

At the Heart of the State

Exploring the moral world of institutions

BY DIDIER FASSIN



Inside a French Tribunal de grande instance (district court): "It is to the Law that Men Owe Justice and Liberty."

Moral economies represent the production, circulation, and appropriation of values and affects regarding a given social issue. Consequently, they characterize for a particular historical moment and a specific social world the manner in which this issue is constituted through judgments and sentiments that gradually come to define a sort of common sense and collective understanding of the problem. Thus, one can speak of the moral economy of asylum to characterize the transformations of values and affects

around the question of refugees: positively valued and emotionally charged in the 1970s and 1980s, when persecutions by Latin American and Southeast Asian dictatorships turned them respectively into heroes or victims, the figure of the asylum seeker was gradually modified to make way in the 1990s for the image of the "fake refugee," stirring mistrust whether he or she came from the Democratic Republic of Congo or Chechnya, Bangladesh or Haiti. Obviously, it is less the objective reality of the persecutions that has evolved than the subjective approach

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Unfashionable Pursuits, Leaps in the Dark, and Detecting Gravitational Waves

How the recent discovery of spacetime ripples began as a risky venture

BY FREEMAN DYSON

The Institute sometimes spends money on risky ventures, giving sustained support to people who work on unfashionable and dubious projects. One example of a risky venture was Einstein, who worked here for twenty years on unified field theories that never fulfilled his hopes. Another example was Joseph Weber, who worked on the design of gravitational-wave detectors that failed even more disastrously to fulfill his hopes.

Now we are celebrating the discovery of a real gravitational-wave signal emitted from a collision of two massive black holes. The discovery paradoxically proves both Einstein and Weber to have been both right and wrong. Einstein was right when he predicted the existence of gravitational waves, wrong when he published a paper claiming to prove that black holes could not exist. Weber was right when he invented and constructed the first detectors of gravitational waves, wrong when he claimed that his detectors had detected real gravitational signals.

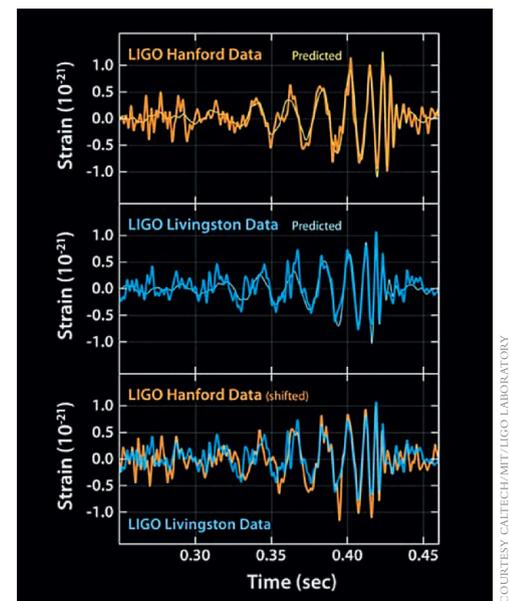
That is the way science works. Great scientists start new fields of science by making leaps in the dark. Nature decides which of the leaps is right and which is wrong. Very often, as in this case, the scientists who made the leaps are dead before Nature pronounces her verdict. The Institute can be proud that we supported both these great scientists with their risky ventures, more than half a century before Nature proved them right and wrong.

Joseph Weber came here three times as a visiting Member, in 1955, 1962, and 1969, each time on sabbatical leave from his job at the University of Maryland. He did not fit into the standard pattern of Institute postdocs. He was not interested in the fashionable topics that most of the young people were pursuing, particle physics and statistical mechanics and quantum field theory. He never

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Above: Member Joseph Weber, pictured at IAS in 1969–70, invented and constructed the first detectors of gravitational waves. Below: LIGO data plots from September 14, 2015, which confirm the detection of the same event at LIGO observatories in Louisiana and Washington, proving Einstein's prediction that gravitational waves exist. The plots show how closely the data aligns with the predicted waveforms resulting from the merging of two black holes, using the equations of Einstein's general theory of relativity.



Global Health Interventions in Africa

Why past failures must inform future approaches

BY JAMES WEBB



The World Health Organization's Malaria Eradication Program used synthetic insecticides such as DDT as a means of disease intervention, unwittingly promoting insecticide-resistant mosquitoes in tropical Africa.

Historical epidemiologists are beginning to explore the documentary record of interventions in tropical Africa to prevent the transmission of infectious diseases and reduce their prevalence. Some interventions against individual diseases began in the late nineteenth- and twentieth-century era of colonialism, when Europeans founded research institutes to investigate the challenges of tropical diseases and deployed their new medical knowledge in mobile campaigns to treat sleeping sickness, tuberculosis, yaws, yellow fever, onchocerciasis, and other diseases. In the aftermath of the Second World War, the newly founded

World Health Organization (WHO) provided expert advice to colonial and later independent African governments and encouraged a more global approach to disease control. In the late twentieth century, international and bilateral organizations, philanthropic organizations, nongovernmental organizations, and public-private partnerships in league with African governments have undertaken initiatives to control diseases and to shape health systems.

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News of the Institute Community

Thames & Hudson has published *Matisse in the Barnes Foundation* (2016), edited by YVE-ALAIN BOIS, Professor in the School of Historical Studies. Comprised of fifty-nine works from every stage of the artist's career, the work is a celebration of the Barnes's Matisse collection.

ANGELOS CHANIOTIS, Professor in the School of Historical Studies, was conferred the insignia of Doctor Honoris Causa, Faculty of Philosophy and Letters by the Université de Liège.

DIDIER FASSIN, James D. Wolfensohn Professor in the School of Social Science, has been awarded the Gold Medal of the Swedish Society for Anthropology and Geography for seminal scholarship in anthropology.

SABINE SCHMIDTKE, Professor in the School of Historical Studies, and HASSAN ANSARI, Member in the School, have been named executive editors of *Shii Studies Review* (Brill Academic Publishers) and consulting editors of the *Encyclopaedia Iranica* Board of Editors. Additionally, Schmidtke has edited the *Oxford Handbook of Islamic Theology* (Oxford University Press, 2016).

The Académie des Sciences d'Outre-mer has awarded the Prix Albert Bernard to GLEN BOWERSOCK, Professor Emeritus in the School of Historical Studies, for his book published in French under the title *Le trône d'Adoulis: Les guerres de la mer Rouge à la veille de l'Islam* (Albin Michel, 2014).

ROBERT DIJKGRAAF, Director of the Institute and Leon Levy Professor, and Co-President of the InterAcademy Partnership, has contributed to *Doing Global Science: A Guide to Responsible Conduct in the Global Research Enterprise* (Princeton University Press, 2016).

CARMELA VIRCILLO FRANKLIN, Institute Trustee and Director's Visitor, has been elected President of the Medieval Academy of America.

ERIC SCHMIDT, Trustee of the Institute, will chair the Pentagon's Defense Innovation Advisory Board, an initiative to bring the practices of management and innovation of Silicon Valley to the military.

SEBASTIAN CURRIER, Artist-in-Residence, has been elected to the American Academy of Arts and Letters, an honor society of the country's leading architects, artists, composers, and writers.

The Society for Classical Studies has awarded a 2015 Charles J. Goodwin Award of Merit to JOSHUA BILLINGS, Member in the School of Historical Studies, for *Genealogy of the Tragic: Greek Tragedy and German Philosophy* (Princeton University Press, 2014).

The American Philosophical Association has honored CAROL GOULD, Member in the School of Social Science, with the 2015 Joseph B. Gittler Award for *Interactive Democracy: The Social Roots of Global Justice* (Cambridge University Press, 2014).

ROGER BLANDFORD, Member (1974–75, 1998) in the School of Natural Sciences, has received a Crafoord Prize in Astronomy from the Royal Swedish Academy of Sciences for his fundamental work on rotating black holes and their astrophysical consequences.

The Royal Swedish Academy of Sciences has awarded a Crafoord Prize in Mathematics to YAKOV ELIASHBERG, Member (2001–02) in the School of Mathematics, for the development of contact and symplectic topology and discoveries of rigidity and flexibility phenomena.

YOHANAN FRIEDMANN, Member (2002) in the School of Historical Studies, has been awarded the 2016 Rothschild Prize in the Humanities and the 2016 Israel Prize in Near Eastern Studies.

The National Science Foundation has awarded a National Medal of Science, the nation's highest scientific honor, to SIMON LEVIN, Member in the Schools of Natural Sciences (1999) and Social Science (2008–09).

NICHOLAS PAUL, Member (2009–10) in the School of Historical Studies, has received the Medieval Academy of America's 2016 John Nicholas Brown Prize for *To Follow in Their Footsteps: The Crusades and Family Memory in the High Middle Ages* (Cornell University Press, 2012).

The American Academy of Religion has honored WINNIFRED FALLERS SULLIVAN, Member (2010–11) in the



The Institute for Advanced Study website was relaunched in April with enhanced functionality and a clean, bold design. New features include an Ideas section that highlights Institute research; enriched scholar profiles; and dynamic portals to IAS history, news, and events. The Institute has also produced its first-ever film, which you may view at www.ias.edu/ias-video.

School of Social Science, with an Award for Excellence for *A Ministry of Presence: Chaplaincy, Spiritual Care, and the Law* (University of Chicago Press, 2014).

ANDREW WILES, Member (1981, 1992, 1995–2004) and Visitor (2007–11) in the School of Mathematics, and a former Trustee of the Institute, was honored with the 2016 Abel Prize for his proof of Fermat's Last Theorem by way of the modularity conjecture for semistable elliptic curves.

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David Lang Appointed Artist-in-Residence

Steven Holl to Design Rubenstein Commons



Steven Holl's watercolor concept sketches for the Rubenstein Commons

The Institute for Advanced Study has selected Steven Holl Architects to design its new Rubenstein Commons, named after Institute Trustee David M. Rubenstein.

"We are incredibly pleased to be working with Steven Holl Architects on this exciting project," said Robert Dijkgraaf, Director of the Institute and Leon Levy Professor. "The Rubenstein Commons will provide a greatly needed space for enhanced social engagement and academic collaboration, and Steven and his team will bring a rich and varied level of experience to help us achieve these goals."

The Rubenstein Commons will support community and academic life on the IAS campus, promoting communication and collaboration through a variety of social and meeting spaces. Providing a communal and flexible gathering place for the Institute's research community, the building will offer a space for the display of images and materials that tell the story of the Institute's heritage, extraordinary scholarly community, as well as current and future efforts.

Questions and comments regarding the *Institute Letter* should be directed to Kelly Devine Thomas, Editorial Director, via email at kdthomas@ias.edu or by telephone at (609) 734-8091.

Issues of the *Institute Letter* and other Institute publications are available online at www.ias.edu/publications.

Articles from issues of the *Institute Letter* are available online at www.ias.edu/ideas.

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considered himself in any way equal to Einstein, but he was in some striking ways similar to Einstein. Both came into academic life late, after spending several years in a job concerned with practical engineering. Einstein acquired his engineering background in the Swiss Patent Office, Weber in the United States Navy. Both of them made important contributions to quantum mechanics, Einstein with the theory of the photoelectric effect, Weber with the theory of the coherent emission of light by lasers. Both of them chose gravitation as the main problem that they spent the greater part of their lives exploring. Both of them continued to explore gravitation through long decades when the subject was unfashionable. Both of them were stubborn as mules when their beliefs were challenged. Einstein never accepted the possibility of black holes, and Weber never accepted the possibility that his detectors were detecting internally generated noise.

I remember with pride and joy the years when Joe Weber was here at the Institute. We argued endlessly about the possible meaning of the signals that he was monitoring every day with his detectors. If they were real gravitational waves emitted by extraterrestrial sources, it should have been possible to calculate the behavior of the sources theoretically. If they were environmental or internally generated vibrations, then it should have been possible to simulate them experimentally. We tried both ways, and neither way succeeded. But Joseph Weber, like Einstein, never gave up hope.

The history of gravitational waves is a fine example of the general rule, that big scientific advances require a combination of new ideas with new tools. Einstein and Weber provided the ideas, the theory of general relativity and the design of a mechanical detector of gravitational waves. The testing of the ideas failed because two essential tools were missing. The missing tools were a detector of adequate size and sensitivity to separate real extraterrestrial signals from noise, and a computer algorithm of adequate power and stability to calculate numerically the precise wave-forms of naturally occurring signals.

Recommended Viewing and Reading: Videos of the IAS lectures and discussion on the new era of gravitational-wave astronomy: www.ias.edu/ideas/2016/gravitational-waves

“Gravitational Waves Detected, Confirming Einstein’s Theory” by Dennis Overbye, *New York Times*, February 11, 2016: <http://nyti.ms/20qIaCA>

“Joseph Weber Dies at 81: A Pioneer in Laser Theory” by James Glanz, *New York Times*, October 9, 2000: <http://nyti.ms/1QZsjZp>

For more information about the LIGO detection, visit www.ligo.org.

It took half a century for the international community of gravitational experts to create the missing tools. The experimenters created the Laser Interferometer Gravitational-Wave Observatory, detecting gravitational waves by observing tiny displacements of mirrors suspended in long narrow vacuum chambers. The computer experts created algorithms to explore numerically the solutions of Einstein’s equations describing exactly the delicate process of coalescence of two massive black holes into one.

These two tools, the LIGO hardware and the black-hole software, were both essential for identifying and understanding the signal that was received on September 14, 2015. Equally essential were the two ideas conceived by Einstein and Weber, the idea of a gravitational wave as a traveling distortion of spacetime, and the idea of a mechanical device converting the spacetime distortion into a detectable signal. We hope that the Institute will continue in the future to give support to people pursuing dubious ventures in unfashionable fields. The example of Joseph Weber shows that even a failed venture can point the way to ultimate success. ■

Freeman Dyson, Professor Emeritus in the School of Natural Sciences, first came to the Institute as a Member in 1948 and was appointed Professor in 1953.

A New Era of Gravitational-Wave Astronomy

Spacetime ripples, black-hole collisions, and surprising masses and binary systems



At 10:30 a.m. on February 11, Faculty and Members gathered in Bloomberg Hall (top left) to hear the Laser Interferometer Gravitational-Wave Observatory (LIGO) announce that it had detected gravitational waves—the first such observation—one hundred years after Albert Einstein had predicted them. These ripples in spacetime were produced from the collision of two black holes that took place 1.3 billion years ago. On February 19, a public event on the discovery and its implications was held in Wolfensohn Hall with lectures by Matias Zaldarriaga (bottom left), Professor in the School of Natural Sciences, Scott Tremaine (top right), Richard Black Professor in the School, and Member Doron Kushnir (bottom right) and Junior Visiting Professor Nadia Zakamska (center), followed by a panel discussion (bottom center) moderated by Robbert Dijkgraaf, Director and Leon Levy Professor. “There is a long tradition of studying gravity in all its aspects at IAS,” said Dijkgraaf in his introductory remarks. “One thing we are celebrating here is not only the conclusion of a long, long effort, but more importantly, the beginning of a new great era in physics and astrophysics.” Videos of the lectures and discussion may be viewed at www.ias.edu/ideas/2016/gravitational-waves.

Cosmic Calorimetry, or How I Learned to Stop Worrying and Love Hydrogen

Counting photons, mapping neutral hydrogen, and balancing theory with observation

BY JUNA KOLLMEIER

The next time you are enjoying the sun's warm rays, think of the tremendous voyage those photons have taken to get to you. Traveling, by definition, at the speed of light, they left their point of origin about eight minutes previously in a furious haul to the Earth. Our detectors are the eyes and skin, which are sensitive to visible photons and infrared photons. Our bodies absorb photons at higher and lower energies, but the effects are only noticed after time and most often, unfortunately, for the damage they have done to our biologic makeup. In these sun-filled moments, it is important to remember that the overwhelming majority of the sun's photons will travel undisturbed for the entire future history of the universe, never meeting a planet, a person, a cell, or even another particle.

The story couldn't be more different for photons coming from the distant universe, which face the barrier of intergalactic hydrogen. Hydrogen is the most abundant atom in the universe, and it's also the simplest and most well understood. A photon with energy above 13.6 electronvolts (or 1 Rydberg, named after the Swedish physicist Johannes Rydberg) can tear the sole electron away from a hydrogen atom, and thus completely ionize it. Young massive stars, supernova and other explosions, and accreting black holes are prodigious producers of these ionizing photons.

Photons with less energy or a lot more energy simply don't wreak such hydrogenic havoc. Below this energy, some photons have the specific energy required to excite the neutral hydrogen atom, jostling its sole electron to higher energy levels as opposed to removing it completely. The electrons are excited to a higher level and eventually decay down, cascading back to the ground state. Those special photons with energies at exactly $3/4$ Rydberg produce "Lyman-alpha" excitation—the transition between the ground state and the first excited energy level (and named for the discoverer Theodore Lyman). These wavelengths are beyond our vision but for very distant sources where the expansion of the universe has redshifted them to visible wavelengths. It is precisely this interplay between the hydrogen in the universe and these photons that astronomers can use to figure out the nature of photon producers over cosmic time, as well as the fundamental parameters of our universe, such as its matter content.

The easiest objects to see in the distant universe are quasars powered by gas accretion onto supermassive black holes. The 1965 observation of a quasar at a redshift of two was transformative. Immediately upon seeing the spectrum, the cosmologists of the time recognized something that remained a puzzle for decades after the observation. Jim Gunn and Bruce Peterson noticed that, contrary to their expectations, they could actually *detect* the UV photons coming from this quasar in the distant universe. We can tell that a photon has been absorbed because this light is "removed" from the spectrum we observe—so instead of light, we see darkness. At that time, as ever, cosmologists were struggling to understand the basic geometry and content of the universe. If prevailing wisdom at the time was correct, these photons should never have arrived at our telescopes on Earth. The great barrier of neutral hydrogen atoms throughout the universe should have absorbed them—all of them. Why was the universe essentially transparent?

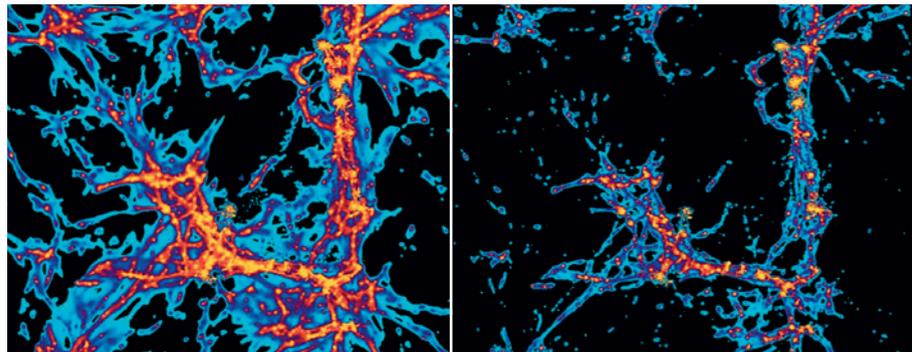
At this time, the density of neutral hydrogen was not known, but it was known that this was a key cosmological parameter. If the density of neutral hydrogen was comparable to the smoothed-out density of matter in stars, the universe would be filled with it and, along every direction, photons would encounter this gas and once they reached the special Lyman-alpha transition, the hydrogen atom would absorb it. It was thus immediately clear that the density of these neutral atoms must be extremely low: either there were very few hydrogen atoms in intergalactic space, or almost all of these atoms were completely ionized.

While Gunn and Peterson found that intergalactic space was mostly transparent, as telescopes got bigger and bigger and instruments could take finer and finer spectra, it was realized that there *was* absorption, but it was concentrated in narrow lines corresponding to concentrations of neutral hydrogen. This pattern of narrow absorption spikes was subsequently called the Lyman-alpha forest owing to its appearance in the observations. For decades, theorists struggled to understand why photons were streaming across the universe unimpeded by neutral hydrogen. Many different ideas for the distribution of neutral hydrogen in the cosmos were put forward. Finally in the 1990s, it became possible to numerically compute the cosmological evolution of the universe accounting for

both the gravitational and hydro dynamics of its contents.

These simulations showed that the Lyman-alpha forest could be reproduced remarkably well by the leading theory of structure formation, with absorption arising in filaments created by gravitational collapse—a metastructure we now refer to as the Intergalactic Medium (IGM). In this model, 99.999 percent of the hydrogen is ionized, but the remainder is enough to produce the Lyman-alpha forest. The comparison of simulations and observations further revealed that *most of the atoms in the universe are in the gas that produces the Lyman-alpha forest.*

The success in explaining the Lyman-alpha forest provided an important confirmation of the leading cosmological scenario in a previously untested regime, and it helped to pin down the total density of hydrogen atoms in the



A slice from a cosmological hydrodynamics simulation at $z=0.1$. In both panels, we show the distribution of neutral hydrogen with blue to red color indicating increasing density. On the left, we show the predictions of our calculations as well as the most recent census of ionizing photons. On the right, we show what is required to match new data from the Hubble Space Telescope. As you can see, the difference between the two predictions is huge—a 400 percent discrepancy.

universe. Two decades on, the parameters of the cosmological model are well measured by other observations, especially the precise measurements of temperature fluctuations in the cosmic microwave background. The Lyman-alpha forest now allows us to test our understanding of the IGM and the sources producing ionizing photons, including their evolution to lower redshifts using Hubble Space Telescope observations of UV light. As the universe ages and expands, it cools off the intergalactic hydrogen gas—creating neutral hydrogen and more absorption in the Lyman-alpha forest. At the same time, galaxies and black holes grow and

evolve, producing the photons that ionize and heat the IGM, effectively "pruning" the forest of absorption. This balance between heating and cooling as recorded in the Lyman-alpha forest thus provides us with a cosmic calorimeter. At intermediate redshifts, this calorimeter is working perfectly. The ionizing photons we count up from the census of stars and quasars is just right to reproduce the observed properties of the IGM. Our IGM calorimeter seemed to be working fine in the local universe as well—until recently.

New instruments on the Hubble Space Telescope, far more sensitive than their predecessors and specifically designed to measure the local Lyman-alpha forest, have indeed produced extraordinarily accurate measurements of the local IGM. Cosmological surveys have made new measurements of quasar and galaxy activity over cosmic time. Cosmological hydrodynamic calculations are now hundreds of times larger and more physically realistic than the original simulations that first reproduced the IGM. Comparing these new observations with the new simulations should have been a matter of a more detailed balance between the theoretical predictions and the observations. However, when we made the first comparison, we found something was broken, a mismatch so striking that we called it the "photon underproduction crisis." The amount of ionizing photons that the measurements of neutral hydrogen demand is much, much higher (a whopping 200–400 percent depending on whose accounting you believe) than that we obtain by counting up the photons leaking from galaxies and quasars. How can this be? There are a few possibilities but they fall into three broad categories: stars in galaxies, quasars, and exotica.

First, we have the galaxies and their stars. It is extremely difficult to observe the ionizing photons escaping from galaxies directly in the local universe owing to the low surface brightness of UV photons that are able to emerge from their galactic origins. Where this measurement has been made, in all but a few very rare instances, the fraction of ionizing photons escaping galaxies is thought to be quite low. If observations have underestimated the escaping flux (by a factor of 5) or perhaps missed the types of galaxies that leak most of the ionizing photons, then this would help us understand the crisis. Of course, this would then mean that our observations of the escape fraction are greatly underestimated (thus moving the crisis from one side of the balance sheet to the other).

The second possibility is the quasars. If there are more accreting black holes than we have accounted for, that would be helpful. Some estimates for the number density of these systems are higher than others. The most optimistic of these estimates turns the 400 percent deficit into a less uncomfortable 200 percent, but I personally don't sleep well with that large a pea under my mattress.

Finally, it is possible that there is something really quite exotic happening and the Lyman-alpha forest is trying to send us a clue. Perhaps there is another source of ionization that we haven't considered at all. One candidate would be high-energy particles produced from the interaction of powerful jets of accreting black holes with the cosmic microwave background. Another candidate would be the decay

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Earth's Last Frontier

The deep sea, the origin of life, and astrobiology

BY DONATO GIOVANNELLI

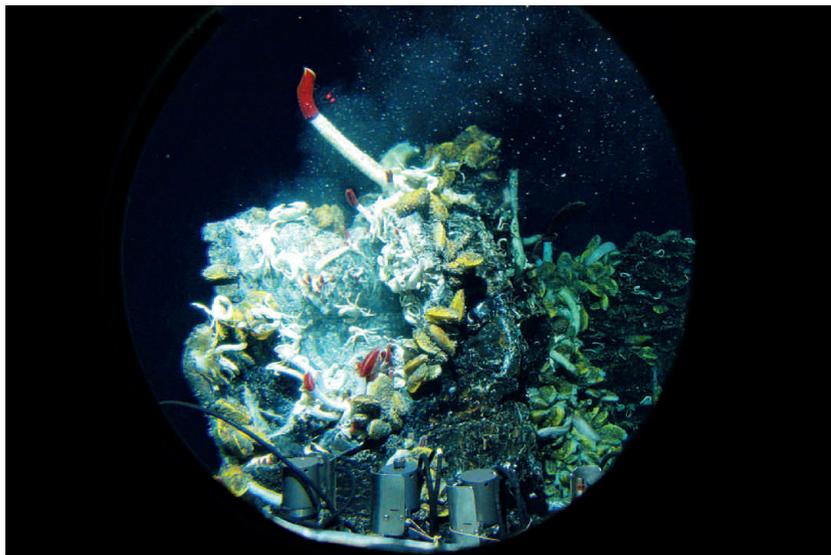
It should come as no surprise that our planet was nicknamed “the pale blue dot” in the wake of the 1990s iconic photograph taken by *Voyager*. Approximately 68 percent of Earth’s surface is covered with water—that is, two-thirds of our galactic home is oceans and seas. With an average depth of 3,800 meters (roughly 2.3 miles), most of Earth’s oceans are well within the realm of the deep sea and represent, considering water column and sediments, 95 percent of the global biosphere. The deep sea is the largest and least explored habitat on Earth, and our knowledge of the biodiversity and functioning of the deep-sea ecosystem is incomplete at best.

By definition, the deep sea starts where less than 1 percent of light penetrates—on average, this happens at around 200 meters depth. From there to the seafloor, the deep sea is a cold, dark place. It is not only the largest ecosystem on our planet, but also our largest extreme environment. Average temperatures range from 0 to 4°C, and pressures can reach a crushing 1,100 bar in the Challenger Deep (Mariana Trench; 10,994 meters depth). For centuries—from Socrates to the late nineteenth century—humans believed the deep sea was a sterile, dead desert. Great minds of the time considered its extreme conditions prohibitive for life.

The Challenger Expedition (1872–76), the first modern oceanographic cruise, set out to challenge this mindset. For the first time in human history, this groundbreaking around-the-globe expedition, financed by the Royal Society of London, probed the unknown depths of the oceans, reporting life beyond the first few tens of meters of seawater. Those aboard the expedition reported 4,700 new species, created charts of circulation, depth, and temperature of the world’s oceans, and discovered the dizzying fact that most of our planet’s surface lies deep beneath the ocean waves. Despite this new appreciation, prevailing hypotheses throughout much of the twentieth century construed life in the deep sea as inconsistent, ephemeral, and limited to the first 1,000 or so meters of depth. In 1977, a second key discovery forever changed how we perceive life on Earth and beyond. An oceanographic expedition led by Richard Von Herzen and Robert Ballard (from Woods Hole Oceanographic Institution) discovered an oasis of exotic and unknown life basking around hot fluids venting from a crack in the seafloor basalt at 2,500 meters depth along the Galapagos Rift.

We now know that life is present at all depths in the oceans (and even deeper into our planetary crust, but this is another story). We also know that deep-sea hydrothermal vents are a common feature along

ocean ridges, and together with other types of extreme environments (such as cold seeps and deep hypersaline anoxic basins), sustain gardens of life, both microscopic and macroscopic, worldwide. At deep-sea vents, cold oxygenated seawater percolates deep through seafloor cracks where it is heated by geothermal activity and enriched in reduced-metal species and gases before returning back to the seafloor. Contact between these hot fluids (with temperatures anywhere from 25 to 450°C) and the ~2°C surrounding seawater precipitates sulfide



A photograph of a low-temperature deep-sea hydrothermal vent in the 9.50°N sector of the East Pacific Rise taken by the author through a viewport of the DSV *Alvin* at 2,500 meters depth. This particular vent is known as Crab Spa and sits atop a lava pillar twelve meters tall. Visible in the picture are white crabs, the gutless tubeworm *Riftia pachyptila*, and vent mussels. The white snow blowing from the center of the vent is hydrothermal fluid, filled with sulfur particles and microbial biomass. Sampling equipment sitting in the DSV *Alvin* basket is visible in the lower section of the photo.

metals, creating massive columnar structures—tens of meters in height—known as hydrothermal chimneys. Life around these chimneys is made possible by the activity of thermophilic (i.e., heat-loving) microorganisms that effectively make a living from reduced volcanic gases and carbon dioxide (chemo-synthesis) much like plants do on the surface of our planet (photosynthesis), but without the need for light to power their molecular machinery.

The realization that life exists in hot, dark, anoxic places as sustainable, large, and productive ecosystems independent of photosynthetic primary producers profoundly changed our understanding of how and where life could exist in the universe. Research on deep-sea hydrothermal vent microorganisms ignited a new wave of theories on the origins of life on Earth, as well as how scientists look for life elsewhere. Active hydrothermal vents were recently reported on Saturn’s moon Enceladus, are likely beneath the frozen surface of Jupiter’s moon Europa, and may have existed on ancient Mars.

Despite interest in the microbiology of deep-sea hydrothermal vents and the deep sea in general,

research and exploration of Earth’s last frontier is still scarce. There was a moment in the ’60s and ’70s when science and popular literature alike depicted the colonization of the oceans by humans, but that moment has come and gone, leaving behind shrinking research budgets and growing commercial interests. Currently, only six research submarines are capable of diving below 4,000 meters. Meanwhile, financial interests in exploiting deep-sea resources are growing. Industrial deep-sea fishing is a booming industry, with unclear impacts on deep-sea ecosystems.

Deep-sea mining is also growing quickly, with the number of granted mining licenses increasing every year. The ocean floor is a rich source of metals and rare-earth elements, and the International Seabed Authority has already granted permits to mine very large portions of the seafloor, often with very little public awareness. Currently, there is no way to predict the direction and magnitude of potential ecosystem impacts of such large-scale deep-sea mining efforts.

Microbes dominate deep-sea and extreme environments, often constituting the only living biomass in these ecosystems. Despite this, we have a limited understanding of the total biodiversity—both microscopic and macroscopic—in the deep ocean. Our comprehension of its role in sustaining ecosystem functioning and providing goods and services to the entire planet is even smaller. *What is the extent and activity of microbial populations in the deep sea and seafloor subsurface? How are microbial populations structured and how are they*

connected? Is there functional redundancy within a population and is it critical in maintaining ecosystem functions during and after perturbation? How have human activities impacted this ecosystem, and how will these changes impact human populations in turn? How did life adapt to such extreme conditions? Or, more accurately, how did life adapt to surface conditions, assuming it originated at the ocean floor in ancient analogues of modern deep-sea hydrothermal vents? These and other basic questions will require our undivided attention as a scientific community. The deep sea is the largest habitat on Earth, and it plays a key role in many crucial features of this planet, including climate and the carbon cycle. Understanding how deep-sea ecosystems function is vital to maintaining equilibrium on this planet and to shedding light on how our pale blue dot became—thus far—the only planet harboring life. ■

Donato Giovannelli, Visitor in the Program in Interdisciplinary Studies, studies the microbiology of deep-sea and geothermal environments, and how the biosphere and geosphere coevolved over time. Giovannelli is a postdoctoral research fellow at Rutgers, The State University of New Jersey.

COSMIC CALORIMETRY (Continued from page 4)

of the heretofore unidentified dark-matter particle into low-energy photons or heat. Finally, it’s possible that the triumph of explaining the local Lyman-alpha forest was a mere coincidence and the forest is actually produced from some other process. It would then be hard to understand why things work so well in the young universe. We think these exotic possibilities are unlikely, compared to the more prosaic explanation of inaccurate accounting, but they are tantalizing nonetheless. Once we fully understand the ionizing flux emerging from galaxies and quasars locally, these possibilities will be either far more or less interesting.

Rather than worry that our predictions do not match the observations perfectly,

we must remember never to let a good crisis go to waste! The detailed use of the Lyman-alpha forest as a cosmic calorimeter will certainly reveal information about the balance of ionizing photons coming from stars and quasars, and perhaps something entirely new about our universe that we have not anticipated. ■

Juna Kollmeier, Junior Visiting Professor in the School of Natural Sciences, focuses on cosmology and cosmic structure formation, including black holes, stars, galaxies, and intergalactic gas. Kollmeier is an astrophysicist at the Carnegie Observatories, Carnegie Institution for Science.

Hospitality at the Hilbert Hotel

How big is infinity?

BY ANA RITA PIRES

In the beginning of the twentieth century, the University of Göttingen was one of the top research centers for mathematics in the world. The mathematician David Hilbert was a well-established professor there, and during the winter semester of 1924–25 he gave a series of lectures about the infinite in mathematics, physics, and astronomy. (These and other lectures by Hilbert are now published in book form by Springer-Verlag. The book is available at the IAS library in translation and in the original German.) In one of these lectures, he used an example to explain the crucial difference between finite and infinite sets: in a hotel with a finite number of rooms, if all rooms are occupied then there is no room for new guests. But in a hotel with infinitely many rooms this is not a problem: if all rooms are occupied and a new guest arrives, simply move each old guest one room over, leaving the first room vacant for the newly arrived guest. A similar argument lets us accommodate any finite number of, and even infinitely many, newly arrived guests.

George Gamow (of the famously authored Alpher–Bethe–Gamow paper in the field of physical cosmology) was a summer postdoc at the University of Göttingen a few years after these lectures happened and probably learned of Hilbert’s example of the infinite hotel there. He popularized it in his 1947 popular science book titled *One Two Three...Infinity: Facts and Speculations of Science* (available at the Princeton University library).

Let us get back to Hilbert’s hotel. To make things neat, let us say that the hotel’s infinitely many rooms are numbered 1, 2, 3, 4, 5, One night, they are all occupied but a new guest arrives. As we said before, we simply move the guest in room 1 over to room 2, the one in room 2 over to room 3, the one in room 3 over to room 4, and in general, the guest in room n over to room $n + 1$, thereby creating a vacancy in room 1 for the new guest, but leaving none of the original guests homeless.

Now say twenty new guests arrive rather than just one. The trick used before works just as well: move the guest in room 1 to room 21, the guest in room 2 to room 22, and in general, the guest in room n to room $n + 20$. This will leave twenty rooms vacant and ready for the twenty new guests.

But what if infinitely many new guests arrive aboard an infinite bus? We can modify the previous argument so that it still works for this situation: space out the guests already in the hotel so that they only occupy every other room. Mathematically speaking, move the guest in room n to room $2n$, so that all the even-numbered rooms are occupied. This leaves every other room (infinitely many!) vacant and ready to accommodate the (infinitely many!) people arriving by the bus. The person sitting in seat number n on the bus should move into the n^{th} odd-numbered room, which is room number $2n - 1$.

What if ninety-nine infinite buses arrive? Simply move the original hotel guests to rooms 100, 200, 300, etc., the passengers of the first bus to rooms 1, 101, 201, etc., the passengers on the second bus to rooms 2, 102, 202, etc., and so on for the rest of the buses. This will occupy all rooms of the hotel while leaving no guests without a room. If the passengers on the buses were themselves numbered 1, 2, 3, 4, 5, . . . (and let us make no distinction and call the original guests of the hotel passengers as well—we can think of it as moving all the original guests out of the hotel and into a decorative bus parked right outside the hotel, which we can call bus number 0), then we would see the first one hundred rooms of the hotel are filled with passengers number 1, the second hundred rooms of the hotel are filled with passengers number 2, and so on.

The next level is dealing with infinitely many infinite buses (each bus with infinitely many passengers). The first thing to do is to get everyone out of the hotel and out of the buses and organized in grid-like form in the parking lot, or on a piece of paper: have the original guests of the hotel (a.k.a., passengers of bus 0) line up in order, left to right, forming a row. Have the passengers from the first bus form another row just below it, and the passengers from the second bus a row below that one, etc. Make the rows line up with each other so that passengers number 1 from each bus line up in a column, passengers number 2 line up in a column to the right of that one, and so on. Now, if we start filling up hotel rooms 1, 2, 3, 4, . . . with people from the first row, we will never finish

it and move on to the second row, and similarly if we try to start with the first column. The trick is to think of diagonal lines, running bottom-left to top-right on the grid. The leftmost of these diagonal lines only hits the one top-left person (bus 0, passenger 1): put that person in room 1. The next diagonal line hits two people (bus 1, passenger 1 and bus 0, passenger 2): put those two people in rooms 2 and 3. The next diagonal line hits three people: put them in the next three empty rooms, 4, 5, 6. Continuing this pattern we will eventually assign a room to each of the people patiently standing in the parking lot.

Can we go deeper into infinity, deeper than infinitely many infinite buses? Yes we can: imagine that right next to Hilbert’s hotel is a parking garage. On the first floor, right next to the hotel door, are our already-known infinitely many infinite

buses. But then we notice: the garage has infinitely many floors, each with infinitely many infinite buses. Can the Hilbert hotel deal with this added layer of infinity? The answer is yes! You can imagine using the previous method to make a single file of passengers on each floor of the parking garage, then tell each single file to go into one infinite bus. Now we have reduced the problem back to infinitely many infinite buses, which we know can be accommodated in the hotel.

What if we add another layer of infinity? For example, if there are infinitely many parking garages, each with infinitely many

floors, each floor with infinitely many buses, each bus with infinitely many passengers? That’s four layers of infinity, and the answer is still yes! In fact, the answer is yes even for four thousand layers of infinity. Does it ever stop? Does Hilbert’s hotel ever fail to accommodate new guests? Is there an infinity that is too large for Hilbert’s hotel?

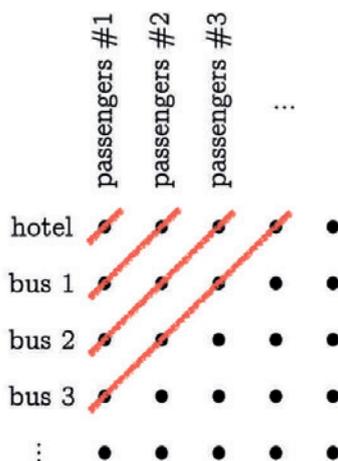
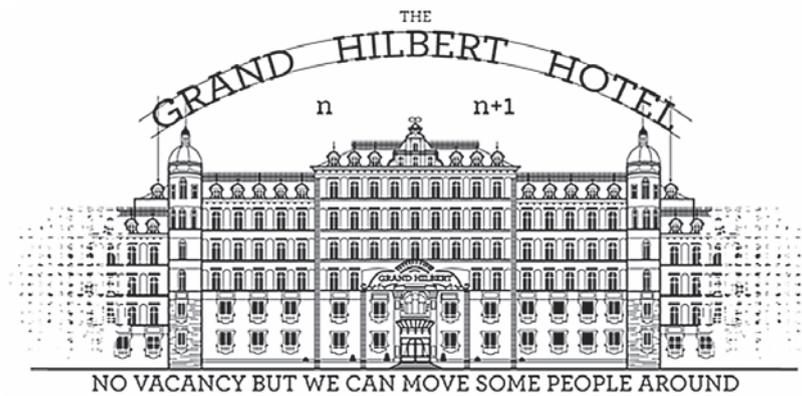
Yes, there is. Indeed, if we had infinitely many layers of infinity, all those people could not possibly be accommodated in Hilbert’s hotel. So . . . what is happening? It turns out that all the infinities described, up to this last one, are of the same size. That size is called $\aleph_{\mathbb{C}}$ (aleph nought), the size of the set $\mathbb{N} = \{1, 2, 3, 4, \dots\}$ and how many rooms there are at Hilbert’s hotel.

It was Georg Cantor who in 1874 introduced the idea of how to compare the sizes of infinities, and showed that there exist infinities of different sizes. Several important mathematicians (Poincaré, Kronecker, and later Weyl) strongly opposed his ideas, as did some theologians—these claimed that Cantor’s ideas challenged the uniqueness of the absolute infinity of God. Hilbert, on the other hand, supported and defended Cantor.

Comparing sizes of infinite sets is not so different from comparing sizes of finite sets: to know if there are more chairs or more people in a lecture room, you do not have to count people and chairs and compare the two numbers. You can just glance at the room and see if there are empty chairs (more chairs than people) or people left standing up (more people than chairs): if every single person is seated in a chair and there are no empty chairs, then the set of the chairs and the set of people are of the same size. Similarly, if every passenger on the buses gets assigned a room in Hilbert’s hotel and no room is left empty, then the set of passengers is an infinity of the same size as the set of rooms in Hilbert’s hotel, $\aleph_{\mathbb{C}}$. Cantor used this idea to show that the set of real numbers, \mathbb{R} , is strictly larger than the set of natural numbers, \mathbb{N} ; his beautiful argument became known as “Cantor’s diagonal.” Cantor also conjectured—and tried to prove but failed—the Continuum Hypothesis: that there is no infinite set strictly larger than \mathbb{N} but strictly smaller than \mathbb{R} . Hilbert included proving that that statement is true or false as the first problem on the famous list of twenty-three problems he presented at the 1900 International Congress of Mathematicians in Paris, which would shape the direction of mathematics research for decades to come. The answer is that this hypothesis cannot be proved to be false (Gödel, 1940s) but it also cannot be proved to be true (Cohen, 1960s): it is an undecidable problem!

Hilbert famously said, about Cantor’s ideas about infinity and all the new mathematics that they brought about: “No one shall expel us from the paradise that Cantor has created.” ■

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Insect Artifice: Art and Science in the Early Modern Netherlands

An interpretive framework for understanding human nature

BY MARISA ANNE BASS

“Art” and “science” meant something very different in the Renaissance than they do within the strict disciplinary divides of today’s academy. Beginning in the sixteenth century, inquiry into the workings of the natural world engaged the visual and literary arts (*artes*) as a means to pursue knowledge (*scientia*) of everything from the stars to anatomy to newly discovered species. My research at IAS this year explores a stunning example of this phenomenon from the sixteenth century: a four-volume series of manuscripts known as the *Four Elements*, which encompasses an encyclopedia of animals and plants from across the globe. Among them is one especially remarkable volume: the first illustrated book in European history exclusively devoted to the subject of insects.

Joris Hoefnagel (1542–1600), the creator of the manuscripts, was among the great polymaths of the sixteenth-century Netherlands. He began work on the series sometime in the 1570s, just decades prior to the emergence of entomology as an independent field of study. The invention of the microscope in the early seventeenth century would catalyze the investigation into the nature and reproductive processes of insects, overturning centuries of misconception concerning their spontaneous generation. Hoefnagel was not privy to these advances. So the question that begs asking is what motivated him to paint the hundreds of specimens in his insect volume—many of them clearly based on firsthand observation—using only his naked eye and the precious manuscript media of parchment, watercolor, and gouache. One folio from the volume gets us closer to understanding what he was up to.

A gilded oval frames a scene of insects and arachnids that appears strangely empty on first glance, with only a grassy mound offering any sense of setting. Closer inspection, however, reveals that Hoefnagel has painted an intricate web attached to the oval border, which overlaps the mound where a cross spider (*Araneus diadematus*) is quietly resting. The brush that Hoefnagel used to paint the spun threads must have been exceedingly fine, only a few hairs thick at most. The web aligns with the surface plane of the page, yet it also invites us to peer through its strands as if through a window onto another world. In fact, on the left and right edges of the oval, Hoefnagel has depicted the hint of a wooden door or window jamb, implying that the web is suspended in the liminal space of a human dwelling.

A second cross spider occupies the web’s center point where all the radial lines of its weft converge. The signature cruciform marking on its back is even more prominent than on the arachnid below and punctuates the horizontal and vertical axes of the surrounding matrix. Hoefnagel shows himself a keen and informed observer in his depiction of the spiral web, a characteristic feature of orb-weavers like the cross spider and other members of the family *Araneidae*. Hoefnagel even distinguishes between the two protagonists by depicting the lower spider with a more rotund body characteristic of gravid females and the upper spider with the longer legs that individuate male members of the species.

Spiders are hunters, and webs are their snares. A meek housefly in the upper right, which fell victim to the trap, has been enshrouded in silk and saved for later meal. Directly opposite is the spiders’ main antagonist, a European hornet (*Vespa crabro*) that has pushed through the web’s threads and left a gaping hole in its wake. For dramatic effect, Hoefnagel has chosen a species that dwarfs the adjacent spider in magnitude; European hornets can be as large as over three centimeters in length. The hornet’s wide wingspan, its fuzzy thorax, and the sheen of light on its abdomen all assert its liveliness in contrast to the vanquished fly. If we follow the logic of the image, the creature has thrust itself through the picture plane and is dangerously encroaching on our space as viewers. To heighten the play of scale—and our sense of the unstable boundary between the real and illusory worlds—Hoefnagel has positioned a diminutive bee in the lower right, safely avoiding the web as it crawls along the interior edge of the frame. Escaping a spider’s clutches is a matter not just of size and strength, but also of ingenuity.

The European hornet and the male cross spider are labeled with the numbers “1” and “2” that might lead one to expect an accompanying key identifying their species, yet the texts surrounding the painted oval are of a very different nature. The Roman numerals “XXXVII” on the right merely indicate the place of this folio within the manuscript as a whole. Hoefnagel has selected the Latin texts above and below to echo the implied narrative of the scene, offering an interpretive framework for understanding how his empirically observed specimens—and

the natural world at large—offer wisdom applicable to the human realm.

“Law/Lawless” (*Lex Exlex*) is a common sixteenth-century aphorism that derives from the ancient Athenian lawmaker Solon, who—according to his biographer Diogenes Laertius—had “compared laws to spiders’ webs, which stand firm when any light and yielding object falls upon them, while a larger thing breaks through them and makes off.” This acknowledgement that laws are biased towards the mighty and lay low the weak directly parallels Hoefnagel’s juxtaposition of the free-flying hornet with the captured fly. Numerous printed emblem books from

the sixteenth century onwards picture the larger insect’s victory over the spider in precisely these terms, though none equal Hoefnagel in combining that message with such splendid visual execution.

The inscription at the bottom of the page derives from one of the most widely read of all Renaissance authors: the great Netherlandish scholar Desiderius Erasmus (1466–1536), whose book of *Adages*, or proverbial sayings, was a smash hit when first published and remained so long after his death. “You weave spiders’ webs; you are more anxious over something trifling” (*araneorum telas texis; in frivolo anxius*). As Erasmus explains, a spider’s web appears carefully wrought, even formidable, but it is actually fragile and meaningless. The web, just as Hoefnagel shows us, is easily broken by a powerful antagonist or eluded by a savvy one.

Both Latin inscriptions urge consideration of the boundary between reality and illusion on

which the image itself so compellingly plays. Marveling at the intricacy of the silken threads, and Hoefnagel’s ability to paint them, should not deceive us in thinking that the constructs of nature and human civilization are always as just or effective as they purport to be. This is a message that would have resonated deeply in Hoefnagel’s contemporary context.

Hoefnagel lived in a time of intercepted letters and secret codes, scholars under arrest, and works of art openly smashed in the streets. The seismic religio-political forces of the Dutch Revolt, which emerged in the late 1560s out of conflict between Catholic Spain and local Protestant factions, wreaked economic havoc and inquisitional atrocities on the Low Countries. Hoefnagel’s hometown of Antwerp, where he began his career as a merchant, had been the most thriving metropolis and art market of Europe until the city’s occupation by Spanish forces in the early 1570s thrust it into turmoil, shattering prosperity and stifling creative progress. Hoefnagel was among the many who fled the region and emigrated abroad in hope of finding greater peace and stability.

Hoefnagel’s *Four Elements* manuscripts, begun in the midst of the Revolt, might seem on first glance a retreat from this violent context. Yet his urgent desire to comprehend the specimens of the natural world arose directly from his personal response to witnessing the unprecedented destruction and dispersal of humanist culture in his homeland. His belief that nature, as the product of divine creation, offered answers to navigating the human conflict unfolding around him led Hoefnagel to the study of insects. The miniscule scale yet infinite complexity of the insect and arachnid kingdoms attested to God’s agency in the visible world, even in the midst of war and spiritual discord. The seemingly indomitable spider at the center of Hoefnagel’s painted web—the cross on its back a blazon of the religious struggle that incited the Dutch Revolt itself—was only a false impediment, which could be overcome through inner strength and the pursuit of true understanding.

The seventeenth-century founders of entomology likewise perceived insects as wonders of divine creation. Yet the intimate and personal nature of Hoefnagel’s volume distinguishes it from the works of those later scholars. Hoefnagel’s singular manuscript was accessible only to a limited audience, unlike the printed entomological treatises that would be published in the decades after his death. Hoefnagel made the manuscript foremost for himself, sharing it only with a close circle of friends who were likewise interested in natural history and who found community and solace from war in the exchange of knowledge. For Hoefnagel, empirical study and virtuosic artifice were not independent ends but instead the means to achieve an understanding of human nature through nature itself. Through his erudite and masterful pictures, Hoefnagel demonstrated that the humanistic arts were vital to advancing knowledge of ourselves and the world around us. ■

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Figure 1: Joris Hoefnagel, *Spiders and Bees*, Folio XXXVII, from the *Four Elements*. Watercolor and gouache on parchment, 14.4 x 19.5 cm.

Palestinian Refugees and the Humanitarian Experience

What can, and should, humanitarians do when nothing they do seems likely to have much effect?

BY ILANA FELDMAN

In 1948, approximately 750,000 Palestinians were displaced from their homes, going both to neighboring countries such as Jordan, Syria, and Lebanon and to the parts of Mandate Palestine that became the West Bank and the Gaza Strip. These refugees have never been allowed to return to their homes, and today there are 5 million Palestinian refugees registered with the United Nations Relief and Works Agency for Palestine Refugees (UNRWA), the body charged with providing assistance to Palestinians across the Middle East, 1.5 million of whom live in one of the 58 official UNRWA camps.

Humanitarian assistance to refugees was first provided by UN-commissioned “volunteer agencies”: the American Friends Service Committee, the International Committee of the Red Cross, and the League of Red Cross Societies. As the longevity of the crisis became apparent, the UN established UNRWA as the agency responsible for providing assistance to Palestinians in the five primary fields of displacement. This assistance has changed significantly over the years as the emergency of flight ebbed into the chronic need of long-term displacement, as new occasions of crisis erupted, as population growth strained available resources, as budgetary constraints mandated retrenchments, and as ideas about what constitutes “good” humanitarian practice have changed. Palestinians are among the world’s longest-lasting refugee populations and as such have experienced the full breadth of post-World War II humanitarianism. Their apparently exceptional experience, in fact, resonates widely.

Humanitarianism exerts a powerful claim on the global imagination. It appears to many as almost the ultimate form of doing good, a path to engagement across distance and difference that is governed by compassion and care, rather than by strategic alliances and cynical political calculations. Others are much less sanguine about the extent to which humanitarianism has so thoroughly saturated the global landscape. People express concern about what other kinds of engagements and solutions are occluded by the humanitarian frame. Among what Fiona Terry calls the “paradoxes of humanitarian action” and David Kennedy describes as the “dark sides of virtue” are the possibilities that humanitarian intervention may prolong conflicts that cause the suffering it seeks to alleviate; that principles of neutrality and confidentiality may impede calling perpetrators to account; that, in serving as gateways to assistance, procedures of refugee identification and registration may also impose restrictions on victims’ actions; and that the need to mobilize international compassion to support humanitarian endeavors may involve some degree of exploitation of people’s suffering.

Even as these constraints are real and significant, identifying them does not provide a sufficient account of humanitarian effects. There are ways in which humanitarian action, without intending to, serves as a space from which people can act politically and provides a language to press such claims. Limitation and possibility are linked in humanitarianism’s effects on those it seeks to help. We need, therefore, to understand not just the humanitarian “politics of life”—that is, calculative engagements with bodies and subjects in the management of aid delivery—but also the “politics of living”—ways that people survive, strive, and act within humanitarian spaces.

During my time as a Member in the School of Social Science at IAS, I am working on a book that explores these politics and lives across the length and much of the breadth of Palestinian exile. Displaced Palestinians live across the globe, but I focus on those who live within the jurisdiction of the humanitarian apparatus established to aid them soon after 1948. The sources for this investigation are both archival and ethnographic. The documentary record—with UNRWA’s archive at the center—includes material on the full temporal and geographic scope. My ethnographic fieldwork was conducted over a five-year period (2008–13) primarily in four refugee camps (Jerash, Wihdat, Burj al Barajneh, and Dheisheh) in three fields of operation (Jordan, Lebanon, and the West Bank). I interviewed hundreds of people in the camps, refugees from multiple generations and humanitarian workers. I also observed a number of different humanitarian projects in action.

With a more than sixty-seven-year displacement, the Palestinian refugee case is an extreme instance of a widespread phenomenon: the need for humanitarian

organizations that are oriented toward emergency to respond to circumstances that are “protracted.” As Palestinian displacement has extended over many decades, and through multiple generations, the broad trajectory of the refugee experience has gone from acute crisis to chronic need. Palestinians share experiences of poverty and immobility with others around the world who are part of what is sometimes referred to as the “precarariat.” Elizabeth A. Povinelli calls this sort of suffering, which often persists below the threshold of an event, “cruddy.”

Even though they are common, protracted situations strain the limits of the humanitarian imaginary, and also of humanitarian resources. Humanitarian actors cannot alleviate the causes of people’s suffering, but in crises they can effect a change in the circumstances in which they are living. In the chronic conditions usually facing Palestinians, it often seems that humanitarian actors cannot do even that. Humanitarian purpose becomes murky in circumstances where people are not in immediate risk of dying, but also where their difficult lives cannot be much improved. What can, and should, humanitarians do when nothing they do seems likely to have much effect?

Another key feature of the Palestinian experience is that the movement to the chronic is not a linear one. Palestinians have experienced long periods of persistent poverty, marginalization, and political stasis that have been repeatedly punctuated by times of acute crisis: the 1967 Israeli occupation of the West Bank and Gaza Strip, the civil war in Lebanon with its assaults on Palestinian camps (1975–90), the blockade of Gaza (2007–), and the conflict in Syria (2011–). The emergency circumstances produced by each crisis are some time thereafter transformed (again) into chronic conditions of need and restriction. One of the challenges that humanitarian actors face is being buffeted between the catastrophic and the cruddy and trying to respond alternatively to both situations.

This oscillation has consequences for both providers and recipients. For providers, these consequences include: confusion about purpose, frustration with having to cover the same ground multiple times, and anger with the apparent incapacity (or unwillingness) of political actors to resolve the underlying conditions that make emergencies repeat and chronic need persist. When the smoke

clears from catastrophic violence, humanitarians make the rounds to see what remains of the lives people were living and of the projects that their agencies have supported. Humanitarian actors may be mobilized by emergency, and may understand better

how to act when faced with a crisis to which they can respond directly, but they suffer the losses of these cycles of destruction. This is the humanitarian double condition produced by the returned (and ever-returning) crisis: a renewed clarity of purpose along with a growing sense of being trapped in a cycle of futility.

Palestinians live with these oscillating conditions, and the related changes in humanitarian assistance, in a variety of ways. One response, in the face of the continuing degradation of Palestinian life and the ongoing failure to reach a political resolution to the Palestine problem, is a feeling of defeat. As the generation of refugees who knew Palestine passes away—without return or resolution—many people express a sense not just of ongoing attack by Israel, but of utter abandonment by the international community, Arab states, and their own leadership. In these conditions it can be hard to imagine political alternatives. But defeat is not the only response. In the course of my research across the Middle East I have also seen people meeting these circumstances with creativity and experimentation, seeking ways around the impasses of the Palestinian present. Some work within the humanitarian apparatus that has structured so much of their lives to try to remake its impact on persons and communities. Others are engaging the camps where they live as sites of political possibility—trying out new political strategies and envisioning new sorts of futures. These are difficult times for Palestinians (and others) across the Middle East. But the experiments in “living otherwise” (as Povinelli puts it) that I encountered in my research are a reminder that these conditions are neither the whole nor the end of the story. ■



The UN Relief and Works Agency attempts to address the issue of hunger associated with exile. Above, a young Palestinian refugee in Syria with a food parcel intended to feed a family of four for ten days.

AS PALESTINIAN DISPLACEMENT HAS EXTENDED OVER MANY DECADES, AND THROUGH MULTIPLE GENERATIONS, THE BROAD TRAJECTORY OF THE REFUGEE EXPERIENCE HAS GONE FROM ACUTE CRISIS TO CHRONIC NEED.

Ilana Feldman, Friends of the Institute for Advanced Study Member in the School of Social Science, explores the complex world constituted by and through humanitarianism in fields of displacement across the Middle East. Feldman is Associate Professor of Anthropology, History, and International Affairs at George Washington University.

Are Military Coups Going Out of Style?

How history, economy, and political landscape determine the answer

BY DUNCAN MCCARGO

The number of military coups and coup attempts since 1950 currently stands at around 530, an astonishing number. We tend to have a very specific notion of a military coup: a military coup is something that rarely takes place; is characteristic of particular kinds of countries—perhaps Latin American states; and belongs mainly to a limited historical period, the heyday of the coup era, during the late 1960s and early 1970s. We think of it as a form of regime change belonging to the post-independence period, when lots of new nations were having trouble consolidating their political institutions and finding ways to manage power transitions.

Most of our basic assumptions about coups do not stand up to close scrutiny. During their heyday, coups were as common a way of changing regime as any other method: power changed hands as frequently as through elections, and much more frequently than through popular uprisings or revolutions. The notion of coup exceptionalism is very misleading. In the 1970s, there were around a dozen coup attempts annually, with a success rate of roughly fifty percent. While the overall number of coups has declined in recent decades, since 2010 there have been about twenty-nine coups or coup attempts, around four or five a year. This is rather more than we might expect in the wake of the “third wave” of democratic transitions in the 1980s and the 1990s, which saw the demise of many military regimes in Africa, Asia, and Latin America.

Coups have significantly fallen off and yet have not completely faded away. To understand why, we need to revisit the heyday period of coups to understand what fueled this trend in the first place. Naunihal Singh (2014) has done an excellent large-scale quantitative study of coups between 1950 and 2000. He found that around half of the countries in the world have experienced military coups between the 1950s and the present—a very large number. In terms of continents, coups were most prevalent in Africa, followed by Latin America. He concluded that just three factors underpinned military coups and the likelihood of their occurrence.

The first factor was whether there had been any successful military coups in that country. A military that has staged a coup before is much more likely to try to attempt another seizure of power. Some states enter a vicious cycle. Where coups have happened before, and have apparently “worked,” both the military and segments of the civilian population may believe that coups are a possible or even a decent way to do political business, usually on the basis of claims that such power seizures are a necessary evil justified by the need to avert crisis and rescue the nation from adversity. As a result, coups develop a life and a momentum of their own.

A second factor concerns economic development. Some scholars try to explain coups almost entirely in these terms. As soon as countries become more developed, and people have higher living standards, then political institutions will solidify, and military coups will become obsolete. There is evidence to support this argument from Latin America, where economies have indeed grown and military coups have declined. Apart from a failed attempt in Ecuador, there have been no coups in Latin America since 2010.

Of the twenty-nine coups since 2010, twenty-two of them took place in the bottom tier of the 188 countries ranked in the United Nations Development Program’s Human Development Index. Virtually all of the last dozen on the list have experienced coups or coup attempts in recent years. Most of these countries have had coups since 2010. There is no denying the importance of this factor. A distinct “coup belt” of very poor countries in sub-Saharan Africa (especially Central and West Africa) accounts for the majority of recent power seizures, which might be termed “scarcity coups.”

A striking exception is Thailand, the main focus of my own research. Thailand has experienced around twenty coups since 1932, most recently in 2014 (but also in 2006 and 1991), despite being one of the world’s fastest-growing economies since 1960. The visual modernity of Bangkok, with its gleaming skyscrapers and high-end shopping malls, appears completely at odds with the country’s chronic

political dysfunction.

How are we to explain the military coups that have taken place in unlikely places such as Thailand in 2014, Egypt in 2013, or Ecuador in 2010? Here, politics rather than economics comes to the fore. A so-called third wave of democratization was much discussed around the end of the Cold War in 1990. Numerous countries underwent transitions toward more open political systems. Lately, however, many of those transitions are going backwards. Countries that came out of authoritarian rule are now struggling somewhere between democracy and authoritarianism. The past twenty-five years has seen an upsurge in anocracy, a politics that mixes elements of authoritarianism and democracy. Features of anocracies include electoral populism, accusations of majoritarianism, the rising salience of inequality grievances, profound alienation between elites and the masses, and a propensity for mass rallies and street protests. According to one source, between 1989 and the present, the number of anocracies has increased from thirty to fifty-five. It seems probable that the greater the degree of anocracy, the more likely a military coup becomes. Countries like Thailand, Egypt, Ecuador, Bangladesh—outliers that are not prime candidates for military coups on purely socioeconomic grounds—could all be classified as anocracies. Given growing levels of political polarization globally, seen in



Thai soldiers in Bangkok led the 2014 coup d'état against then Prime Minister Yingluck Shinawatra, a seizure of power spurred by political polarization and prolonged unrest.

different forms in recent British and United States electoral politics, anocracy is fast becoming the “new normal” and could account for a growing proportion of military coups.

We tend to assume that coups involve the military sending tanks into the streets. Both of these assumptions—military leadership and physical deployment—are open to question. No tanks were used in Thailand’s May 2014 coup. In Ecuador in 2010, the police attempted a coup, and the military came to the president’s rescue. Turkey experienced a so-called “e-coup” in 2007—the coup consisted of the Army posting a commentary on its website. Britain experienced a kind of a “TV coup” in November 2015—the chief of the armed forces went

on television and criticized the new Leader of the Opposition, Jeremy Corbyn, for his stance on nuclear weapons. The interview had echoes of the novel *A Very British Coup* by former minister Chris Mullin. It tells the story of how a left-wing Labour

prime minister was eased out of office by an establishment conspiracy. In other words, a coup could be carried out by the military or the security services without the use of any physical force.

Accordingly, we may need to revisit the original eighteenth-century definition of *coup d'état*, a “master stroke of the state,” which does not necessarily have a military component. Perhaps one reason why we are seeing fewer military coups is because of the parallel rise in “new coups”: judicial coups, or coups precipitated by protest movements, such as the 2001 toppling of President Joseph Estrada in the Philippines. Estrada was an extremely popular former movie star disliked by the middle classes for various reasons and accused of corruption. He was removed from office not by a formal military intervention (though army commanders had said they would no longer follow his orders), but by a *coup d'état* in the classic French sense.

Although, on one level, military coups are indeed going out of style, they are not dissipating as rapidly, as consistently, or as straightforwardly as might be expected. Scarcity coups, military coups as conventionally understood, are still being staged on a regular basis—especially in less-developed African countries. Anocracy coups, in countries affected by extreme political polarization, form a second category of military coups that looks set to increase. And in many anocracies, “new coups”—in other words “big strokes of the state” led not by the military but by other institutions and political forces—form the most likely future direction. ■

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The Shiite Interpretation of the Status of Women

And how it is enacted across philosophy, religion, and social contexts

BY HASSAN ANSARI

The status of “women” as interpreted by Shiites in a philosophical and legal context, as well as their social status in Shiite communities, throughout history up until today, can only be considered and studied within a general framework, using an approach that must obviously be based on the legal foundation established by religious Islamic thinking. Nevertheless, there are obvious differences between what is understood as Shiite philosophy and religious prescription and what is actually practiced in a social context within Shiite communities.

Those differences are not only due to and justified by theological or legal issues, but various sociohistorical contexts have also played a major role in their development. The important fact that, for at least a few centuries, Shiites have mainly settled in Iran leads us to the conclusion that basic (even pre-Islamic) culture and Iranian civilization are the most important influences on Shiite beliefs, its concepts, its religious beliefs, and its legal and sociopolitical philosophies, whereas the great majority of Muslims—in other words, religious schools and theological doctrines—are affiliated with the Sunni community and are generally present in all Arab countries, Turkey, and in the Far East, Malaysia, and Indonesia. Naturally, a major issue such as the role of “women” and “the social status of women” in society can be directly influenced by the social and political environment as well as local traditions and beliefs. The main factors in this regard are: the contribution of religious beliefs and national folklore as well as local literature and the collective conscience of a nation, including the epic history of a nation as told in prose or verse and popular stories that have had an important direct impact on behavior and traditions throughout history.

According to the Koran, women (at least in terms of their relationship with God and their responsibilities) are equal to men. Women have the same obligations as men when it comes to a belief in God, worship, and the practice of certain religious rituals such as prayer. Women are born just like men, according to divine nature. If Eve—as the first woman—was misled by Satan, her fault is equal to that of Adam—as the first man—and not superior. Thus, she is not the symbol of fault or “original sin.” Overall, the original religious texts describe women in Islam as innocent and pure beings who cannot be more tempted by Satan than men.

Insofar as exclusively religious rituals are concerned, Muslim women and men have the same obligations. However, this equality is challenged when it comes to civil rights, where women and men are not equal with regard to rights and responsibilities according to the Koran and the religious teachings of Islam. Here, the differences between the Shiite and Sunni interpretation of jurisprudence (*fiqh*; religious law) create this divergence. Shiite thinking provides a constant and dynamic aspect to *ijtihad* (personal interpretation of the religious texts in order to adapt them to new situations) and to the renewal of religious *fatwas* that must be followed at all times by the *fuqaha* (legal scholars).

Of course, women have an important role in Shiite religion; the generation of the prophet of Islam can only continue through his daughter Fatima. The latter is not only the prophet’s daughter, but she is also the mother of the Shiite Imams. She transfers the prophet’s legacy to the Shiite Imams, their sons, and all future generations. Fatima’s predominance as the wife of Ali b. Abi Talib—the prophet’s cousin—her son-in-law, and first Shiite Imam takes on divine proportions. This image of Fatima that the prophet transferred to the Shiites is represented with tremendous honor and respect in Shiite writings and traditions. This is an important contribution to the role of women in the collective memory and in Shiite tradition. In certain Shiite traditions, she is represented as the one who transmits the prophet’s enlightenment and soul to the prophet’s children and the Imams. She is a commentator on the Koran, her divine knowledge giving her scientific expertise that is comparable to that of the Imams. Thus, the fact that she is a woman does not prevent the Shiite from considering her as a divine reference in Shiite religion, a reference that not only embodies divine purity and justice as well as eternal enlightenment, but also presents her as the teacher and divine guide of the Islamic *umma*. Fatima is always a role model in the Shiite community. The role model that she represents is not limited to her knowledge; she also has a dominant role as the wife of Imam Ali, the prophet’s successor, and she is the defender of his succession (contested by the Caliphs). The teachings of Ali b. Abi Talib, which later become the guide for all Shiite Imams, owe a lot to his wife’s spiritual influence. Such a status is neither introduced nor authorized for any woman in Sunni tradition, a doctrine that is completely different from that of the Shiites. And that has had its repercussions in Sunni thinking and actions with regard to this issue throughout history.

Aïcha, the prophet’s wife and the daughter of the first Caliph, is—contrary to Shiite tradition—the favorite and predominant female figure in Sunni religion; she is mentioned as a narrator and a source of *shari’a* and jurisprudence, but her status has nothing to do with that of Fatima. The latter’s daughter, Zaynab, also plays an important role. She was present at the side of Husayn b. Ali, the third Shiite Imam, at the battle of Karbala and thus embodies a crucial contribution to the heroic legacy and religious beliefs of the Shiites. Her tomb is worshipped with fervor by the Shiites in Damascus. After the tragic events surrounding the assassination of her brother Husayn by a Caliph among the Umayyad in Karbala, she took over and assumed the responsibility for her family, and even for her brother, the next Imam,

and for the transmission of the political and religious message of this movement. Other women of the prophet’s family also represent the status of women and its importance in Shiite thinking. Among them is Fatima Masumeh, the daughter of Musa b. Ja’far, the seventh Imam among the Twelve Imams. Her shrine in Qom is the reason that this city exists as one of the main centers of Shiite power and authority throughout history. Even in the Islamic Republic of Iran, where *shari’a* is the foundation of the constitution, even though Fatima and Zaynab shape the religious image of women in Shiite society and tradition, and despite the importance of the veil, which has become a condition and law to be respected by all women, the social and political role of women has grown in importance since the beginning of the Islamic revolution. This has opened up a way for women to become more active participants in Iranian society where the majority is Shiite.

Women’s participation in society is not limited to social and political activities; they also play a much larger role in universities and other educational and professional institutions than women in other Muslim countries, or even in Iran before the revolution, where globalization had resulted in an increased presence of women in every sector. Of course, this development had its own consequences in Iran as a Shiite country compared with many other Muslim countries. During the last thirty-five years, Iranian women have become more and more demanding. Literacy among women has increased at a moderate pace, which

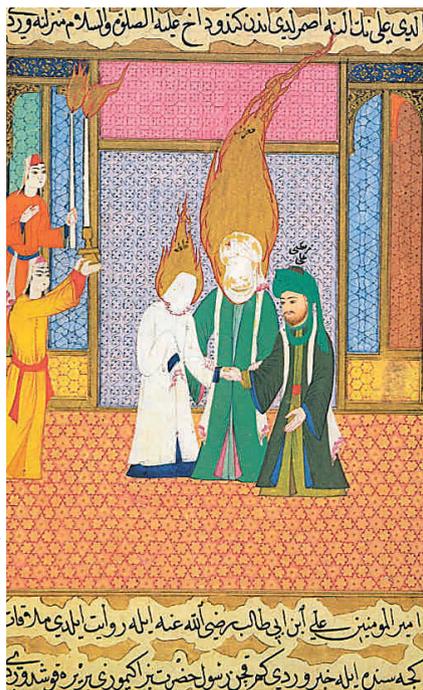
has allowed them to become familiar with various aspects of modern life. Today, women’s expectations have turned into demands for civil rights, which is of course a big challenge for the Islamic Republic. The presence of women in elections and government positions, such as the parliament and local councils, as well as their participation in different ministerial functions are notable examples.

However, the result of these developments is not limited to this. Women play an active role in newspapers and media, and feminist movements are on the rise. All of these factors combined have applied pressure to modify or weaken several of the strict laws of *shari’a* concerning women in areas of society such as marriage, divorce, succession, and specific legal questions concerning women and the inequality of women.

Besides the increase of the scientific level in women’s education and the importance of their demands for equal rights, traditional women have also penetrated the religious schools in cities such as Qom and Teheran. The religious education of women in Muslim tradition goes back to early Islam, but this Shiite tradition originates with Fatima, a role model for Iranian women. Having participated in religious education and being familiar with the fundamentals of religion and theology, women have made a brave attempt to resolve many legal problems that are based on *shari’a* and were adopted by the parliament of the Islamic Republic. In this context, the movement of religious modernism, which has seen most of its growth since the death of Ayatollah Khomeini in 1989, focuses in particular on the issue of women with regard to the necessary changes in the legal system. The subject of women has thus become an issue that must be revealed in the sources of Islamic thought and tradition in order to be able to come to a modern interpretation that is in line with human rights. Today, a new interpretation of women’s rights and other issues related to women is becoming a challenge for the religious modernists.

Shiite thought has at least the potential advantage to create the foundation for the revision of the status of women and women’s rights in Islamic jurisprudence. However, Shiite legal scholars are still conflicted by conservative thinking, and many reformists consider the status of women in Islamic society to be a great challenge to the interpretation of *shari’a* and its modernization in order to protect women’s rights and modify religious laws relating to women. For example, certain modern Shiite thinkers currently oppose the obligation of women to cover their heads. The overall attitude of Iranian society in this regard is very different from that of other Muslim countries. Young women, especially, have decided to wear their head cover in a completely different way than prescribed by the strict Muslim

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Mohammed giving his daughter Fatima in marriage to his cousin Ali. From the *Siyer-i Nebi*, illustrated ca. 1595

The subdiscipline of historical epidemiology, located at the intersection of medical history, epidemiology, and other allied public health disciplines, is in development. The field is multidisciplinary. It requires the integration of different kinds of scientific knowledge and an understanding of changing social, political, economic, and epidemiological contexts. Its premise is that an understanding of past global health interventions can contribute to an improvement in the design and implementation of future interventions.

The long struggle against malaria in tropical Africa is instructive. It began to be waged aggressively in the immediate aftermath of the Second World War, when enthusiasm for the public health benefits of synthetic insecticides such as DDT ran high. In 1945, the United States Public Health Service sent a team to Liberia that was charged with the control of the mosquito vectors that transmitted malaria in the capital of Monrovia. They sprayed the houses in Monrovia with DDT and achieved a marked reduction in severe malaria. The program was then extended into the hinterland, into the same areas in which the recent Ebola outbreak took place. There, too, they achieved good results. In line with the WHO's 1955 decision to launch its Malaria Eradication Program, the Americans sprayed DDT and other residual insecticides to remarkable effect. They reduced malaria transmission to low levels and kept it at low levels for several years. This marked the first large-scale use of synthetic insecticides to control malaria in tropical Africa.

After a few years of regular insecticide spraying, however, the heavy selection pressure promoted insecticide-resistant mosquitoes. When this resistance was confirmed, and when the project directors realized that immigrants from regions and countries outside of the malaria eradication pilot project zones were introducing new infections, they came to the conclusion that eradication was not possible. The projects were closed down.

The years of success in malaria control came at a price. The Liberians in the project zones had lost most of their acquired immunity, and when the insecticide spraying stopped, malaria resurged with a vengeance. It struck adults more severely than before the intervention. The Liberian projects were part of a larger mosaic of malaria control and eradication projects that were launched before and during the WHO's Malaria Eradication Program, largely financed by the United States government.

In the twenty-first century, global health organizations, led by the Gates Foundation, made a new commitment to the global eradication of malaria. This commitment was based upon an incomplete assessment of past experiences with malaria control and eradication. The biomedical and global health communities were broadly unaware, for example, that the first global malaria eradication program had carried out extensive pilot projects in tropical Africa in an effort to develop successful eradication protocols.

As a result, some experiences were repeated. Twenty-first-century malaria eradication programs deployed DDT and other synthetic insecticides in the same West African regions where their predecessors had used a similar array of insecticides. The synthetic insecticides once again produced resistance in the mosquito vectors.

The grand shift in malaria interventions toward the use of synthetic insecticides during the World Health Organization's Malaria Eradication Program took place on a global scale, and it displaced one of the older approaches to malaria control that had been based on chemical therapy. In the 1930s, in the Belgian Congo, for example, it was recommended clinical practice to treat an African child with quinine regardless of whether or not the child had malarial symptoms. The colonial-era physicians did not know how this treatment worked, but it reportedly reduced childhood mortality by 50 percent among those who received the treatment. This practice was forgotten during the grand paradigm shift. Countless lives were lost as a consequence. Indeed, it was not until the late twentieth-century discovery of the

efficacy of intermittent preventive malaria therapy with synthetic malaria drugs for pregnant women and, in later decades, for infants and children, that this practice became part of contemporary therapeutic practice.

Other historical evidence has proven cautionary. In 2013, the global health planners for a major intervention involving mass drug administration using a single dose of primaquine became aware, quite by happenstance, that a single dose of the drug had been used in several earlier malaria control projects in tropical Africa. This was potentially important because a second therapeutic treatment with primaquine could be toxic for individuals who carry a genetic mutation known as G6PD, the most common enzyme deficiency in human beings, affecting about 400 million people.

Other types of historical records have also proved to be directly relevant to the contemporary malaria eradication campaign. During the Cultural Revolution in China, Mao Zedong ordered researchers to find a cure for malaria in the Chinese pharmacopoeia. The pharmaceutical chemist Tu Youyou discovered a reference to the plant *Artemisia annua* in a Chinese medical text from the first millennium C.E. She isolated the active antimalarial compound, artemisinin, that became the frontline antimalarial drug. Tu Youyou received the 2015 Nobel Prize in medicine for this important discovery that has saved millions of lives.

Historical epidemiology holds the promise of developing as a fundamental resource for global health. Like some other new fields, it is emerging on the cusp of existing disciplines. One practical order of business will be for doctoral programs in history to facilitate disciplinary training in the public health sciences at the master's level. Another order of business will be for departments of epidemiology and global health to open their doors to historical epidemiologists and broaden their curricula to expose master's degree candidates to this field.

Beyond the academy, the philanthropic organizations, nongovernmental organizations, and other global health actors must be encouraged to improve the historical conservation of global health intervention data. Members of the global health community—and the individual states with responsibilities for their populations' public health—need to collect and preserve records of what has happened in the course of their programs, even if these records include failures, problems, obstacles, and glitches. At present, this is made difficult by the donor culture of program evaluation that exclusively valorizes positive data. It is time to appreciate that there is a great deal to be learned from the past that can improve future interventions.

There are positive developments afoot. The World Health Organization and the Rockefeller Foundation have embarked upon large-scale digitization projects to make their historical records accessible to researchers, and they have made fine progress to date. Most other major global health actors have yet to make such commitments. There is an enormous amount of unpublished "grey literature" of project evaluations and assessments by nongovernmental organizations and national governments that is currently inaccessible.

The emerging field of the historical epidemiology of contemporary disease has the potential to integrate a number of disparate fields of knowledge and to improve the practice of global health. In a generation from now, it is likely that historical epidemiology will be fully integrated into the field of global health. Its logical imperative is straightforward. Ignorance of the epidemiological past precludes its lessons from being learned and creates unnecessary vulnerabilities for the global health enterprise. ■

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STATUS OF WOMEN (Continued from page 10)

dress code. They wear it in a variety of colors, shapes, and fashions, which in itself represents creative diversity and is setting new role models and beauty standards. This is a strictly Iranian phenomenon that has attracted much attention from abroad. Wearing a *burqa* and having to cover the eyes and face are considered very shocking concepts in Iranian society, contrary to many other Muslim countries where it seems that the Salafists who adhere to Sunni tradition have applied more pressure than ever to impose their opinion on the status of women in Islamic society.

Shiite philosophy considers that renewal in *ijtihād* and in *fiqh* is always possible, and it acknowledges this as one of its main points and differences from Sunni jurisprudence. Morteza Motahhari, the famous ideologue of the Islamic Republic, has dedicated part of his religious activity to women's issues in Muslim society, including giving his opinion on the veil, which is new and relatively speaking much more permissive—he does not see the necessity of wearing the *burqa* or covering the hands.

One of the problems of Islamic jurisprudence is based on the influence of patriarchy, which in turn was influenced by different social traditions throughout the history of Islam. Insofar as the issue of heritage is concerned, it is very well known that this is a case of inequality between men and women in Islamic

jurisprudence, but there have been efforts in Iran to resolve at least parts of this inequality. Of course, this goes back to Shiite teachings and to the role and status of Fatima in the transmission of her father's heritage, where—contrary to Sunni jurisprudence on heritage, which is more patriarchal—women's rights are supported, which is the case with regard to heritage.

The Shiite *fuqaha* are able and many of them are willing to express their opinion with regard to the modern status of women. This surfaces with the radical opposition of Shiites against Salafists, but there are still many questions regarding women's rights that must be resolved in the Islamic *fiqh*. It is crucial to consider these issues carefully and to find solutions to modernize Islam's teachings in order to prevent the Salafist movements, which arise among the majority of Muslim countries, from becoming more powerful. ■

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Matisse in the Barnes Foundation

The hand-to-hand combat between the artist and fifty-two square meters of surface

BY YVE-ALAIN BOIS

Matisse gave two separate accounts of the moment at which he began work on the first version of *The Dance*, each of them emphasizing the immensity of the surface he had to master, “to possess,” as he put it. In the first version, it is an architectural rhyme that triggers the onset of this sense of possession:

As I was pacing in front of my seventy-two square meters of white canvas destined to become the decoration of Doctor Barnes, not knowing which way to start, I noticed by chance a rope hanging from a window to a random spot in my studio, standing out and projecting a curve on my canvas. I suddenly had before me the relationship of this curve to the great rectangle of the edges of my decoration. This was the first connection with the surface to decorate, made of three pointed arches, and it is this unexpected connection that allowed me to begin taking possession of this large surface.

The jolt comes from an encounter with real space (the real space of the makeshift studio’s architecture, which Matisse paces), with real scale—that is, with the relative proportions of specific elements in that space (the curve made by the rope’s shadow, the body of the artist) vis-à-vis the real surface quantity of the canvas. The phenomenology of this encounter, an immersion in the thick of things, has nothing to do with the distanced, imaginary space of projection. Matisse is particularly eloquent about this when he writes to Raymond Escholier, his first biographer, about the Barnes *Dance*:

Perhaps it would be important to signal that the composition of this panel came out of a hand-to-hand combat [*un corps à corps*: literally, “a body-to-body combat”] of the artist with the fifty-two square meters of surface of which the mind of the artist had to take possession, and not from the modern method of projection of a composition on a much larger surface, traced “on demand.” The man who looks for a plane in the sky with a beam [*projecteur*] does not scour its immensity in the same way as the aviator. I think you understand, if I am expressing clearly, the essential difference between these two conceptions.

Still, the second version of what kicked off Matisse’s sense of taking possession is perhaps more surprising than the first, architecturally driven anecdote:

Faced with my huge white canvases, I took a model and began a study that had nothing to do with the decoration. At each of the model’s breaks, I relaxed by looking at these great surfaces, absentmindedly—or so I thought. Then, at a certain point, there came a flash of inspiration. I took my big charcoal, attached it to the end of a big bamboo, and began drawing the circle of my dancers, from one end to the other of my thirteen-meter surface. I’d got off the mark, taken possession of my surface entirely through the power of my imagination. That’s how I made my painting: entirely from feeling, without a model.

The first thing that is striking about Matisse’s explanation is the sheer athleticism of his technique: looking at photographs in which he is indeed shown drawing *The Dance* with a bamboo stick as long as he is tall (and he would do the same a quarter of a century later when working on his Vence chapel!), one wonders where he got the strength and balance (try it and see for yourself!). Then there is the role of the model: the fact that she was a mere presence whom Matisse did not watch or even think about (though he was conscious of her body, which must have enhanced his



In an imaginative response to the vastness of his canvas, Matisse attached his charcoal to a long branch of bamboo, taking possession of his surface and commencing work on *The Dance*.



Matisse’s preparatory sketches for *The Dance* are minimal, rapid drawings, capturing the singularity of a movement or posture in a few strokes.



Installation of *The Dance* (1932–33) at the Barnes Foundation, a triptych filling the surface made of three pointed arches totaling thirty-four feet across.

Recommended Viewing: Watch a recent IAS lecture by Yve-Alain Bois, “Picasso and Abstraction: Encounters and Avoidance,” at www.ias.edu/ideas/2016/bois-picasso.

sense of scale) is not so astonishing. What is, however, is that Matisse’s account does not correspond to the facts, for he did make use of a model at first for studies that had *everything* to do with *The Dance*, and stopped doing so only when he realized he no longer needed them. He obviously forgot this episode, and that, in itself, is quite telling.

Even before his second trip to Merion, in December 1930, to get a better feel for the space, Matisse worried about the model he would use. He somewhat reluctantly opted for Lisette Löwengard, who was tending Matisse’s wife at night and had already posed for many hours for two paintings that were still eluding him (*The Yellow Dress*, which he may have finished as late as the spring or summer of 1932, and *Woman with a Madras Hat*, which would remain incomplete). From Merion he wrote to his wife to keep an eye on Lisette’s diet and exercise so that she would be able to perform the acrobatics he wanted to sketch. The drawings in question, filling two whole sketchbooks, are extraordinary. They all belong to the category of the rapid drawing that he had mastered with Marquet in his youth—a drawing that captures the singularity of a movement or posture in a few strokes. This drastic economy has nothing to do with the slow process of gradual purification and condensation to which Matisse would still subscribe, a few months later, in the plates of the Mallarmé book. The drawings are minimal, to be sure, but done in a matter of seconds. In them, Matisse is no longer trying to refine an essence but rather to internalize it—to capture within himself, synesthetically, as it were, the very movement he draws. He wants to identify with this movement, to draw as if he were dancing.

Matisse wrote and spoke on numerous occasions about his desire to identify with his model (whether it was a female nude or a tree), but to my knowledge these statements only began to appear after his work on *The Dance*. It is as if it was only then, perhaps because he had at last found a way to accomplish this identification, that he could verbally articulate the intensity of this desire. And when he did so retrospectively, one of the first examples that came to his mind was the memory of his work on *Le Bonheur de vivre*’s central group of dancers. Painting in his studio, all he needed to do was to sing the same tune that the dancers used to sing at the Moulin de la Galette while making a round, hand in hand, at the end of the session, which he had so often observed. He summoned the same tune again, he noted, when working on the *Dance* for Shchukin in 1909–10, and then once more when engaged on the Barnes commission: “I was whistling while painting. I was almost dancing. . . .” It is thus not by chance that, in 1939, in order to expound his new theory and practice of drawing, Matisse would reach for the analogy of a dancer or a funambulist:

It is in order to liberate grace and character that I study so intensely before making a pen drawing. I never impose violence on myself; to the contrary, I am like the dancer or tightrope walker who begins his day with several hours of numerous lumbering exercises so that every part of his body obeys him, when in front of his public he wants to give expression to his emotions by a succession of slow or fast dance movements, or by an elegant pirouette.

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Between the Eroticized Bourgeois Family and the Liberal Individual

A new, more ambiguous context for incest prohibition

BY BRIAN CONNOLLY

Why do we still prohibit incest? Despite our sense that the incest taboo is universal, beyond question, it is in fact neither consistent nor universal. The prohibition of incest has existed across cultures and epochs, but it has varied in significant ways to perform specific political, social, and moral work at specific moments. And we should be willing to ask: what cultural work does *our* incest taboo perform?

To answer that question, we need to turn to the nineteenth-century United States, when the meaning of incest had to do with complicated concerns about the middle-class family. Now a cornerstone of U.S. political life, the middle-class family—in its modern form as a cultural center of feeling, class, and consumption—had not existed in previous eras. And this new bourgeois experience of family, in its sentimentality and its encouragement of effusive affection, was both valued as a source of national morality and feared as a dangerous nest of eroticism.

That sentiment and effusion are still with us now. This is because the modern subject—the individual whose political relevance both the right and the left, though in different ways, extol—is fundamentally conditioned by the bourgeois family. The bourgeois family cannot be a site of intimacy without the hovering threat of incest; thus, the modern individual, too, is never free from the threat of incest.

While the specter of incest haunts the bourgeois family, it has not always led to calls for prohibition. Indeed, the conflict between the safety of the family and the rights of the individual are to this day at the heart of discussions of incest. In Germany, for instance, where there have been not infrequent petitions to courts to allow sibling marriages, the German Ethics Council, an advisory body to the federal government, stated in 2014, “the fundamental right of adult siblings to sexual self-determination is to be weighed more heavily than the abstract idea of protection of the family.” Put differently, the liberal individual has the right to incest.

To move into the world as individuals, we must leave our families behind—but this raises the concern that we will find our families again and feel differently about them. In our era, anxiety about natal alienation emerges in concerns about incest and sperm donation, for example. As the popularity of sperm donors increases yearly, some worry about “a risk of unwitting incest between half-siblings.” Since the nineteenth century, freedom from the burden of being overdetermined by one’s natal origin is as potentially incestuous as life in the prison house of the family.

If the nineteenth-century emergence of the liberal individual and the bourgeois sentimental family created a new context for incest prohibition, a context that remains with us, then incest’s historicity is also apparent in the 1970s revision of incest law. The revision has given rise, among other things, to questions about the legality of adult incest in New Jersey after *New York* magazine published claims from an eighteen-year-old living in the Midwest that she and her fiancé/father were planning to move to New Jersey, where adult consensual incest is not prohibited. The 1970s legal transformation, which emphasized incest as sexual violence, essentially normalized consensual adult incest.

In the nineteenth century, when state-by-state the biblical basis of incest law was given up, the variation in incest law could be extreme. New York, for instance, had no law prohibiting incest until 1830. The 1877 Ohio criminal code called seminal emission “an essential ingredient in the crime of incest,” thus making incestuous sex a crime only if the man reached orgasm. All of which is to say, if incest was prohibited in every state, what actually constituted incest was a rather ambiguous matter. In a world in which the family and the individual were increasingly figured as incestuous, anything like a unified incest prohibition was becoming more and more difficult to articulate.

Incest law in the nineteenth century, for the most part, treated incest as a consensual act—if convicted, both parties were guilty. While some states, like Ohio, had so-called “rape of daughter” statutes, these were anomalous, and were part of rape law not incest law. While there were some changes in the law in the twentieth century, the language of morality and biblical phrases like “carnal knowledge” continued to suffuse statutes. However, feminist activism in the 1970s led to a wholesale transformation of incest law as part of the reform of rape statutes.

Feminist activists in the 1970s and ‘80s worked tirelessly to reform sexual assault law to better address the victims of sex crimes. While incest had been primarily a part of the civil law, which prohibited and continues to prohibit incestuous marriages, the reform of rape legislation worked to include incest in the criminal code. Prior to rape reform legislation, father-daughter incest fell under three statutes: incest, statutory rape, and child abuse. In 1974, Michigan became the first state to pass comprehensive rape reform legislation making incest a subcategory of rape.

Unlike most states that followed, Michigan repealed its criminal incest statute in its entirety. New Jersey was one of the few states to follow suit, effectively decriminalizing adult consensual incest. More states decriminalized consenting sexual activity between teenage relatives, provided the age gap was no more than three to four years, effectively legalizing brother-sister incest, at least for a short period of time. While New Jersey and Michigan were exceptions, the reconstitution of incest as sexual violence in the law was part of a self-conscious political strategy. The laws became sex neutral and the language was more clinical than moral, putting them in line with feminist psychology and social work. And this emphasis on coercion worked to make consensual incest’s status as a transgression more and more ambiguous.

When reports of the legality of adult incest in New Jersey surfaced after the publication of the eighteen-year-old’s *New York* interview last year, a bill was quickly introduced to ban incest between consenting adults—legislation that has not yet passed. The absence of a ban on adult consensual incest, however revolting some might find it, is not an anomaly but the effect of the eroticized bourgeois family and liberal individual, both of which have been with us for more than two centuries. We have to confront then the idea that incest is, perhaps, becoming something new. ■

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Detail of *Lot and His Daughters*, Lucas Cranach the Elder, ca. 1528.

MATISSE (Continued from page 12)

However, we are not quite there yet, in the early months of 1931, when Matisse is jotting on paper the soubresauts or splits he is asking Lisette to perform. Pierre Schneider has rightly identified what is still lacking in those sketches (as well as the series of lithographs that resulted from them) to redirect Matisse’s drawing in a fundamentally new, irreversible path:

They are in fact exceptions, unlike most of the drawings of his mature years, for the artist is so absorbed in his effort to condense the forms and figures of dance that he forgets about their relationship to the page. To be sure, there is no negation of the white surface in these drawings—no attempt to introduce a fictive space—but the paper is neutralized rather than brought to life.

Furthermore, those drawings are centered. In other words, Matisse has not yet gone through the experience of the Mallarmé book—in whose plates he felt that the drawing “spreads over the whole sheet.” Does that mean that the two modes (the quasi-somatic identification one observes in the rapid sketches and the all-over investment of the surface) are incompatible? Not at all, as Matisse’s subsequent drawing practice shows. But the compatibility of the two modes is something he learned while working on *The Dance*, I surmise, perhaps in summoning his old procedure of the blind drawing—a procedure in which the physical, bodily contact with the paper, and the kinesthetic evaluation of its size, play a role as big as, if not bigger than, visual memory, in the marks traced by the hand.

Shortly before he started using the concept of the unconscious in his statements, Matisse had made reference to “reflex.” (Speaking to Tériade about Manet in January 1932—when he was fully engrossed in the work on *The Dance*—he praised the painter for having been “the first to have made an immediate translation of his sensations, thus liberating the instinct. He has been the first to *act by sheer reflex* and in doing so to simplify the work of the painter.”) It is unfortunate, in some sense, that the term was displaced so soon thereafter (in a year’s time) by the word “unconscious,” for the muscular connotations of “reflex” are much closer to the kind of nonconscious, quasi-automatic mechanism that Matisse wanted to be triggered when he was drawing. What he had in mind is akin to what Henri Bergson, the only philosopher he is known to have read with some constancy, called the “memory of the body,” and to what Marcel Proust (of whom he was also fond) called the “involuntary memory of limbs.” It was this involuntary memory, and the kind of reflex activation of his body that it effected, that allowed him to get rid of the model when he worked on *The Dance* and, once he had taken in its considerable extension, had “identified” with it, to begin the hand-to-hand combat with its surface. ■

This article is an excerpt from Matisse in the Barnes Foundation (*Thames & Hudson*, 2016), edited by Yve-Alain Bois, Professor in the School of Historical Studies since 2005.

that one has of it. In the same way, the moral economy of punishment involves the appropriateness and fairness of the sentence, which change over time: the rehabilitative paradigm of the sanction, which was dominant until the 1970s, has been replaced by a retributive one, but this punitive turn has disproportionately affected disadvantaged minorities by focusing repression on certain types of offenses, such as drug use, while overlooking others, such as financial crime. As can be seen, moral economies do not characterize a specific group or activity—we do not speak of the moral economies of judges or of justice—but of a social fact—here, asylum or punishment.

Moral subjectivities refer to the processes by which individuals develop ethical practices in their relationships with themselves or others. They attest to the autonomy and freedom of agents, notably within contexts in which opposing values can come into conflict, contradictory sentiments can create tensions, or political injunctions can run counter to professional ethos. They may be conscious exercises stemming from reflections on a dilemma or they may be ordinary gestures stemming from a sense of care. Thus, the members of a prison disciplinary board can decide not to apply sentencing guidelines to an inmate who is found in possession of a telephone or who angrily replied to a guard by taking into account both the necessity to recall the authority of the rules and the singularity of the individual situation; likewise, the police can lend a sympathetic ear to the plight of an undocumented immigrant whom they have arrested or psychiatrists can express their concern with regard to an African father destabilized by his son's delinquent behavior. In discussing subjectivities, we do not seek to encroach upon the field of psychology, which is not ours, but to signify the sociological production of subjects both as subjection and subjectivation.

Relating these two concepts, as we propose to do here, allows us to combine the two major approaches to moral questions in the social sciences inspired by Kant and Aristotle, namely the ethic of duty and the ethic of virtue, respectively. According to the first paradigm, any society is characterized at a given moment by a set of norms and values which defines a moral code to which individuals must submit themselves either out of an obligation to accomplish their duty or out of a desire to do good. According to the second paradigm, any individual can develop virtuous practices with respect to him or herself and with respect to others independently of the rules that are collectively imposed. The first approach underscores constraint, the second freedom. But moral economies and moral subjectivities offer insights into the moral world of institutions that differ in some way from these philosophical legacies. Unlike codes, which are fixed and stable, moral economies permit us to grasp the changes in time and

the appropriations by agents: norms and values are not simply imposed upon them, and furthermore they are associated with emotions and sentiments. Unlike virtues, which ultimately refer to practices focused on seeking to do good, moral subjectivities integrate all forms of practices having moral content whatever their valence and thus include resentment or indignation as well as compassion or admiration.



King Charles XVI Gustav presented the Swedish Society for Anthropology and Geography (SSAG) Gold Medal to Didier Fassin in April. From left to right: King Charles XVI Gustav; Sten Hagberg, President of SSAG; Madeleine Bonow, Secretary of SSAG; Jacques Lapouge, French Ambassador; Ulf Hannerz, the Swedish anthropologist; and Anne-Claire Defossez, Fassin's wife and a Visitor in the School of Social Science

Moral economies and moral subjectivities are connected in the daily activities of institutions through the values and affects which crystallize around social issues and the responses that are given in concrete situations: for the law enforcement agent, the immigration judge, the probation officer, and the job counselor, they are, respectively, the insecurity embodied in the adolescent from the projects, the suspicion in the asylum seeker, the dangerousness in the inmate considered for parole, the unemployment in the discriminated young adult. These professionals face each of these cases through evaluations and emotions, judgments on what is a true refugee or a good prisoner and indignation over a lack of respect or a need for justice. To describe the moral work of institutions is therefore to account for both the tensions within the public sphere surrounding these problems (moral economies) and the actions in the professional world charged with resolving them (moral subjectivities). This moral work is therefore inseparable from the political stakes which underlie both of them—at the heart of the state. ■

These articles are excerpts of Didier Fassin's preface and introduction to At the Heart of the State: Exploring the Moral World of Institutions (Pluto Press, 2015). The book is the result of a five-year European Research Council project led by Didier Fassin, James D. Wolfensohn Professor in the School of Social Science since 2009, with the collaboration of Yasmine Bouagga, Isabelle Coutant, Jean-Sébastien Eideliman, Fabrice Fernandez, Nicolas Fischer, Carolina Kobelinsky, Chowra Makaremi, Sarah Mazouz, and Sébastien Roux.

Recommended Reading: Read Didier Fassin's recent article "From Right to Favor: The Refugee Question as Moral Crisis," *The Nation* (April 5, 2016): www.thenation.com/article/from-right-to-favor.

What Is a State?

What is a state? Answers to this question vary, depending on whether they are provided by a political philosopher, a political scientist, a legal scholar, or a historian. We propose our own response as sociologists and anthropologists. But rather than in its disciplinary configuration, the specificity of our approach resides in its method: ethnography. A political organization governing a given territory and its population, the state is generally studied in terms of its formation, structure, functions, laws, and relations with other similar entities. Such an approach presupposes not only a macropolitical perspective, which tends to produce a relatively abstract representation from above, but also an a priori definition, which delimits the scope of the study.

Our method adopts a symmetrical view. It is inductive, micropolitical, and from below. It is based on the participant observation of various institutions through the routine work of their agents and the everyday interactions with their publics. We do not determine in advance what the police, the justice system, the prison apparatus, the welfare services, and the mental health facilities are, but we examine the situations and problems which the people who belong to these institutions are confronted with, and analyze how they manage them: our theory of the state is therefore constructed empirically. We do not presume that it is a unified entity, but explore the diversity of its rationalities: we analyze, for instance, the tensions and contradictions existing between the logics of security and rights, the principles of coercion and responsibility. The state, we believe, is what its agents do under the multiple influences of the policies they implement, the habits they develop, the initiatives they take, and the responses they get from their publics. By inverting traditional perspectives, whether they be normative or deductive, ethnography thus offers a unique way of approaching the state.—DF



Angelos Chaniotis (far right), Professor in the School of Historical Studies, and Stephen Tracy (center), Visitor in the School, examining the Institute's squeeze collection with history students from Columbia University. Invaluable to the study of Greek epigraphy, squeezes are impressions of inscriptions that allow scholars to more easily study the etchings of the ancient past.

The IAS Questionnaire: Carl P. Feinberg

Carl P. Feinberg recently endowed a Professorship in the School of Natural Sciences in which Juan Maldacena becomes the first Carl P. Feinberg Professor in the School. Feinberg is founder and Chief Executive Officer of the software products firm Relational Architects Intl. He has been a Friend of the Institute since 2002, with his wife Toby. “We are extremely grateful,” said Robbert Dijkgraaf, Director and Leon Levy Professor, “for Carl’s extraordinary gift to the Institute.”

What makes you curious? Everything. I want to understand what I perceive.

Whom do you most admire and why? Newton and Beethoven: Newton as an immortal theorist, experimentalist, and mathematician whose achievements in those fields represent just a fraction of his total output and activity. I revere Beethoven because I continue to thrill to his music and marvel at its construction. His was not the effortless perfection of Mozart, but Beethoven’s finished works give me pleasure bordering on rapture, accompanied by a sense of exaltation.

Outside of your own, which field interests you most? Science in general and theoretical physics in particular.

What is the most surprising thing you’ve learned? It surprises and exasperates me that governments so seldom undertake projects whose benefits should

make them slam-dunk no-brainers. Investments in infrastructure and R&D are current cases in point.

How do you free your thinking? I walk.

What question would you most like answered? How to consistently and reliably ask the right question.

Hermann Weyl, who served on the Institute Faculty from 1933 until his death in 1955, once said, “My work always tried to unite the truth with the beautiful, but when I had to choose one or the other, I usually chose the beautiful.” If you had to choose between truth or beauty, which would you choose and why? Truth and beauty are so often coincident one could make a case that although distinguishable, they are inseparable. But if forced to choose, I would go with truth because it inevitably prevails.



Carl P. Feinberg

What is the purpose of knowledge? For those who *create* knowledge, it’s often to satisfy their own curiosity and derive gratification from having done so. The sentient beings and civilizations that *utilize* knowledge seek to achieve purposes of their own. Regrettably, those purposes aren’t always good.

How do you play? Travel remains an inexhaustible adventure. I love to dance, go to the movies, and listen to music as well.

Which three words best describe the Institute? Unique, unconstrained, and invaluable.

David Lang Appointed Artist-in-Residence

Bridging academic disciplines through music

The Institute has announced the appointment of Pulitzer Prize-winning composer David Lang as Artist-in-Residence effective July 1, 2016. Lang will curate the Institute’s Edward T. Cone Concert Series



David Lang

as well as pursue his creative work as part of the Institute’s community of scholars.

Lang is the recipient of the prestigious Pulitzer Prize (2008) for his piece *The Little Match Girl Passion*, which the *New Yorker* called “one of the most original and moving scores in years.” Based on a fable by Hans Christian Andersen

and Lang’s own rewriting of the libretto to Bach’s *St. Matthew’s Passion*, the recording of the piece was also awarded a 2010 Grammy Award for Best Small Ensemble Performance. In addition to these works, Lang’s “Simple Song #3,” written as part of his score for Paolo Sorrentino’s acclaimed film *Youth*, received many award nominations in 2016, including an Academy Award and Golden Globe.

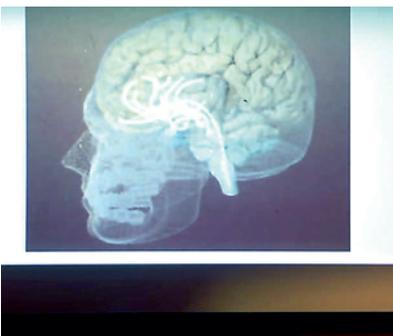
“We are thrilled that David will be the Institute’s next Artist-in-Residence,” said Robbert Dijkgraaf, Director and Leon Levy Professor. “This appointment speaks to the growing role of the Artist-in-Residence program and the importance of using music as a tool to bring together different academic disciplines and perspectives.”

“The Institute is a legendary home for independent thought, and it is a great honor to become an active member of this community of powerful thinkers,” said Lang. “I thank the Institute and

previous Artists-in-Residence for building this residency into such a meaningful program.”

The Artist-in-Residence program was established at the Institute in 1994 to create a musical presence within the Institute community and to have in residence a person whose work could be experienced and appreciated by scholars from all disciplines. Pianist Robert Taub was the first Artist-in-Residence (1994–2001), followed by Jon Magnussen (2000–07), Paul Moravec (2007–09), and Derek Bermel (2009–13). Lang succeeds composer Sebastian Currier, who was named Artist-in-Residence in 2013.

“David is an engaging and thoughtful composer who has wide intellectual interests and is very influential in the field,” said Currier. “I believe David will quickly become an important presence at the Institute, and I’m very excited for what his appointment will bring to the community.”—Alexandra Altman, Communications Associate, aaltman@ias.edu



Scholars and experts of varying disciplines discussed the limits and horizons of science, art, and culture at the Categorically Not! On the Edge event copresented by the Institute and Nautilus magazine. Led by science writer and current Director’s Visitor K.C. Cole (center right), participants looked through the lenses of physics, medicine, photography, and anthropology to explore the edges of academia, architecture, relationships, and knowledge. Videos of the event may be viewed at www.ias.edu/ideas/2016/cole-categorically-not.

