boxes exported to China were collected for this purpose in 1845 by Frederick “Fritz” Bovet, a member of the famous Bovet family of watchmakers. Puccini's encounter with Chinese tunes was thus mediated by a Swiss watchmaker's transcriptions in China and then by the Swiss music box manufacturers who pinned these melodies onto the music box cylinders. Of course, an unmediated experience of an exotic musical tradition is impossible in any case given that our own musical ears are profoundly shaped by personal and cultural musical histories. The most famous Chinese song, now commonly referred to as “Mo-li-hua” (“Jasmine Flower”), was one of the ten tunes collected by Bovet and was repeatedly

placed as the first tune on these Swiss music boxes. By featuring this melody prominently in *Turandot* after hearing it on a music box, Puccini ensured that the song would continue to represent China musically throughout the twentieth century. Indeed, the melody was featured prominently even during the 2008 Beijing Olympics. However, when news of the 2010–11 “Jasmine revolution” in Tunisia began to spread, the Chinese government attempted to suppress this most beloved Chinese song, “Jasmine Flower,” and even the flower itself.

It is somehow both disconcerting and invigorating to realize that what will likely stand as my most notable historical contribution is one I had no intention of making. A rather unadorned musical object that includes multiple traces of its well-traveled history as well as a particular seventeen-second tune has functioned for me as a crucial shard, a missing manuscript fragment that prompted a reexamination of the musical past. Likewise, the pursuit of false leads proved surprisingly valuable. For example, only after searching in vain for a transcription of “Shiba mo” in the collections of

eighteenth and nineteenth-century Jesuit missionaries did I realize that the music box manufacturers likely had another unique source for their Chinese tunes. Throughout my career I have repeatedly looked for an x only to find an entirely unsuspected y that, quite often, has led to a more significant and interesting project.

The Institute justifiably prides itself on being conducive to interdisciplinary study and for fostering collaborative work. However, I doubted that my research projects would profit directly from lunchtime conversation with classicists, Medievalists, and historians of nineteenth-century China. Once again, I was mistaken. I am indebted to multiple colleagues at the Institute for assisting me with this project. The enthusiasm expressed each day at the historians' lunch table spurred me on. I benefited from Professor Glen Bowersock's keen interest in the details of my discoveries, insights from Ping Wang and Kenneth Pomeranz concerning Chinese language and history, and Christopher Stray's suggestions for tracking down Bovet. Christina Kiaer and Marjorie Woods must be credited for the decision to direct my initial report at the broadest possible readership. By April, I felt that if I was unable to earn one of Israel Gershoni's inimitable lunchtime cheers of “unbelievable” with my latest report, I had simply not worked hard enough that morning. The extraordinary support of the staff in the Historical Studies Library and School, and the exceptional resources of the Princeton University libraries, enabled me to move very quickly on this project.

Much to my surprise, I culminated my year at the Institute by publishing an article on this research on the front page of the *New York Times Arts* section on Sunday, June 17. To date, it has appeared in French, Spanish, and Portuguese, and a Chinese translation is in progress. I have received correspondence of all kinds, including—perhaps most bizarrely—a poem written in tribute to my article, and I have recently been informed that an Off-Broadway play based on the life of Puccini is being reworked to incorporate aspects of my research. Needless to say, none of this was remotely on my mind as I set out to pursue my research agenda at the IAS last September. I now plan (if I may still be permitted to employ that word) to complete an academic article on this research in the near future. It simply would not have been possible for me to make such progress on this project without working at the Institute. Indeed, I am quite certain that without the invitation to spend a year at the IAS, I would never have heard these particular serendipitous sounds at all. ■



The Morris Museum “Harmoniphone”—a Swiss-made, six-tune cylinder musical box with reed organ, ca. 1877—and its crucially preserved original tune sheet, listing the song titles in nonstandard transliteration and in Chinese characters

Five months of intensive historical and analytical research at the Institute revealed that the Chinese melodies played by this box ultimately link a nineteenth-century Swiss watchmaker to several of the most important themes in *Madama Butterfly*.

W. Anthony Sheppard is Professor of Music and Department Chair at Williams College and was the Edward T. Cone Member in the School of Historical Studies in 2011–12. He is the author of *Revealing Masks: Exotic Influences and Ritualized Performance in Modernist Music Theater*, and he frequently lectures for the Metropolitan Opera Guild.

facilitator, or adviser to negotiators, have mostly been between a country's government and a population group within that country seeking a cultural or political autonomous status, a special constitutional arrangement, or independence. In these kinds of conflict, history typically plays an important role. The entrenched and deeply felt "truth" of the respective perceptions of history on each side of a conflict contributes to its intractability and constitutes a serious obstacle to its resolution, in some cases literally blocking the negotiations and therefore the peace process.

The justice or injustice of past actions is felt and argued on the basis of each side's understanding of history; parties also view their rights and make substantive claims on that basis. Even where it is not made explicit, a party's belief in or use of a particular interpretation of history is the fundament on which it builds its claims, positions, and expectations. Mediators too often trivialize arguments put forth by negotiating parties on the basis of history, especially if the latter invoke things that took place centuries ago and use sources and accounts that may be specific to a culture and unfamiliar to the mediator or those that he/she does not consider credible. Some mediators exhibit impatience and irritation at those who dwell on the past and thereby ostensibly inhibit progress in resolving the conflict. Others focus on getting parties to come to a shared understanding of specific events in the past. And some, like myself, find themselves listening all too patiently to repeated passionate historical accounts, week after week, month after month, and, in some instances, year after year.

To be sure, if parties are able to set aside their differences with respect to their pasts, it becomes much easier to look at new ways to coexist in the future. And this is precisely the challenge we face: *how can mediators work with parties to address convictions and arguments grounded in perceptions of history, knowing that these inform the parties' aspirations and positions?*

I have chosen the approach of delving deeply into history, not with the intention to establish the truth or prove respective perceptions right or wrong, but to understand how they arose and what sustained the divergent historical narratives that live on today. Many intrastate conflicts can

Michael van Walt van Praag joined the School of Historical Studies as a three-year Visiting Professor in November 2011. He is an international lawyer and mediator, specializing in intrastate conflicts worldwide. He has also served as adviser to parties in peace processes and to governmental organizations involved in such processes. He has worked in conflict regions ranging from Chechnya to the Niger Delta and is currently Executive President of Kredha, an international nongovernmental organization for the prevention and resolution of intrastate conflicts, which he cofounded in 1999.

be traced to the effects of colonialism, to the actions of political leaders in response to the newly emerging world order centered on European concepts of international law and equality of "civilized" nations, and to the transformation of empires into nation-states. To understand the significance of what happened, and to appreciate differing interpretations by conflicting parties of the legitimacy of the new states and power relations, we need to go further back in history and study the nature of the polities that existed and of the relations they maintained with one another before then.

With the help of historians, political scientists, social anthropologists, and other scholars, I am testing, among others, the following hypotheses:

- placing history and historical perceptions in the context of their historical periods rather than interpreting history retroactively from a present-day frame of reference can help undo some of the loaded modern political and legal reinterpretations of past relationships that tend to inform the perceptions of conflicting parties;

- placing the history of a people or state, or that of relations between them, in the broader context of regional, continental, or even world history can recast the discourse from a predominantly bilateral focus to a multilateral and more complex one that could challenge some of the assumptions contained in the simpler, often mutually exclusive narratives;

- recognizing and understanding the nature of the different world views that existed, and possibly still exist, which largely determined the manner in which historical events and relationships were interpreted and explained, sheds light on some of the sources of divergent interpretations;

- exposing how, by whom, and why certain historical narratives informing today's perceptions and convictions were developed may contribute to a more realistic appreciation of the value of historical narratives.

This approach, if valid, should help in the search for ways to address the hold that absolute and exclusive views of the "truth" of particular narratives and perceptions have on parties as well as diminish the ability of some to knowingly use false or distorted representations of history for their gain. It might also create avenues for different, less absolute or exclusive and incompatible, historical perceptions to coexist.

Conflicting perceptions of history play a role in violent conflicts and can hold peace processes hostage anywhere in the world. Given my own experience in various parts of Asia, where such problems are very prevalent, I set out, with the help of leading scholars in the field, to find new ways of addressing this phenomenon by looking more closely at perceptions of history in that continent. The methodology, if found valid and helpful, could be applied in other parts of the world as well.

In East, Southeast, North, and Inner Asia, over the course of centuries, the existence and coexistence of seemingly incompatible interpretations of events and of relations among polities and leaders developed, rooted in distinct world views. For long periods of time, the Mongol Chinggisid conceptualization of the state and empire, of the legitimacy of rulers, and of the place of Chinggis Khan's descendants in the world as they understood it coexisted with a Confucian world order in which all relations of the emperor, the Son of Heaven, with other leaders could only be portrayed as unequal ones between a supreme and benevolent ruler and subservient supplicants, and a Tibetan Buddhist world view in which the religious teacher was supreme and worldly leaders gained merit by protecting and supporting their teacher and showing him devotion. In Southeast Asia, Buddhist narratives of universal rulership (*chakravartin*)—for example, of Burmese monarchs—similarly coexisted with other seemingly contradictory Confucian narratives of subjection projected by the emperors of China.

The above admittedly simplistic characterizations are in no way intended to imply that relations were always harmonious and peaceful. War, conquest, looting, and pillaging occurred in all parts of Asia at various times in the past centuries. The different renditions of reality themselves, however, did not, for the most part, render them mutually exclusive in practice despite the political consequences they undoubtedly had.

A layer of complexity was added with the advent of self-serving European concepts of international law, including those of exclusive sovereignty and territorial ownership, the law of conquest and title, and the nation-state concept, as well as the division of the world into civilized and not-civilized nations, which pushed Asian rulers to recast their understanding and representation of their own state's place in the world and of their relations with others in ways that would secure for them a dignified place in the emerging world order of the nineteenth and early twentieth centuries. The tensions caused by this transformation of traditional Asian state and empire formations are still felt today as arguments of history and international law—infused with nationalist rhetoric and used to justify the unwilling incorporation of peoples and territories into newly reconfigured nation-states—are still contested. By gaining a deeper understanding of the complexities of historical relations on the Asian continent, and by testing the hypotheses mentioned above, I hope to develop an effective method that mediators can apply to overcome the recurring obstacles posed by conflicting perceptions of history in intrastate peace processes. ■

* The terms *armed* or *violent conflict* and *war* are used interchangeably in this article to denote organized use of force by two or more groups (the parties to the conflict) in the pursuit of political and sometimes economic goals.

After Hours Conversations

The After Hours Conversations program, launched in February 2008 to encourage inter-School conversations in an informal and relaxed environment, continues in 2012–13. Talks are held in Harry's Bar every Monday and Thursday, beginning at 5:00 p.m., in October and November and again in February and March. After a ten-minute presentation of a theme or problem of broad significance, there are twenty minutes of lively group discussion, often followed by continuing conversation as people linger over drinks. The bar opens thirty minutes prior to the informal talks, which begin at 5:30 p.m., and stays open until 7:00 p.m.

The conversations in the fall term covered topics as varied as genetic history, Aristotelian discourse, the shape of data, and marriage market imbalances. Following are a few impressions of the program as perceived by prior speakers who have also attended as audience members.

- *I think it is a terrific format in which an intense, concentrated, enjoyable discussion can take place and, moreover, it is between Institute Members from different disciplines and with different perspectives, who can also meet and mingle.* —Steven Lukes, School of Social Science



Juan Maldacena, Professor in the School of Natural Sciences, spoke about black holes in November.

- *The format is great in its stringency, it's challenging and interesting to do, and I also found it extremely pleasant to attend. . . . I felt that the audience was very interested, positive, and welcoming, both during my talk and when attending others.* —Elke Markert, School of Natural Sciences

- *What I found most satisfying is the fact that the audience gets a lot of stimulation from the speaker but learns from other participants in the audience—this, I gathered, was probably the original idea.* —Jochen Bruening, School of Mathematics

- *Ernest Rutherford believed that any theory you can't explain to a bartender isn't likely to be a very good theory. The audience at Harry's Bar is as sophisticated as any, but the ten-minute, no-notes presentation format encourages a direct approach in the same spirit as Rutherford's adage. The After Hours Conversations also offer a valuable opportunity to discuss questions at the boundary of one's discipline.* —Philip Ording, Program in Interdisciplinary Studies

- *Ten minutes of hearing a world expert speak, even, or perhaps especially, about areas of knowledge I knew nothing about, was completely seductive. And my expectations, which were high, were always surpassed.* —Marjorie Woods, School of Historical Studies ■

For a schedule of After Hours Conversations and to learn more about the program, visit www.ids.ias.edu/after-hours-conversations.

Play Reading at the Institute



Participants in a recent play reading, from left: Indu Devi Prasad, Gopal Prasad, Freeman Dyson, Imme Dyson, and Annette Munt

Annette Munt, spouse of Jonathan Israel, Professor in the School of Historical Studies, writes:

Once a month, from October until April, a group of play reading enthusiasts from all parts of the Institute community gather in the living room of Marquand House (the IAS guest house at 150 Stockton Street) and assume character roles in a stage play. When the winter chill sets in, an open fire adds a cozy glow and encourages lingering for a lively discussion after the reading.

Play reading at the Institute started around 1965–66, and for several years took place in the home of Professor Freeman Dyson. He remembers that a lively group of French IAS Members were actively involved in its beginnings. They read a wide variety of plays by Edward Albee, J. M. Barrie, Anton Chekhov, Friedrich Dürrenmatt, T. S. Eliot, Robert Greene, Henrik Ibsen, Mark Medoff, Jean-Paul Sartre, George Bernard Shaw, Stephen Spender, Oscar Wilde, and Peter Weiss, among others.

“We probably read most of these in the years when the group was active in our home, perhaps 1965–73,” recalls Professor Dyson. “I think we tried *The Cocktail Party* by Eliot. He was invited to the Institute in the hope that he would write a masterpiece, and I remember Oppenheimer saying that it was the worst thing he ever wrote, and it certainly is not a great play [chuckles]. But Eliot did write some wonderful plays, like *Murder in the Cathedral*. Eliot wrote it long before he came here. It is a masterpiece.”

When the Dysons went on a sabbatical, in 1973, play reading stopped and was not revived for some years. With the arrival in 1987 of Mildred Goldberger, wife of Marvin [“Murph”] Goldberger, IAS Director from 1987–91, it was renewed and held in Marquand House. Charlotte Langlands, artist and spouse of Professor Robert [“Bob”] Langlands of the School of Mathematics, recalls, “As chance would have it, the same year Susie Burke came with her husband Charles [“Chas”] Beichman, an infrared astronomer and IAS Member for two years. Susie was an actress, a director, and a producer and was in charge of a small theater somewhere in the Los Angeles area. Mildred took a great interest in the founding of a play reading group. She was very enthusiastic, and Susie was very

experienced and charismatic.”

After Susie and Chas left the Institute (with a new baby in tow!), Charlotte led the play reading. She compiled a list of the plays that Susie had left behind for the benefit of the group, and the stacks of copies that Charlotte started, and her successors continued, have over the years piled up to a veritable mountain of texts, deposited in the basement of the Institute’s activity center.

When Charlotte and Bob Langlands went on a sabbatical, Allen Rowe (at the time Associate Director and Treasurer of the Institute) stepped in to head the play reading, until Donne Petito, Administrative Officer for the School of Social Sciences and a professionally trained actress, still active with several community theaters in the area, took over for Allen.

“During the first year, we did the theme ‘Science on Stage,’” says Donne. “I knew a playwright in New York, Arthur Giron, who had written a science-related play about the life of Nobel Prize-winning physicist Richard Feynman. People here knew him; some had known him personally. I wrote asking for a copy of the play, and he replied, ‘What if we came down there and did it?’ I said, ‘Well, we don’t have any money to pay you, and how would we get the actors?’ Well, he managed to get the actors to come to the Institute. All we did was give them dinner, and maybe paid their train fare, and they did it as a staged reading, with a little bit of movement, but mostly just sitting. They were professional actors, and that was a kind of nice hook for getting people interested that year in the play reading group. We did it at Wolfenson Hall and had a reception afterwards.”

Donne organized the play readings for twelve years; due to her deeper involvement with acting, I took on the play reading last autumn. Faculty, Members, Staff, and spouses and partners are cordially invited to join this year’s play reading series, which will run through April and explore “Art for Art’s Sake.” The readings are not performances, so you need not be experienced. All are welcome, even those who just wish to listen.

For more information or to be included on the contact list for the play reading series, please forward your name and email address to amunt29@hotmail.com. ■

S. T. Lee Gift Triples Fund and Income for Historical Studies

The Dr. S. T. Lee Fund for Historical Studies was established in April 2007 with a gift from philanthropist Lee Seng Tee, Director of the Lee Pineapple Company, a Singapore-based conglomerate of firms that include rubber, pineapple, banking, and investments. This endowed fund, which enables the Institute to hold important international colloquia with public lectures as a key component, has resulted in many benefits to the Institute, including the exchange of ideas between different disciplines represented within the School and engagement in deep discussions about emerging developments.

Increasingly, Faculty in the School have sought to hold a greater range and depth of colloquia. In response, Lee doubled his contribution to the endowed fund this fall. It

was an auspicious time to increase his gift as the funds will be matched from the \$100 million challenge grant from the Simons Foundation and the Charles and Lisa Simonyi Fund for Arts and Sciences that launched the Institute’s four-year \$200 million campaign in 2011. The gift from Lee, a Foreign Honorary Member of the American Academy of Arts and Sciences and an Honorary Fellow of the British Academy who supports institutions of higher education through his Lee Foundation, effectively triples the fund and the annual income available to the School of Historical Studies. It also advances the Institute’s mission and increases public awareness of some of the most important historical issues of our time. For more information about giving to the Institute, visit www.ias.edu/campaign. ■

In Xanadu or A Vision of the Institute

In Xanadu, did Flexner plan
A stately Institute to be,
Where Stoney Brook to Raritan
Passed Princeton’s taverns measureless to man,
Down to sunny Carnegie.
On five quarter sections’ field and wood
A chimneyed Hall they built, called Fuld.
And there were shady lawns, and fountains free
That watered the magnolia trees.
And here were woods of oak and myrtle,
Which Members ancient as the sky
Haunt with strange, insistent cry;
The ghosts of Einstein, Weyl, and Gödel,
Erase! Do Not Erase! echo among the trees, and die.
Nor Grove nor Porch nor Stagirite’s Lyceum,
Could such distinguished ranks display—
The owl of Minerva here flies all day—
That tourists even come to see ‘em.
And for the vagrant Members’ ease,
A slew of Bauhaus flats to lease.
Through wood and park the vagrants ramble,
Lost in their thoughts, and in the brambles;
Then all troupe back to dining room,
To take their honey-dew at noon,
Once sated, wander off again,
To dream on through the afternoon.
But oh! across those lawns that ran
Down to the Brook, by Olden Lane—
A savage place! far from the taverns measureless to man,
There von Neumann, banished from his kind,
Presumed to build—an Artificial Mind!
The pristine woods of sacred Theory
Tainted were with Practice dreary.
But midst the din rose from afar
Trustees’ voices prophesying war!
So banished was the ECP;
The building’s now a nursery,
And nevermore will sordid Use
Intrude on imperturbable Nous.
Einstein walking on the grounds
In a vision I espied;
And lo! the fields him all around
Suddenly were unified.
And I heard Witten touch his Strings;
Such music came from cosmic lute,
Could I but call his song to mind,
The quantum melody entwined,
I’d build my very own Institute,
And all who saw it dazzling there,
Should cry, amazed, Beware, beware
His blood-shot eyes, his unkempt hair;
Weave a force field round him thrice,
And take away his office key,
For he, with cookies and with tea,
Hath drunk the milk of paradise.

—W. Roy Laird, Member (2007–08) in the School of Historical Studies



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IAS The Institute Letter

Fall 2012



BRUCE M. WHITE

Truth and Beauty

The need for an official Institute seal (above) was one of the first things that Abraham Flexner, founding Director of the Institute, turned his attention to even before preliminary financial and practical arrangements were in place. In this issue, **Irving Lavin**, Professor Emeritus in the School of Historical Studies, and his wife and colleague, **Marilyn Aronberg Lavin**, trace the seal's origins and influences—among them the final couplet of John Keats's "Ode on a Grecian Urn"—and articulate why and how its elements and design embody the rare and very modern mission of the Institute (page 6). "The radical nature of Flexner's twinning of science and humanism with truth and beauty arose in part from the radical nature of his concept for a 'modern' university," writes Irving Lavin, "by which he meant a university devoted exclusively to the pursuit of higher learning for its own sake and without regard to practical value."

At the Institute, scholars and scientists seek truth and question claims of it. Mathematicians have long been motivated by beauty in mathematics, compelled to find the most elegant proof and often referring to mathematics as a form of art, writes **Mina Teicher**, Visitor in the School of Mathematics (page 1). Teicher explores the mathematics of beauty itself, equating beauty to an absolute term (up to cultural, geographical, and historical dependence) seen, for example, in the golden-section ratio of the most harmonious rooms and human bodies or the number of possible symmetries in a mosaic.

Mathematics, observes **Freeman Dyson**, Professor Emeritus in the School of Natural Sciences, is always full of surprises (page 1). With William Press of the University of Texas, Dyson recently found new strategies for the Prisoner's Dilemma, a game with a deep and subtle mathematical structure used by population biologists as a model for the evolution of cooperation. Dyson explains his reasons for doubting the relevance of the model, which focuses exclusively on individual selection—the death of individuals who make bad choices—and negates group selection in which the battle for survival is lost collectively rather than individually.

The power and complexity of collectivity are further explored in articles about resolving intrastate conflict by Visiting Professor **Michael van Walt van Praag** (page 1), controlling borders by Professor **Didier Fassin** (page 5), curtail sex trafficking by Member **Elizabeth Bernstein** (page 5), and curbing piracy by Member **Eugene Kontorovich** (page 8).

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