Spring 2021

IAS The Institute Letter

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IAS The Institute Letter

Institute for Advanced Study Spring 2021

Avi Wigderson at the reception in Simonyi Hall, March 17, 2021

Avi Wigderson Awarded 2021 Abel Prize

Recognition for foundational contributions to the field of the theory of computation

Avi Wigderson, Herbert H. Maass Professor in the School of Mathematics at the Institute for Advanced Study, was named a recipient of the 2021 Abel Prize, which he shares jointly with László Lovász—a former IAS Visiting Professor—of Eötvös Loránd University. They are cited by the Abel Committee "for their foundational contributions to theoretical computer science and discrete mathematics, and their leading role in shaping them into central fields of modern mathematics."

At IAS, Wigderson leads the IAS program in Computer Science and Discrete Mathematics, which was formally established at the Institute in 1999 with Wigderson's appointment to the permanent Faculty.

"I am thrilled that the mathematics community has recognized with this prize the entire field of the theory of computation, which has been my academic and social home for the past four decades," stated Wigderson. "I feel lucky to be part of this extremely dynamic community, whose fundamental goals have at the same time deep conceptual and intellectual meaning, scientific and practical motivations, with pure fun problems and brilliant collaborators to pursue them with."

Wigderson is recognized for his prolific contributions to the major areas of computational complexity theory, including randomized computation, algorithms and optimization, circuit complexity, proof complexity,

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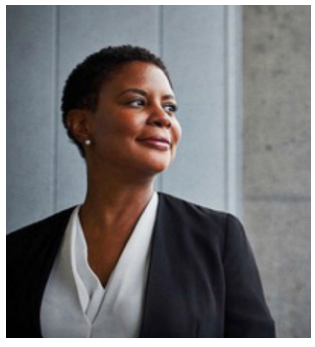

Alondra Nelson

Alondra Nelson Appointed to White House Science Team

No mistaking the power and meaning of the moment we are living through today

Alondra Nelson, Harold F. Linder Professor in the School of Social Science at the Institute for Advanced Study and President of the Social Science Research Council, has been appointed by President Joe Biden to the position of Deputy Director for Science and Society. Nelson is the first person in this role, which brings social science expertise explicitly into the work of federal science and technology strategy and policy.

"Science, at its core, is a social phenomenon. It's a reflection of people, our relationships, and our institutions. There is an incredible window of opportunity ahead of us to approach our science and technology policy in ways that are accountable, inclusive, and trustworthy," Nelson said. "I am honored to be entrusted with this important role in public service at this critical time in this nation's history."

"During her illustrious career, Alondra has been committed to the highest ideals of scholarship, diversity, and intellectual exchange, always with the aim of a more just and equitable society," said Robbert Dijkgraaf. "The Institute for Advanced Study is strengthened and enriched through her leadership. I couldn't imagine a better person for this important position in such crucial times."

Following is a transcript of Nelson's remarks, delivered on January 16, 2021, following her introduction by President-elect Joe Biden, on the occasion of her appointment as Deputy Director for Science and

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Reworking the Origins of the Second World War

Bringing together the history of international relations

BY JONATHAN HASLAM

Jonathan Haslam

The dramatic story of the origins of the Second World War has long been used by politicians to buttress foreign policy. The stark lesson, certainly in Britain, where the consequences of naïveté were the most severe, but also for the French, who suffered so much from the failure of Britain to lead in the right direction, and the United States that stood aside but eventually had to carry the burden, was that appeasing dictators like Hitler only whets their appetite.

Subsequently the lesson was successfully applied in the Cold War against the Soviet Union, which ultimately collapsed under its own dead weight from U.S. pressure, and even with Mrs. Thatcher's determined fight to retain tiny, wintery islands in the South Atlantic against Leopoldo Galtieri, a tin-pot Argentinian dictator. But, and this should also not go forgotten, it was equally disastrously misapplied—most notably against Nasser of Egypt by Sir Anthony Eden in 1956.

There is, however, another crucial lesson in the story that has all too frequently been overlooked. Our understanding of international relations in the twentieth century cannot be reduced to the simplicity of traditional balance of power politics without doing serious damage to the truth. The indifferent application of our understanding of interstate relations in one epoch—the nineteenth century—to an entirely different time—the twentieth century—is not a sound recipe for success.[1]

Something fundamental happened in November 1917. The Bolshevik revolution shook the foundations of the European states system. It was assumed that although the allied war of intervention had failed to strangle the infant in its cradle, Soviet Russia would, under sustained pressure to conform, sooner or later miraculously transform into a "normal" country. This assumption emerged from the determinism of classical economics, the roots of nineteenth-century liberalism in Britain. It gave officials in the Foreign Office a comforting rationale for the much favored policy of doing nothing, or "watchful waiting," as they preferred to call it.

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News of the Institute Community

ANGELOS CHANIOTIS, Professor in the School of Historical Studies, has edited *Unveiling Emotions III: Arousal, Display, and Performance of Emotions in the Greek World* (Franz Steiner Verlag, 2020). Additionally, *Age of Conquests*, authored by Chaniotis, has been translated into Chinese by Huang Kaijun under the title 征服的時代: 從亞歷山大到哈德良的希臘世界 (Marco Polo Press, 2021).

CAMILLO DE LELLIS, IBM von Neumann Professor in the School of Mathematics, has been elected to the German National Academy of Sciences.

DIDIER FASSIN, James D. Wolfensohn Professor in the School of Social Science, has authored, with Frederic Debomy and Jake Raynal, *La Force de l'ordre. Une enquête ethno-graphique* (Seuil/Delcourt, 2020).

SABINE SCHMIDTKE, Professor in the School of Historical Studies, has coedited, with GEORGE A. KIRAZ, Research Associate in the School, *Scribal Habits in Near Eastern Manuscript Traditions* (Gorgias Press, 2021).

FRANCESCA TRIVELLATO, Andrew W. Mellon Professor in the School of Historical Studies, has been awarded the 2020 Jacques Barzun Prize in Cultural History for *The Promise and Peril of Credit: What a Forgotten Legend about Jews and Finance Tells Us about the Making of European Commercial Society* (Princeton University Press, 2019).

AVI WIGDERSON, Herbert H. Maass Professor in the School of Mathematics, has been awarded the Abel Prize, which he shares jointly with LÁSZLÓ LOVÁSZ, Visiting Professor (2011–12) in the School. MATIAS ZALDARRIAGA, Richard Black Professor in the School of Natural Sciences; MARKO SIMONOVIĆ, Member (2014–18) in the School; and MIKHAIL M. IVANOV, an incoming Member, have been awarded the Second Buchalter Cosmology Prize by the American Astronomical Society. Additionally, Natural Sciences Members DAVID WEINBERG and ROBERT LUPTON (2006–07) have been awarded the Dannie Heineman Prize. Finally, DANIEL GREEN (2009–12) and RAFAEL ALEJANDRO PORTO (2010–13), past Members in the School, have been awarded the First Buchalter Cosmology Prize.

Italica Press has published *The Art of Commemoration in the Renaissance: The Slade Lectures* (2020), authored by IRVING LAVIN, late Professor Emeritus in the School of Historical Studies, and edited by Marilyn Aronberg Lavin.

Trustee MARIO DRAGHI has been sworn in as Prime Minister of Italy.

The Institute for Advanced Study has awarded JAMES D. WOLFENSOHN, late Chair Emeritus of the IAS Board of Trustees, the IAS Bamberger Medal.

STANLEY DESER, Member (1953–54, 1993–94) in the School of Natural Sciences, has been elected to the Royal Society.

JESSICA FINTZEN, Member in the School of Mathematics, and BIAO LIAN, Visitor in the School of Natural Sciences, along with eleven former scholars in the Schools, have been awarded Sloan Research Fellowships.

MIKHAIL M. IVANOV, incoming Member in the School of Natural Sciences, has been named an Einstein Fellow of the NASA Hubble Fellowship Program.

SCOTT AARONSON, Member (2004–05) in the School of Mathematics, has been awarded the 2020 ACM Prize in Computing by the Association for Computing Machinery.

MARGARET GRAVES, Member (2015–16) in the School of Historical Studies, has been awarded the Medieval Academy of America's Karen Gould Prize in Art History for *Arts of Allusion: Object, Ornament, and Architecture in Medieval Islam* (Oxford University Press, 2018).

School of Natural Sciences Members PURAGRA GUHATHAKURTA (1989–92) and ELLEN ZWEIBEL (1977–78) have been named 2021 Fellows of the American Astronomical Society. Additionally, RASHID SUNYAEV, Distinguished Visiting Professor, CHARLES ALCOCK, Member (1977–81), and RACHEL SOMERVILLE, Visitor (2020–current), have been named Legacy Fellows.

MAURO F. GUILLÉN, Member (1998–99) in the School of Social Science, has been named Director and Dean of Cambridge Judge Business School.

JUNE HUH, Visiting Professor (2017–20) and Veblen Fellow (2014–17) in the School of Mathematics, has been awarded the 2021 Samsung Ho-Am Prize by the Ho-Am Foundation.

JUNA KOLLMEIER, Junior Visiting Professor (2015–16) in the School of Natural Sciences, has been named director of the University of Toronto's Canadian Institute for Theoretical Astrophysics.

JOEL L. LEBOWITZ, Member (2013–14, 2006, 2001–02) in the School of Mathematics and Member (1980–81) in the School of Natural Sciences, has been awarded the 2021 Dannie Heineman Prize for Mathematical Physics by the American Physical Society.

ADAM MARCUS, von Neumann Fellow (2016–17) in the School of Mathematics, and NIKHIL SRIVASTAVA, Visitor (2012) and Member (2010–11) in the School, with Daniel Alan Spielman, have been awarded the 2021 Michael and Sheila Held Prize by the National Academy of Sciences.

VLADIMIR OLEGOVICH PECHATNOV, Member (2017) in the School of Historical Studies, with David Reynolds, has been awarded the Link-Kuehl Prize for Documentary Editing by the Society for Historians of American Foreign Relations for *The Kremlin Letters: Stalin's Wartime Correspondence with Churchill and Roosevelt* (Yale University Press, 2018).

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Questions and comments regarding the *Institute Letter* should be directed to Amy Ramsey, Assistant Director, Communications at aramsey@ias.edu.

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.

To receive monthly updates on Institute events, videos, and other news by email, subscribe to *IAS eNews* at www.ias.edu/enews.

Carl P. Feinberg Cross-Disciplinary Program in Innovation

The Carl P. Feinberg Cross-Disciplinary Program in Innovation launches at the Institute to unite today's boldest ideas in physics, mathematics, and beyond to unlock fascinating truths about the natural world. Endowed in perpetuity with a gift from Carl P. Feinberg, this supercharged coalition of scholars will expand the Institute's capacity to advance understanding of the universe and break through to new planes of knowledge. Feinberg is a prolific supporter of physics at IAS who endowed a Professorship of Theoretical Physics, currently held by Juan Maldacena.

"I welcomed the opportunity to make another 'investment in civilization' by endowing the Cross-Disciplinary Program in Innovation. I trust the program will complement the Institute's core mission and extend its impact by providing an agile source of funding with which to rapidly assemble cross-disciplinary teams for brief periods as targeted research opportunities arise," Feinberg stated.

The most exciting new areas in science are most often created when experts in seemingly distant fields realize that they have chanced upon similar territory, and are drawn by the exigencies of their specialized interest to work together. The past decade has seen surprising connections between quantum computation and black holes; new phases of matter, topology, and quantum field theory; and deep new mathematical structures in combinatorics, algebra, and geometry and the basic physics of elementary particle scattering.

"The past few years in particular have seen startling developments—new continents of ideas—largely fueled by the insights of people from very different fields literally collaborating, rather than just lobbing ideas, conjectures, and proofs at each other. This is propelling us to the discovery of new principles deeply connecting space-time and quantum mechanics," stated Nima Arkani-Hamed, Professor in the School of Natural Sciences.

The Carl P. Feinberg Cross-Disciplinary Program in Innovation will build on the Institute's collaborative model with the recruitment of mid-career scholars who have pioneered foundational developments in new areas. Bringing together scholars with unique insights—which may not be obviously connected to themes of the past 20 or 30 or 40 years—ensures that IAS will remain agile and responsive to new intellectual developments that do not yet fit the mold of what graduate students and postdocs generally know. In order to close this knowledge gap, the program will feature intense, focused workshops and "master classes," providing an unparalleled opportunity to advance cutting-edge, cross-disciplinary research to unlock new insights into the workings of the natural world.

"Since its founding, the Institute has served as a world center for investigations into the fundamental laws of nature. We are currently in the middle of a grand symbiosis of ideas, from the equations of general relativity to the quantum information of black holes," stated Robbert Dijkgraaf, IAS Director and Leon Levy Professor. "This revolutionary program will provide a dedicated space and the necessary flexibility to accelerate these exciting developments, and will surely forge new connections across fields." ■

ABEL PRIZE *(Continued from page 1)*

quantum computation, cryptography, and understanding of fundamental graph properties.

"Avi Wigderson stands, in the tradition of Gödel and von Neumann, at the pinnacle of the theory of computation," stated Robbert Dijkgraaf, IAS Director and Leon Levy Professor. "His work shows how some of the deepest ideas in mathematics are intimately connected to a technology that is totally transforming our society. Avi is also a convincing advocate for computation as a powerful and promising perspective on all fields of knowledge. I am honored to congratulate Avi and László as this year's Abel laureates and applaud their ongoing leadership and mentorship of young researchers in this fast-evolving field."

John von Neumann, one of the Institute's founding Professors, pioneered the Electronic Computer Project, which resulted in the construction of the world's first stored-program computer in the basement of Fuld Hall. His colleague Kurt Gödel, one of history's greatest logicians, had a foundational impact on Alan Turing and the study of computability. While at IAS, Gödel was the first to contemplate a version of the P vs. NP problem and to understand its importance. Wigderson has carried the torch forward into the next century, producing paradigm-shifting ideas powering the future of computing.

"From its inception, complexity theory produced challenging mathematical problems. As the theory matured and its problems were vigorously probed, many of them turned out to be fundamental in computational theory as well as in diverse mathematical areas," said Peter Sarnak, Professor in the School of Mathematics. "Laci Lovász and Avi Wigderson have been at the center of many of the breakthroughs that have shaped these flourishing areas of theoretical computer science and mathematics, and especially their very fruitful marriage. The doors that they have opened, coupled with their leadership and generosity, have allowed many others to achieve lofty goals in these areas. It is wonderful to see them recognized with the Abel Prize."

DAN KOMODA

Avi and Robbert after a socially distanced reception

Wigderson's main research area is computational complexity theory, which concerns itself with the power and limitations of algorithms. He has co-authored papers with more than 100 people, producing novel connections between mathematics and computer science. His investigations have advanced understanding of questions including: Can creativity be automated? (the P vs. NP question). Can randomness speed up computation? (the BPP vs. P question). Which distributed tasks can be computed privately and securely in adversarial environments? (the foundations of cryptography). What are the power and limitations of communication and interaction?

Such questions, while theoretical in nature, have significant real-world implications. Wigderson's contributions to the foundations of cryptography have led to the development of protocols as complex as playing a game of poker online, without any physical means. His work on interactive proof systems, in particular the paradoxical notion of zero-knowledge proofs (viewed too impractical to ever be implemented) has recently found its way to blockchain technology and digital currencies. Digital innovations in industry, medicine, online communications, electronic commerce, and the economy, are all underpinned by algorithmic and complexity theoretic research. These ideas have also transformed scientific practice across the board, and this is only the beginning. Scholars like Wigderson and Lovász will continue to pursue these foundational questions and their potential impact.

Prior to joining the IAS Faculty, Wigderson held academic appointments at the University of California, Berkeley (1983–1984); IBM Research, San Jose (1984–1985); Mathematical Sciences Research Institute (1985–1986); Princeton University (1990–1992); and the Hebrew University of Jerusalem (1986–2003).

Wigderson is the recipient of numerous awards, including the Rolf Nevanlinna Prize (1994); Levi L. Conant Prize (2008); Gödel Prize (2009); and Donald E. Knuth Prize (2019). He is a member of the American Academy of Arts and Sciences and the National Academy of Science. ■

Recommended Reading and Viewing:

"2 Win Abel Prize for Work That Bridged Math and Computer Science," Kenneth Chang, *New York Times*, March 17, 2021: www.nytimes.com/2021/03/17/science/abel-prize-mathematics

Avi Wigderson and the Second Golden Era of Theoretical Computing: www.ias.edu/ideas/wigderson-second-era

Interview with Avi Wigderson: www.ias.edu/ideas/wigderson-abel-interview

NELSON *(Continued from page 1)*

Society in the White House Office of Science and Technology Policy:

Thank you, President-elect Biden, and Vice President-elect Harris, for your trust, for your faith, and for this extraordinary honor. I am beyond humbled. I come from a family that long dedicated itself to public service. My parents are veterans. My mother, Delores, was a cryptographer for the U.S. Army and later served in federal government. My father, Robert, spent his 30-year career in the Navy. Thanks to them, I grew up instilled with an abiding belief in the importance of serving one's country. I thank my family for this model of service and also for their love and support. Now I am deeply grateful that I will have the opportunity to lend my own experience and expertise in public service. For an academic whose work stands at the intersection of technology, science, and our social fabric, there is no mistaking the power and meaning of the moment we are living through today. Of course, science and technology have permeated nearly every aspect of our lives throughout the course of human history. But perhaps never before in living memory have the connections between our scientific world and our social world been quite so stark as they are today. The Covid-19 crisis has inflicted extraordinary suffering but it has also held up a mirror to our society reflecting in its deadly wake resource gaps and medical disparities. The inequality we've allowed to calcify. And as new technologies take root in our lives from artificial intelligence to human genome editing, they reveal and reflect even more about the complex and sometimes dangerous social architecture that lies beneath the scientific progress we pursue. Science at its core is a social phenomenon. It is a reflection of people, of our relationships, and of our institutions. When we provide inputs to the algorithm, when we program the device, when we design, test, and research, we are making *human* choices—choices that bring our social world to bear in a new and powerful way. It *matters* who makes these choices. It matters who they're thinking about when they do. That's why in my career I've always sought to understand the perspective of people and communities who are not usually in the room when the inputs are made but who live with the outputs nonetheless. As a black woman researcher, I am keenly aware of those who are missing from these rooms. I believe we have a responsibility to work together to make sure that our science and technology reflects us and when it does that it reflects all of us, that it reflects who we truly are together. This too is a breakthrough. This too is an innovation that advances our lives. We have an incredible window of opportunity ahead of us to approach our science and technology policy in ways that are honest and inclusive, to bring the full strength of our communities, our experiences, our concerns, and our aspirations to every table as we think through emergent forms of science and technology. There has never been a more important moment to get scientific development right or to situate that development in our values of equality, accountability, justice, and trustworthiness. It is my honor to pursue that effort with this distinguished team and with a President-elect and Vice President-elect who stand up proudly and consistently for scientific integrity. And the dignity and worth of every community. Thank you. ■

ALEX WONG/GETTY IMAGES

Alondra Nelson delivered remarks on January 16, 2021, following her introduction by President-elect Joe Biden.

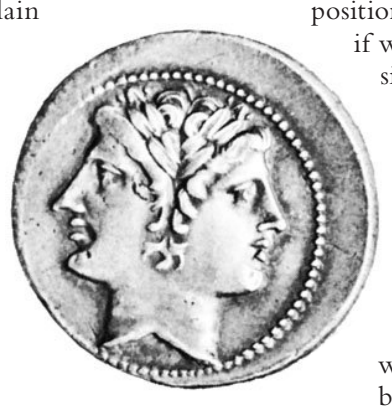
An acclaimed sociologist, Alondra Nelson is the Harold F. Linder Professor in the School of Social Science. Nelson's major research contributions are situated at the intersection of racial formation and social citizenship, on the one hand, and emerging scientific and technological phenomena, on the other.

The Unity of Dualities

Or: an apologia for the two-faced

BY NATALIE PAQUETTE

In colloquial speech the word "duality" connotes two contrasting facets of a single entity, often at odds with one another. The concept is anthropomorphized in mythology by deities or monsters with multiple faces, like the two-faced Janus,[1] Roman god of doorways. It is also enshrined in pop culture in the double visages of Jekyll and Hyde, and in the Batman villain Harvey Dent (alias Two-Face). In physics and mathematics, the concept of "duality"[2] takes on a more positive connotation because of its ubiquity, utility, and power. Rather than perceiving the two opposing faces in tension with one another, they are complements; each face (which we often call a "duality frame") exhibits something the other cannot, and in studying both faces or frames we acquire a more unified understanding of the whole. Many systems in mathematics and physics admit two (or more) duality frames, where difficult problems in the first frame become tractable in the second. When the physicist's usual workmanlike tools become inadequate, dualities can help illuminate a new path.



The two-faced Janus: one face looks toward the past, the other face toward the future. Roman coin, Bibliothèque Nationale

Many profound dualities are Fourier transforms. (Of course, I am oversimplifying here, but to say "many profound dualities are *like* or *analogous to* Fourier transforms" undersells the conceptual through-line). In a Fourier transform, the unified entity or whole which we wish to understand is a certain function[3] of interest, and it admits two duality frames. Depending on the application we have in mind, it can be expedient to represent the function in one domain (one of Janus's faces) or as a function on another, complementary domain (the other, *dual* face). I call the entity $f(x)$, a function f of the real variable x, in one frame and $\hat{f}(p)$, a function $\hat{f}$ of the real variable p, in the other. An entity that looks untamable in one frame can be exquisitely simple in the other; here, as with all dualities, it is not at all obvious that we should have found ourselves in such a happy circumstance![4]

There is a precise way to get from one frame to the other, which we call the "duality map" or "duality transformation." I will write out the map for those who like formulas, but if the symbols look forbidding, just think of them as a precise recipe for translating between the two representations. We start with $f(x)$ and apply a so-called "integral transform": multiply by a suitable function called the kernel, in this case an exponential $e^{-2\pi ipx}$, and integrate over the variable x:

$$\hat{f}(p) = \int_{-\infty}^{\infty} dx f(x) e^{-2\pi ipx}$$

Of course, duality transformations must go both ways, so we could have equally well started with $\hat{f}(p)$ and gone the other way by applying the "inverse transform" with the inverse kernel.

$$f(x) = \int_{-\infty}^{\infty} dp \hat{f}(p) e^{2\pi ipx}$$

The variables x and p live in *dual* spaces. Dual spaces are those which come equipped with a natural pairing, often denoted $\langle , \rangle$, where you can input an element of a space on the right and its dual on the left and obtain a number, $\langle p, x \rangle$. The pairing appears in the kernel function of a Fourier transform. In this example, the pairing is just ordinary multiplication of real numbers: $\langle p, x \rangle = px$, which appears in the argument of the exponential. In other contexts, the pairing may be more involved.

Now, what do these dual representations of our entity look like? Here, the complementary nature of the duality comes to the fore. A function that is concentrated, or localized, in one variable will be spread out in the dual variable (Figure 1). What's more, a function that is perfectly concentrated at a particular point x with infinite value, say at $x = a$, will be as spread out as possible in p (or vice versa); we say that the Fourier transform of this *delta function* $f(x) = \delta(x-a)$ is an exponential $\hat{f}(p) = e^{-2\pi ipx}$, which is just the constant function 1 when $a = 0$. A function that looks both a bit concentrated and a bit spread out in one variable will look that way in the dual variable, too: the Fourier transform of a Gaussian $f(x) = e^{-ax^2}$ is another Gaussian $\hat{f}(p) = \sqrt{\pi/a} e^{-p^2\pi^2/a}$ (Figure 2).

In physics, these complementary perspectives have meaning. Now we will think of x, p not just as variable names but as encoding a particle's position and momentum, respectively.[5]

Heisenberg's uncertainty principle tells us that for pairs of complementary observables in the quantum mechanical world, of which position and momentum furnish the most basic examples, there is a fundamental limit to how accurately we may measure both simultaneously. If we measure x precisely (the observable is localized in position space, or particle-like), we sacrifice knowledge of p (the observable is spread out in momentum space); if instead we measure p precisely, then the observable becomes spread out in position space, or wave-like. We may measure both observables only if we are willing to accept inherent uncertainty in the simultaneous measurements (the observable is both particle-like and wave-like); the standard deviations of these measurements are bounded below by Planck's constant: $\sigma_x \sigma_p \geq \hbar/2$. What's more, since these observables are complementary, we may express the quantum state of our particle as a function[6] of either x *or* p but never both simultaneously; however, we may apply a Fourier transform to choose the frame we prefer. When we have made a choice of coordinate x and its corresponding dual, or conjugate, momentum p we say that we have chosen a *polarization* on the *phase space* locally spanned by the coordinates x and p. In classical physics, we do not need to make this choice and, in particular, we may compute quantities that depend on all position and momentum coordinates at once. In quantum physics, the choice of splitting is mandatory, but a Fourier transform allows us to exchange the position and momentum coordinates of our chosen polarization.

Many other mathematical dualities, including important dualities arising in string theory, are basically Fourier transforms—or at least like Fourier transforms on steroids (think of Jose Canseco in his prime). Roughly, one starts with two complementary, or dual, mathematical spaces[7] $\mathscr{A}, \mathscr{A}^\vee$ on which one can define objects (which could be algebraic, geometric, number theoretic, etc. in nature) that we wish to study. In our example, $\mathscr{A}$ is the space spanned by the x coordinate and we may study functions f on it, while $\mathscr{A}^\vee$ is the "dual space," spanned by the dual coordinate p, on which the function $\hat{f}$ lives.[8] Of course, x is a function on $\mathscr{A}$ and p is a function on $\mathscr{A}^\vee$. One then formally considers a bigger object which incorporates both of our original objects at the same time, which we write as $\mathscr{A} \times \mathscr{A}^\vee$. Functions on this combined space (e.g. $\mathbb{R} \times \mathbb{R} \simeq \mathbb{R}^2$) would be functions on the entire phase space, though our quantum functions are restricted to be functions of only one variable or the other. Nevertheless, there is a special creature in the combined object that helps furnish our duality map: in our case the integral kernel, which is function of both x and p, given by $e^{-2\pi ipx}$. We also have its inverse for the inverse map. For a general such duality, we need the analogue of the integral transform with respect to a kernel in order to obtain the

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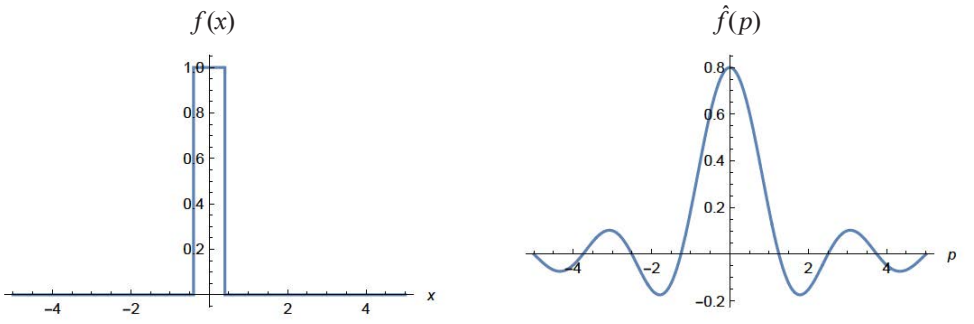


Figure 1: A simple piecewise function and its Fourier transform

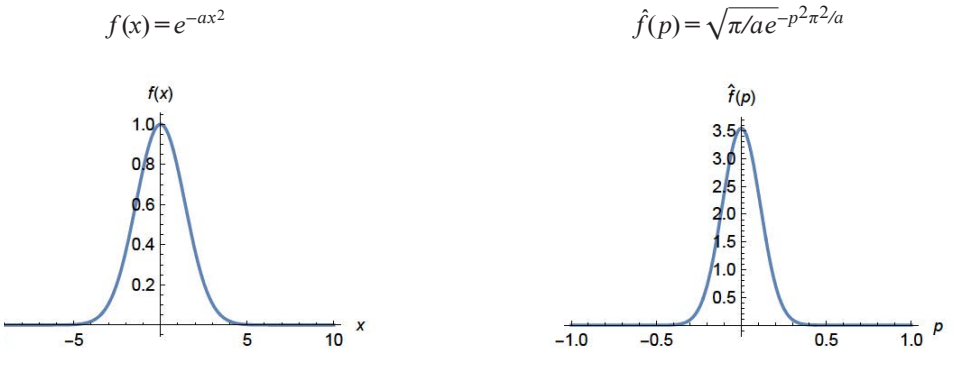


Figure 2: A sample Gaussian and its Fourier transform

duality map that enables us to move freely between any object on $\mathscr{A}$ (any $f(x)$) and its dual on $\mathscr{A}^\vee$ (the Fourier transform $\hat{f}(p)$), and vice versa.

Finding the duality map can be quite difficult. Even if the map is known, computing the transformation explicitly might only be feasible for special, simple classes of objects in $\mathscr{A}$ or $\mathscr{A}^\vee$. More hairy still, in physics we often work with objects that are difficult to formulate mathematically. Even when we understand (part of) the mathematical description of a physical system, there can be various complications (spaces encoding physical degrees of freedom may be infinite-dimensional, have nasty singularities, or suffer other pathologies). But there is nevertheless always great utility in knowing that an entity has two faces and glimpsing them both.

A geometric duality of the Fourier ilk in which we still have an explicit command of many objects on both sides is called the Fourier-Mukai transform. It also arises in string theory in a physical duality called T-duality: it is the mathematical description of how T-duality acts on objects called D-branes. Instead of mapping between dual classes of functions, we map between geometric objects known as coherent sheaves, which generalize the functions of our previous example. Sheaves are naturally defined on spaces that mathematicians call varieties, and some varieties (such as what mathematicians call abelian varieties) admit a natural notion of dual variety.

There are sheaves that live only over a single point on a variety, much like the delta function we met earlier, called skyscraper sheaves; there are also simple one-dimensional sheaves called line bundles, which are analogous to the exponential function dual to the delta function. (Geometrically, the line bundles in question are "topologically trivial," which you can think of as being akin to the special case of the constant function: spread out uniformly over its domain). Indeed, the Fourier-Mukai transform, when applied to simple abelian varieties called elliptic curves, maps skyscraper sheaves to line bundles, just as the Fourier transform mapped delta functions to exponentials, and the recipe is the same: take a skyscraper sheaf on a curve $\mathscr{A}$ and consider it as an object on the bigger space combining the abelian variety and its dual, $\mathscr{A}\times\mathscr{A}^\vee$.[9] Then use a special "kernel" sheaf in $\mathscr{A}\times\mathscr{A}^\vee$ called the Poincare line bundle, "multiply" it with the original skyscraper sheaf, and perform an "integral transform" with respect to this kernel. These ingredients are all understood quite explicitly for Fourier-Mukai transforms, though I won't go into details.

Coherent sheaves are mathematical models for D-branes, which are charged, dynamical objects that are, like the strings themselves, part and parcel of string theory. D-branes have been indispensable ingredients in string theoretic studies of black hole microstate counting, top-down constructions of holographic systems, the discovery and elucidation of non-perturbative phenomena in quantum field theories, and much more. String theoretic dualities need D-branes to work. D-branes can have varying numbers of spatial dimensions (e.g. they can be point- or particle-like, one-dimensional or string-like, two-dimensional or membrane-like, and so on). Just as the Fourier-Mukai transform mapped a point-like sheaf (the skyscraper) into a one-dimensional sheaf (the line-bundle) on the elliptic curve, its physical counterpart T-duality maps D-branes with differing spatial extent into one another, even on more complicated varieties. For a physicist, this is a dramatic operation! You start with some point-like D-branes (imagine them as heavy charged particles) sitting on a certain space, or variety, and I come along and tell you that this is the *same* physical system as some string-like (imagine charged, high-tension strings) D-branes winding around a different variety. The two faces of Janus are not those of twins, but the magic of dualities is that a computation expressed in the first frame must give the same answer as its dual computation in the second frame. If we only have the computational power to produce answers in one frame, we can still learn something about the complicated physics of the dual frame by the existence of this duality map.

I spend a lot of my time thinking hard about physical dualities, including how to translate them into mathematical statements (some physicists may tell you that such work is the province of fussbudgets, but I have always found precision a good antidote to ego). I also study preexisting mathematical dualities that I believe arise in string theory, and probe the consequences of that mathematical structure for the physics. Sometimes, these mathematical dualities turn out to be Fourier transforms, though a bewildered physicist may need a lot of time, and many patient explanations from colleagues,[10] to realize it. Koszul duality is the latest such mathematical duality that has begun to permeate theoretical physics. There are many avatars of Koszul duality, but it can still be viewed as a Fourier transform, although it looks a bit fancier than our previous examples. The mathematical objects at play are now dual algebras, rather than dual spaces, and the Fourier transform map is a map of representations of these algebras, instead of a map of functions or sheaves.[11] One appearance of Koszul duality in physics (though there are others) arises when considering boundary conditions of fields in certain quantum field theories. Boundary conditions involve choosing a polarization on a phase space, as we saw before in quantum mechanics—roughly: to get a good boundary value problem, you must set half of the degrees of freedom of your physical system to zero on the boundary, which means you lose access to half the coordinates on your phase space at the boundary. Choosing between "complementary" variables is often called choosing between "transverse polarizations" and the corresponding boundary conditions are sometimes called transverse themselves. Basic Neumann and Dirichlet boundary conditions in free theories are the prototypical examples of transverse boundary conditions. In certain systems, physics can associate algebras to boundary conditions, and the algebras one associates to transverse boundary conditions turn out to be Koszul dual. Kevin Costello recently proposed that Koszul duality is a mathematical ingredient in special examples of *holography*, a profound physical duality which equates theories of quantum gravity in d-dimensions, and ordinary quantum field theories in $(d-1)$-dimensions said to live on the boundaries of the gravitational systems. Boundaries of physical systems can support surprising, rich physics! We wrote a paper fleshing out this suggestion in a concrete example of holography arising from a string theory construction (D-branes, as always, being a key ingredient), and there is a great deal more to explore and understand.

SOMETIMES, MATHEMATICAL DUALITIES TURN OUT TO BE FOURIER TRANSFORMS, THOUGH A BEWILDERED PHYSICIST MAY NEED A LOT OF TIME, AND MANY PATIENT EXPLANATIONS FROM COLLEAGUES, TO REALIZE IT.

Now, I would never claim that all deep physical dualities boil down to dressing up the humble Fourier transform in increasingly abstruse garb. But I do claim that Nature reuses beautiful ingredients and simple ideas over and over again, sometimes when we least expect it. In view of that, we should keep our eyes peeled—perhaps even two sets of eyes. ■

1 In fact, Janus lends his name to a species of object in physics called the "Janus interface," a type of wall through which particles may pass at the price of undergoing a transformation, as befits Janus's dominion over transitions in myth. This type of transformation is a duality in the physics sense.

2 In physics, the term *duality* is a bit overloaded. We will focus on a certain class of "exact" dualities today.

3 When I say functions I really mean tempered distributions, but we will treat such technicalities like illicit cash flows and keep them off-book.

4 Even after discovering a duality, there may be no good *post hoc* reasoning that renders its existence obvious. But we may still allow ourselves to be happy about it.

5 Of course, position and momentum have units (position, for instance, is measured in units of length) whereas x, p were just names for real numbers. To endow these variables with physical meaning, we need to correct the units with factors of Planck's constant. Then, for example, the Fourier kernel becomes $e^{-2\pi i p x/\hbar}$, so that the exponent is once again a dimensionless number.

6 Physicists call the function describing the quantum state of a system (our entity of interest) the wave function, which can be used to compute the probabilities of finding a particle at a particular position *or* at a particular momentum.

7 In the example of the basic Fourier transform, $\mathscr{A}$ and $\mathscr{A}^\vee$ are (dual) copies of the real line: $\mathscr{A}=\mathbb{R}$, $\mathscr{A}^\vee=\mathbb{R}^\vee=\mathbb{R}$. The dual of the real line is the real line.

8 More formally, $\mathscr{A}$ is the domain of the function f and $\mathscr{A}^\vee$ is the domain of $\hat{f}$.

9 Mathematicians call mapping the sheaf on $\mathscr{A}$ to one on $\mathscr{A}\times\mathscr{A}^\vee$ a *pullback*. The analogue of the "integral transform," which produces the dual sheaf on $\mathscr{A}^\vee$ from the sheaf on $\mathscr{A}\times\mathscr{A}^\vee$ that combines the original sheaf and the "kernel" sheaf, is known as a *pushforward*.

10 This bewildered physicist would like to express gratitude to Kevin Costello, Tudor Dimofte, Justin Hilburn, Ingmar Saberi, Brian Williams, Philsang Yoo, and many others, for patient explanations and enjoyable collaborations.

11 For the mathematically inclined reader: the prototypical example of Koszul dual algebras are the symmetric algebra on a finite dimensional vector space $S(V)$ and the exterior algebra on the dual vector space $\Lambda(V^*)$. The "kernel object" comes from the Koszul complex, whose differential is the standard Casimir element in $V\otimes V^*$, viewed as a subalgebra of $S(V)\otimes\Lambda(V^*)$. The Casimir element is our friend, the kernel $e^{i\langle p,x\rangle}$! The complex furnishes a map between graded algebra modules in the corresponding derived categories of these algebras. Usually a physicist does not wish to bandy about phrases like "the derived category of the abelian category of graded $S(V)/\Lambda(V^*)$-modules," but the details are important for getting the Fourier transform equivalences.

Natalie Paquette, Member in the School of Natural Sciences since 2020, studies quantum field theory and string theory, with a particular interest in their mathematical underpinnings and applications. Some of her recent work explores connections between holography and the mathematical subject of Koszul duality. She is also interested in quantum field–theoretic studies of condensed matter physics.

The Three Moral Hazards of Health Insurance

The troubling history and misuse of the term

BY DONALD W. LIGHT

The current pandemic intensifies the need for universal health insurance, but it raises, in some quarters, the specter of "moral hazard." This term, with its troubling history, is taken to refer to incentives for patients to overuse healthcare services because these costs are borne by other policyholders. Put another way, policyholders as patients have an incentive to use more services than those on which their insurance premiums are based. For Massachusetts Institute of Technology professor Amy Finkelstein, the presiding expert on moral hazard, this is what "moral hazard" means.[1] Besides policyholders, however, there are two other parties to health insurance: the insurers and health care providers. In a straightforward or perverse way, all three are subject to forms of moral hazard.

"Oh, come on, it's not like you had to leave the solar system to get a good health plan."

ANDREW GROSSMAN

Like policyholders as patients, providers have the same incentives to overuse or over-provide services. Providers profit from this practice while patients simply get expenses covered. On the other hand, insurers have an inverse incentive to provide fewer services than those on which premiums are based and profit from the difference. This triangle of so-called moral hazards (which are not really about hazards of morality) has been overlooked by policymakers and leading economists whose work forms the basis for health insurance policy.

The history of the term "moral hazard" dates back to the nineteenth and early twentieth centuries, when people did not trust insurance companies.[2] They offended clergymen and upright citizens as they were seen as gambling on the bad luck or ill fate of others.[3] In response, insurance agents and advocates turned the tables by focusing on distrustful people and screening out those who posed a "moral hazard" to honest policyholders seeking to cover genuine risks. As a leading historian wrote, "[A]ddressing moral hazard signified the morality of the insurance enterprise at a time when that morality was in substantial doubt."[2] This newfound moral hazard pointed to ethnic minorities, immigrants, and others regarded as less than upright. Insurance agents (principally white, middle-class men) were trained to screen out such "distrustful risks" and take on the mantle of moral integrity. Moral hazard continues to discriminate against minorities to this day.

The modern meaning of "moral hazard" began when Kenneth Arrow, who went on to win the Nobel Prize in economics, started training after the Depression to become an insurance actuary.[1] He conceived of insurers' use of moral hazard as referring to information asymmetry—the fact that policyholders know more about their health conditions and risks than the insurance company.[1, 2] The health economist Mark Pauly affirmed this new meaning and concluded "that the problem of 'moral hazard' in insurance has, in fact, little to do with morality" but rather with lowering the cost to a policyholder of a claim.[4] Over time, moral hazard has come to refer to people with medical insurance getting more medical care, aside from whether they need it or not.[5, 6]

The theory of moral hazard implies that if policyholders' costs drop to zero with single-payer, publicly-funded universal health insurance, demand and expenditures would become infinite. The theory questions the merit of any health insurance. In reality, countries like the UK that have universal health insurance free at the point of service spend far less on medical services than does the United States, and their services are rated higher by their own sick patients than U.S. patients rate their quality of care.[7] But the idea that comprehensive health insurance helps to control appropriate use and prices is not part of moral hazard theory. While Finkelstein provides evidence that individuals with more health insurance use more medical services, she does not consider other good reasons why sick patients seek medical care, or why free health care can cost less. Instead, critics invoke moral hazard whenever policymakers campaign for universal health insurance.

Overlooked is how insurance policies work for the other side of policies, the insurers. Through claims adjustments and actuaries, companies can control how much of policyholders' premiums they keep—an inverse insurer moral hazard faced by sick policyholders trying to get coverage for their medical expenses. Some well-established techniques of insurer moral hazard include setting coverage limits, deductibles, and co-payments; denying legitimate claims;

(Continued on page 9)

The Institute at Crossroads

Gender, Work and Family in a Scholar's Paradise

BY HISTORY WORKING GROUP

In a 1997 letter to Myrna Jenkins, the longtime director of Crossroads Nursery School, Homer Thompson recalled being present, fifty years earlier, at the nursery's "birth pangs in the autumn of 1947."

The distinguished archaeologist and Professor Emeritus in the School of Historical Studies had good reasons to remember the meeting: it was J. Robert Oppenheimer's first as Director-elect of the Institute for Advanced Study. Oppenheimer's predecessor, Frank Adeylotte, had championed the idea of a nursery during his term, but organizational issues had hampered the project.

SERGE J-F LEVY

Crossroads Nursery School

Thompson recalls witnessing "the growing impatience" on Oppenheimer's face as the Faculty discussed the nursery's establishment. When they left the room, the new Director whispered, audibly enough for him to understand: "Never again will the Nursery School appear on the agenda of a faculty meeting." "Nor did it," Thompson adds in his letter, "during the Oppenheimer regime" (which lasted almost two decades, until 1966).

Were it not for this source we would have no knowledge of these events: the minutes of the meeting record only a discussion on taxation and a vote on the motion that the secretary should collect the Lunch Club due of $10 from each Faculty member. Perhaps the nursery school conversation was not deemed worthy enough to be mentioned.

A full-length article by the History Working Group explores the Institute's vocation as a place of scholarship and knowledge from an angle that may, at first, seem marginal: the Crossroads Nursery School, founded in 1947 and in operation on site ever since. This work was made possible thanks to hitherto unseen archives made available by Danielle Otis (the current director of Crossroads). The view from the nursery opens up a new social history of the IAS, shedding light on questions of gender and science that were as salient back then as they are today. In particular, we excavate the unspoken, and fundamental, views on gender and parenting at the Institute from the late 1940s, and their historical transformations.

Recommended Reading:
The full-length article is available at www.ias.edu/ideas/crossroads

The Institute was initially envisaged (at least implicitly) as a scholar's paradise for heterosexual men assisted by female spouses whose primary role was to free up their husbands' time by taking care of the children. This original model was put under severe strain as women became increasingly present in the academy. As a result, policies at all levels were implemented to reduce the gender gap among invited Members of the Institute's various schools. But measures to produce free time for research conflicted with the labor demands expressed by the female staff working at the nursery school, bringing to the fore how class and gender divides intersect. Far from being marginal, the view from Crossroads brings us to the very heart of the Institute's mission, with a simple yet thorny question: what are the conditions of possibility for the production of autonomous knowledge? ■

This piece is authored by past Members Fadi Bardawil, fadi.bardawil@duke.edu; Céline Bessière, celine.bessiere@dauphine.psl.eu; and Thomas Dodman, td2551@columbia.edu, for the History Working Group, a Member-organized initiative that mobilized in response to the executive order of January 27, 2017, which initially banned travel and immigration to the United States from seven predominantly Muslim countries.

Sir James D. Wolfensohn (1933–2020)

James Wolfensohn

Sir James D. Wolfensohn, Chairman of Wolfensohn & Company, L.L.C. and a global champion of human rights, economic justice, scholarship, and the arts, died on Wednesday, November 25 at his home in Manhattan at the age of 86.

Wolfensohn was the ninth president of the World Bank, sworn into office on June 1, 1995, after being nominated by President Bill Clinton. A transformative and hands-on leader, Wolfensohn re-envisioned the Bank's commitment to alleviating poverty, investing in sustainable development, and promoting social justice globally.

In 1979, Wolfensohn joined the Institute for Advanced Study's Board of Trustees and became the Board's longest-serving Chair (1986–2007). Wolfensohn had a passionate commitment to the Institute's mission of enabling the world's foremost scholars to conduct breakthrough research at the highest levels of academia.

"Jim embraced the world and everything in it—its challenges, the arts, science, politics, and people most of all," stated Robbert Dijkgraaf, IAS Director and Leon Levy Professor. "A man of no excuses and a boundless diversity of interests, Jim believed in and harnessed the enormous potential of the human spirit for the common good. We are eternally grateful for the wisdom and generosity he brought to the Institute and world for which he cared so deeply."

James David Wolfensohn was born on December 1, 1933, in Sydney, Australia. He was a veteran of the Royal Australian Air Force and a member of the 1956 Australian Olympic fencing team. Educated at the University of Sydney, he received a B.A. and LL.B. in 1954 and 1957, respectively. He worked as a lawyer at an Australian law firm and went on to earn an M.B.A. from Harvard University in 1959.

"Jim was larger than life, hard-working, and compassionate," stated Charles Simonyi, IAS Board Chair. "His moral vision spanned the globe, complemented by a gift for connecting with individuals. Passionate about music and sciences, he was an inspiration to all who knew him. The Institute for Advanced Study will always treasure the memory of his extraordinary leadership."

As the longest-serving Chair in the Institute's history, Wolfensohn stewarded the growth of the Institute's endowment, which more than doubled in real terms under his leadership. His many accomplishments as Chair included overseeing the endowment of six Professorships across the Institute's four Schools. Wolfensohn also took a particularly active interest in extending the global impact and profile of the Institute, reaffirming and strengthening its reputation as an international center for scholarship.

Having served as Chairman of the Boards of Carnegie Hall (1980–91) and the John F. Kennedy Center for the Performing Arts (1990–95), Wolfensohn, who was an accomplished cellist himself, encouraged musical performance at the Institute, contributing to the establishment of the Artist-in-Residence program and regular concerts. Reflecting Wolfensohn's long-standing commitment to the Institute and his dedication to the arts, the Institute named its lecture and performance hall, Wolfensohn Hall, in his honor in 1993.

Wolfensohn was the third World Bank president to serve more than one five-year term. During his tenure, which extended from 1995 to 2005, Wolfensohn implemented an agenda to fight corruption, fund education, and support global health and HIV/AIDS programs. His efforts were also transformative in bringing more transparency to the organization. In 2005, Wolfensohn's experience as an investment banker and international advocate for human rights led him to found Wolfensohn & Company, LLC. The firm provides strategic consulting advice to governments and large corporations doing business in emerging market economies.

Among his numerous awards, Wolfensohn was made an honorary officer of the Order of Australia (1987), received an honorary knighthood of the Order of the British Empire (1995) for his service to the arts, and the Leo Baeck Medal (2006) for his humanitarian work promoting tolerance and social justice. In 2020, Wolfensohn was recognized with the IAS Bamberger Medal for his extraordinary service in fortifying IAS for the twenty-first century and his unwavering commitment to the pursuit of new knowledge. ■

Martin Chooljian (1930–2021)

ANDREA KANE

Martin Chooljian

Martin Chooljian, Trustee Emeritus, longtime Friend of the Institute, beloved personal friend to many in the community, and one of the Institute's most generous benefactors, passed away this week at the age of 90.

Elected to the Institute's Board of Trustees in 1997, Chooljian served with distinction for thirteen years in this role and subsequently as a Trustee Emeritus. He made significant contributions to the growth and governance of the Institute, having served on the Audit, Finance, Academic Affairs, Buildings and Grounds, and Development and Public Affairs Committees.

He and his late wife Helen joined the Friends of the Institute in 1992, and went on to become two of the group's most passionate advocates and supporters. As inaugural members of the Founders' Circle, the association's highest level of giving, the Chooljians set a model for philanthropy. In recognition of his service and remarkable generosity, he was named an honorary lifetime member of the Friends Executive Committee in 2016.

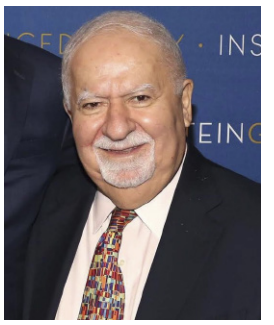
"Marty gave true meaning to the word friend," stated Robbert Dijkgraaf. "Beyond his extraordinary leadership as a donor with the Friends, Marty always answered the call to provide funding for critical needs and special initiatives as they arose."

Having endowed two Memberships in the School of Natural Sciences, one in particle physics and another in theoretical biology, Martin took great pleasure and pride in meeting the "Chooljian Members" each year. As founding co-Chair of the Institute's Legacy Society, Chooljian led by example.

In May 2010, the Institute's Board of Trustees adopted a resolution recognizing Chooljian's work to "fortify the Institute's mission, broaden its reach, and strengthen its sources of unrestricted income." The Board further recognized Chooljian, a "beloved member of the Institute community," for his "outstanding efforts to support the curiosity-driven research that produces advances in knowledge."

Beyond their support of the Institute, the Chooljians were champions of the local community and the arts. Martin served as trustee and treasurer of McCarter Theater from 1987 to 1994. Given their longtime support of the Princeton First Aid and Rescue Squad, the organization announced in 2018 that its new building would be named in Helen's honor. ■

Vartan Gregorian (1934–2021)



Vartan Gregorian

Vartan Gregorian, Trustee Emeritus, lifelong champion of education, and renowned global intellectual, has passed away this week at the age of 87.

Gregorian served on the Institute's Board of Trustees from 1987 to 2013 with an unmatched appreciation for the IAS mission and its commitment to advancing knowledge. He once described IAS as the "university to universities," and as a Trustee worked tirelessly to cultivate this reputation at a global scale. He continued to actively serve IAS as Trustee Emeritus over the past years.

With an unshakable work ethic, Gregorian was a lifelong advocate for education and the transmission of knowledge. He had the highest respect for teachers, journalists, and librarians and was singular in his accomplishments to fortify such pillars of truth in society. He once described the sole function of education as providing an "introduction to learning."

Robbert Dijkgraaf referred to Gregorian as "An ambassador-at-large for scholarship, philanthropy, and the common good," adding, "It is hard to think of a more inspiring example to us all."

Gregorian served as president of the New York Public Library from 1981 to 1989, securing the needed funds and imparting the vision necessary to revive the struggling institution. He was equally impactful as president of Brown University from 1989 to 1997. He has been recognized with more than 70 honorary degrees and dozens of significant awards, including the National Humanities Medal (1998) and the Presidential Medal of Freedom (2004). Vartan had served as president of the Carnegie Corporation since 1997.

Gregorian earned B.A. and Ph.D. degrees in history from Stanford University in 1958 and 1964 respectively. He went on to join the faculty of the University of Pennsylvania in 1972, became the founding dean of Penn's Faculty of Arts and Sciences in 1974, and subsequently served as the 23rd provost of the university from 1979 to 1980.

An Armenian born in Iran, Gregorian moved to the United States at 22. His life experience ingrained in him a solid constitution and seemingly limitless energy for advancing immigrant rights and international peace. ■

Thus the exile of Trotsky in 1929 after the triumph of Stalin was completely misunderstood. The only real difference between the two in international relations was that whereas, on the whole, Trotsky believed foreigners had the capacity to make their own revolutions because the capitalist order was inherently unstable, Stalin equally firmly believed that foreigners were generally too incompetent to manage it without direct military assistance from the Soviet Union because the underlying conditions were by no means as propitious as Trotsky supposed. The case of Germany was not the only instance of this.

Though the importance of such world changing events has never been in question, historians of international relations since the 1960s have come under attack. Social historians have casually dismissed the value of military history, diplomatic history, and the history of political thought as old hat. Instead they advanced the untested proposition that social history was "the most important area of research in history" and that all future history should be centered on social history.[2] That never happened, however. It did not happen because it is inherently preposterous to assert that one branch of history holds all the answers. And even to assert its primacy is merely bold assertion.[3] On the other hand, it was right to challenge the complacency of notable historians of international relations.

Buttressed by knights of the realm, such as Sir Llewellyn Woodward or Sir Charles Webster, diplomatic history offered tempting targets to snipers from opposing camps. Reviewing a meticulous account of the Manchurian crisis (1931)—Japan's attack on China—that was based almost entirely on British and American diplomatic archives, the Sinologist John Gittings took to task its author for ignoring Chinese sources available even in English. His target, Christopher Thorne, whose scholarship had yielded a penetrating attack on Britain's appeasement of Hitler's Germany, was accused of bending over backwards to excuse the British and the Americans for not standing up to Japan. "Diplomacy is often said to be the art of the possible," Gittings wrote. "It is perhaps less that than it is the art of asserting one's country has done all that is possible when it has done nothing at all." Having taken Thorne severely to task, Gittings walloped a very hard ball into an open goal. He caustically alluded to "one of those rare passages where the diplomatic historian allows the fundamental assumptions on which he operates to become explicit, too often illustrating his essential subservience to the myth-making of the official diplomats."[4]

Zara Steiner's Oxford history of Europe, *The Triumph of the Dark: European International History 1933–1939*, also came under fire. One assertive reviewer excoriated it as "old-fashioned international history, barely discussing the ideological and social forces lying behind diplomacy."[5] Yet Steiner did grant that "ideological assumptions affected the way statesmen and their advisers saw the world about them. It mattered that Neville Chamberlain hated war and believed that wasteful arms races led to conflict. He assumed that others shared his views."[6]

But there is more. Important though he was as Prime Minister, Chamberlain was not alone in his beliefs, and they went much further than an instinctive aversion to war. Steiner, however, offered no broader consideration of the attitudes and prejudices prevailing at the top of society: not just among Cabinet members but also the assumptions, written and unwritten, of the Foreign Office clerks whose minutes and despatches are so frequently cited. This was, after all, a society run by a homogenous caste who had usually attended leading private schools and invariably Oxford or Cambridge. Steiner herself was very early on the awkward recipient of patronizing remarks from such as Sir Orme Sargent: "A woman, an American, a Jew? Studying the Foreign Office?" But she never let personal rebuff color the text. Britain's best dressed ambassador to Berlin, Sir Nevile Henderson, was surely not so wide of the mark when he told the Germans that "Great Britain should not be rated as a democracy but as an aristocracy" and that the "aristocratic ruling class was at present on the defensive against the broad mass of the popular front."[7]

My book recognizes that discernible bias is built into state documents that we usually rely so heavily upon for our accounts. The history of international relations has to be scrutinized at more than one level and in more than one dimension. Leaving the victims' side of the story out of the Manchurian crisis was not deliberate on the part of Thorne. But it followed directly from the sources chosen. The values inherent in relying on those sources, cultural and political, subconsciously shaped the result and those values were too embedded to be challenged. The prevailing notion of what is "normal" tends to go untested. Unguarded empiricism is, however, never a sensible way of proceeding. A suite of diplomatic documents alone will never provide the answers, however closely examined; and, remember, not all are declassified for the interwar period, even now. I had to go to Moscow to find the minutes of the Committee of Imperial Defence for December 20, 1936. When I complained to an official from the Cabinet Office, her retort was: "Why should we be dictated to by the Russians?" We have no access to the files of Britain's secret service, M.I.6., for the interwar period, let alone those of the Soviet equivalent. To a greater or lesser extent historians are captive to government censorship. This being so, how are they to break out?

To offset bias, official papers have to be transcended. It is a serious error to scrutinize them in isolation (that is to say only within the confines of one's own language and exclusively from within one's own culture), which is unfortunately too often the norm in the English-speaking world. The diplomatic sources have to be triangulated (from various foreign archives rooted in distinctive national perspectives); contextualized (through the domestic realm, where beliefs originate and are reinforced); and, of no lesser importance, interrogated for what is not always made explicit—the unwritten assumptions of those who in haste composed the texts for purely operational purposes—as well as for what the documents say. That requires heightened consciousness of the dominant mindset as well as active imaginative insight.

Ideas, mindsets, and assumptions matter just as much as do more elaborate ideologies that make explicit the purposes of power. Raw power alone goes only so far in ensuring states behave in identical ways in differing circumstances. For this reason, statesmen who lapse back into the reassuring predictability of balance of power politics tend to come unstuck. The international situation never looks the same from every perspective. Not everyone subscribed to "the comity of nations." Counterparties acted in response to the specific vantage point of their own society, not in response to a worldview shared by all.

ONE DOES NOT HAVE TO BE A MARXIST TO SUPPOSE THAT THOSE RULING THE STATE ARE LIKELY, IF UNCHECKED, TO SERVE THE INTERESTS OF THEIR OWN CLASS, WHETHER ARISTOCRACY OR BOURGEOISIE.

The interwar period is a lesson in point. Rivalry between the Great Powers after 1917 was acutely affected by a battle of ideas that reached above and beyond the normal preoccupations of diplomatic practitioners accustomed to the European states system from 1815 to 1914. In this sense, the twentieth century more closely resembled the era of the wars of religion of early modern Europe and of the French revolution than the nineteenth-century Concert of Europe, where eminent diplomatic historians traditionally cut their teeth.

Seen through the lens of classical realism or the opaque windows of a department of state, the international relations of the interwar period actually make little sense. It soon becomes evident that divergent and contested purposes drove the foreign policy of the various states which cannot be explained wholly along traditional lines. Indeed, politicians and diplomats came to fear more the insidious power of ideas than the measurable components of military capabilities. So a country with demonstrably weak offensive military capabilities—Soviet Russia—could seem all-threatening because of the power of its ideology. Yet a state with belligerent military strength—Nazi Germany—could appear as ultimately acceptable as an idiosyncratic member of the club because its ideology was seen by those ruling a country like Britain as none too pleasant, but complementary rather than menacing.

Thus instead of worrying about fascism, the British élite worried more about what would likely as not replace it—communism—were fascism destabilized and overthrown. An often silent complicity can thus be observed among those who would not have openly advocated an alignment with fascist states as witnessed during the Spanish civil war. The roots of anxiety lay well beyond the confines of ministries of state, in society at large, where, since the First World War, traditional loyalties could no longer be taken for granted.

It therefore does not make sense to reduce intention in foreign affairs to *ragion di stato* or *raison d'état*: the interests of the state that override every other interest. Who ran the state? Who were the custodians of diplomacy? They may not all have been the sons of "gentlemen of independent means" with a lot to lose. But more than a few undoubtedly were; certainly in London and Paris. Could these men (and they were invariably men) define the interests of the state without reflecting their own sectional interest? One does not have to be a Marxist to suppose that those ruling the state are likely, if unchecked, to serve the interests of their own class, whether aristocracy or bourgeoisie. The Renaissance idea of *ragion di stato* was invented precisely to offset such distortions. It was never suggested that governments invariably further the interests of the state, but that they *should* do so in the interests of society as a whole rather than in furthering

(Continued on page 9)

HASLAM *(Continued from page 8)*

sectional or ideological interests. The historian, like the political scientist, is entirely wrong to read this back to front and impose this as an assertion that this is what states actually do and have always done.[8]

The bias is not only one of class but also of nation. Commuting between foreign archives alone makes one exceptionally aware of entire societies whose practices are centuries old and are not at all easily captured in neat formulations by those who blandly assume that the makers and executors of policy are "rational actors." This is a highly misleading notion borrowed from political science which, in turn, was taken from economics, at the very time discerning economists such as Kenneth Arrow were abandoning it.[9] And whose rationality are we referring to? It is a form of imperial provincialism strikingly apparent across the social sciences in Britain and the United States, particular in the field of international relations, that assumes we reason alike regardless of social and national provenance. Thus examining the conduct of foreign policy within a vacuum inevitably makes for misleading assumptions, perhaps not about what has been happening but certainly why.

DISCERNIBLE BIAS IS BUILT INTO STATE DOCUMENTS THAT WE USUALLY RELY SO HEAVILY UPON FOR OUR ACCOUNTS.

So are we left with an impossible task? How are we to get into the minds of those taking and executing decisions in ministries of foreign affairs? Declassified dispatches and policy memoranda obviously count for a great deal. But take care. In the modern era busy bureaucrats write elliptical telegrams that have to be enciphered at one end and deciphered at the other, before being reviewed or minuted speedily upon receipt. They are not about to waste valuable time telling each other what they already know; nor are they about to do so in position papers directed at the Secretary of State, who is, after all, even busier than they are and a politician wedded to his or her own insights or prejudices. Moreover, some statesmen are merely unreflecting caretakers dependent on subordinates for their judgements in fields far removed from their own. Personal papers such as diaries help and without them we would be lost—where, indeed, would we be without the indiscretions of former diplomat and writer Harold Nicolson? And without Chamberlain's letters to his sisters we would also be much the poorer. But, as historians of the interwar period have found, the great houses of the British aristocracy who were highly influential in foreign affairs have in notable instances to their shame refused access to the relevant primary sources likely to embarrass living relatives. Some former ministers, such as Richard (R. A. B.) Butler, destroyed crucial papers—such as those touching on peace feelers to Germany (behind Churchill's back) in the summer of 1940—that contradicted the dissembling memoirs they had put into print. And in Britain oppressive libel laws enabled culprits such as Sir Joseph Ball and Lord Rothschild to threaten court action in order to prevent the truth from being outed—in Ball's instance, secret overtures to Mussolini; in Rothschild's, his complicity with the Cambridge Five.[10] For all of these various reasons foreign observers are, generally speaking, far more likely to be able to identify an implicit consensus of thought prevalent among those ruling another state, than are those safely on the inside.

The aim of my study is to bring together the history of international relations from the outside and the history of ideas from the inside; ideas projected to conscious purpose in international relations. ■

1 *The Struggle for the Mastery of Europe 1848–1918* (Oxford: Oxford University Press, 1954) and *The Origins of the Second World War* (London: Hamilton, 1961).

2 L. Hunt, *The New Cultural History* (Berkeley: University of California Press, 1989) p. 1; and K. Thomas, "The Tools and the Job," *Times Literary Supplement,* 7 April 1966.

3 Thomas later backed off from his youthful zealotry: Thomas, "History Revisited," *The Times*, 11 October 2006.

4 C. Thorne, *The limits of foreign policy: the West, the League and the Far Eastern Crisis of 1931–1933* (London: Hamilton, 1972). J. Gittings, "Rules of the Game," *New York Review of Books*, 17 May 1973. Thorne's *The Approach of War 1938–39* (London: Macmillan, 1967) was written before most of the documents were available. Yet he successfully built upon an inestimable advantage obtained from direct access to those son the periphery of the tragedy.

5 V. Bogdanor, "Hitler's Willing Executioners," *New Statesman*, 18 November 2010.

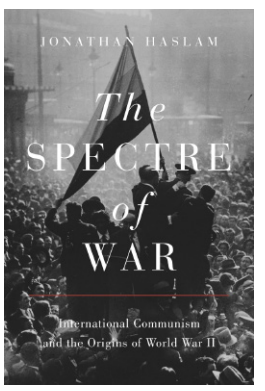
6 Z. Steiner, *The Triumph of the Dark. European International History 1933–1939* (Oxford: Oxford University Press, 2011) p. 1048.

7 Quoted in Thorne, *The Approach of War 1938–39*, p. 17.

8 See Haslam, *No Virtue Like Necessity. Realist Thought in International Relations Since Machiavelli* (New Haven and London: Yale University Press, 2002).

9 K. Arrow, "Risk Perception in Psychology and Economics," Technical Report No. 351, October 1981. A Report of the Center for Research on Organizational Efficiency, Stanford University.

10 The five most notorious Soviet spies emanating from Cambridge University were Kim Philby, Donald Maclean, Guy Burgess, John Cairncross, and Anthony Blunt. See Haslam, *Near and Distant Neighbours: A New History of Soviet Intelligence* (Oxford: Oxford University Press, 2015). The Russian foreign intelligence service, for whom they worked, are now releasing onto the worldwide web classified documents relating to their operations at *www.cambridge5.ru*



This article has been excerpted from The Spectre of War: International Communism and the Origins of World War II *(Princeton University Press, 2021). Jonathan Haslam, George F. Kennan Professor in the School of Historical Studies, is a leading scholar on the history of thought in international relations and the history of the Soviet Union whose work builds a bridge between historical studies and the understanding of contemporary phenomena through critical examinations of the role of ideology. Haslam is the author of many books, as well as a blog, www.throughrussianeyes.com, which highlights aspects of Russia's foreign and defense policies that do not see the light of day in mainstream media.*

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profiting from delayed claims processing; and making it difficult to get valid claims paid through claims harassment. Other techniques include contingent or conditional coverage that disqualifies services a claimant believes are valid, and "gotcha" clauses such as requiring prior notification for elective procedures as specified in the fine print that few policyholders read. Unlike individual moral hazard, which makes no money for the patient but only pays for services rendered for treating a medical problem, companies stand to profit millions from exploiting the perverse incentives of insurer moral hazard. Historically, short-changing policyholders is where moral hazard began in the early days of widespread distrust of insurers.

The third kind of moral hazard consists of physicians, clinics, labs, and hospitals profiting from provider moral hazard by carrying out more services than insured patients really need. It is providers, not patients, who generate most of the medical bills sent to insurers. Provider moral hazard lies behind efforts to induce insured patients to want or "need" more tests and procedures. High-margin testing and elective surgery especially benefit providers. While both patients and insurers depend on providers as the experts to determine which services and claims are valid and legitimate, there seems no limit to the upward spiral of provider moral hazard.

In sum, of the three moral hazards in health insurance, the consequences of incentives faced by patients seem least substantial and are offset by the uncompensated pain, suffering, anxiety, and trouble of seeking care. More substantial are the incentives and profits built into insurer and provider forms of moral hazard. If we want to rein in spiraling medical costs, the proven best way is to have integrated universal health care insurance and service protocols, as found in countries like The Netherlands or Germany. Some moral hazard would remain, but much less. ■

1 A. Finkelstein, K. J. Arrow, J. Gruber, J. E. Stiglitz, *Moral Hazard in Health Insurance*. (Columbia University Press, New York, 2015).

2 T. Baker, "On the Genealogy of Moral Hazard," *Texas Law Review* 75, 237–292 (1996).

3 V. Zelizer, *Morals and Markets: The Development of Life Insurance in the United States*. (Columbia University Press, New York, 1979).

4 M.V. Pauly, "The Economics of Moral Hazard: Comment," *American Economic Review* 58, 531–537 (1968).

5 D. Stone, "Moral Hazard," *Journal of Health Politics, Policy and Law* 36, 886–896 (2011).

6 J. A. Nyman, "Is 'Moral Hazard' Inefficient? The Policy Implications of a New Theory," *Health Affairs* 23, 194–199 (2004).

7 E. C. Schneider, D. O. Sarnak, D. Squires, A. Shah, M. M. Doty, "Mirror, Mirror 2017: International Comparison Reflects Flaws and Opportunities for Better U.S. Health Care," (Commonwealth Fund, New York, 2017).

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