

Professor Kenneth Joseph Arrow (1921-2017), Founding Member, PASS.¹

We are gathered here today in Casina Pio IV to remember and pay tribute to the memory of our dear friend and colleague, Kenneth Joseph Arrow, a Founding Member of PASS, who died on 21 February this year.

If you click onto Google and type "Kenneth Arrow", you will find many, many tributes to him, not just from economists, nor only from people who knew him. You will read that he made momentous discoveries that spanned economics, political science, sociology, and moral and political philosophy. If you continue to look, you will discover that he made significant contributions to operations research, in particular the stability of certain dynamical systems. And if you look some more, you will read that his first publication, based on work done during the Second World War as a weather forecaster in the US Air Force, was on a problem in aeronautics (the path that should be taken by an aeroplane flying from A to B that, so as to conserve fuel, corrects for wind velocities). Arrow created an entire branch of thinking (the possibilities of designing ethical voting rules - he showed there can be no voting rule that satisfies a set of minimal normative requirements); he helped to close a long standing attempt to conceptualise an ideal price-guided economy (the existence and efficiency of general competitive equilibria - joint work with the late Gerard Debreu); and he opened new areas of thinking (identifying unique features in doctor-patient relationships that make unassisted markets unsuitable for supplying medical care; understanding the forces that drive the practice of racial discrimination; deriving the meaning of option values for environmental goods; uncovering the meaning of sustainable development; exploring the characteristics of knowledge that make it very different from marketable commodities; using the Aristotelian Principle - learning by doing - to show how practice is an engine of economic growth²; and so on). Even in his more discursive papers,

1 The Tribute was prepared and read by Partha Dasgupta (Member PASS) at the Plenary Session of the Pontifical Academy of Social Sciences on Saturday 29 April 2017. It will appear in the Academy's annual Proceedings.

2 Appealing to what was then a sparse empirical literature within industrial economics, he assumed that a firm's productivity is a function of its cumulative output to date. Borrowing from Thomas Dewey's writings on education policy, Arrow gave his paper the title "The Economic Implications of Learning by

Arrow offered insights that have repeatedly been used by others to build their own work. You will find in your Google search that he was not only admired universally for his brilliance and creativity, but more importantly, that he was much loved. In an international ballot among economists some twenty years ago, he was voted the greatest economist of the twentieth century. Arrow was not unaware of his natural gifts, and because he did it unconsciously, he was not reticent about displaying them; but for a reason I discovered many years ago, none of that ever grated on others (I come to that later in this tribute). His presence caused others to balk before speaking, but he was never intimidating.

Those intellectual gifts included not only an exceptionally creative mind, but also the ability to read at speed, distilling from what he read were their essential elements, and recalling them when he had need to do so. And he was a voracious reader of whatever lay close to hand - books, journals, newspapers, and magazines. There is a story, that at the time of his move from Stanford to Harvard in 1968, the younger members of Harvard's Economics Department devised a plan to open a discussion on a subject of which they were confident Arrow would be innocent. (I imagine they connived so as to retain some form of respect for their own abilities.) In anticipation of a dinner in Arrow's honour, the group read what they thought was then available on how gray whales find the same breeding ground every time. The topic was duly introduced at the dinner, casually of course, and the protagonists talked at length on the subject. Arrow, as the story goes, remained quiet, but before the conversation moved on to other things, he murmured; "But I thought Turner's theory was discredited by Spencer, who showed the supposed homing mechanism couldn't possibly work." The story isn't apocryphal. I once asked Arrow if it was true; he didn't say "no".

We at PASS remember him as a dedicated Member, duly attending meetings and being fully engaged in our discussions (even while taking his renowned naps during sessions). He was proud of being Member of PASS, loved staying in Domus Sanctae Marthae, and made a habit of visiting a favoured coffee shop near the Pantheon. On every occasion we both were at a PASS meeting, he would pick me up from my room on arrival at the Domus so that we could visit his

Doing" (*Review of Economic Studies*, 1962). Dewey in turn had borrowed it from Aristotle: "Anything that we have to learn to do we learn by the actual doing of it: people become builders by building and instrumentalists by playing instruments." Aristotle, *The Nicomachean Ethics*, trans. J.A.K. Thomson (Harmondsworth: Penguin Books, 1976: p. 63). John Rawls in his *Theory of Justice* (1972) christened "learning by doing" the Aristotelian Principle.

favourite coffee house and catch up on our thinking.

Kenneth Arrow was born in New York City on 23 August 1921 to Lillian Greenberg and Harry Arrow, both Romanian immigrants of the Jewish faith. A younger sister, Anita (Summers) – Emeritus Professor at the Wharton School, University of Pennsylvania - survives him. The family income dropped precipitously during the Depression, so the Arrow family was poor for a number of years. Ken once said to me in passing that he walked several miles each day to school. As I understand it, his exceptional intellectual gifts were recognised early. He attended City College New York for his undergraduate studies, graduating in mathematics in 1940, and moved to Columbia University for graduate studies and obtained his Master's degree in mathematics and statistics in 1941. There he came under the influence of the great economist/statistician Harold Hotelling, who helped him to obtain a scholarship to study for a Ph.D, but in the Economics Department. As Arrow told the story, Hotelling said he had no influence over the Mathematics Department, so could not be of help obtaining funds there.

During 1942-1946 Arrow's studies were interrupted while he served as a weather forecaster in the US Air Force. He returned to academia in 1946, partly as a graduate student at Columbia University and partly as a Research Associate at the Cowles Commission for Research in Economics at the University of Chicago, under the Directorship of Tjalling Koopmans. In all the years I knew Ken, the two scholars to whom he showed reverence (and I mean this literally) were Harold Hotelling and Tjalling Koopmans. They had both served as his mentors during a period when he needed reassurance that the life of an academic economist was what he should aim for.

Arrow married a fellow research associate, Selma Schweitzer, herself a statistician of distinction, in 1947. Together they moved to Stanford University in 1951, where Ken assumed an Acting Assistant Professorship in the Economics Department. The couple remained there until 1968, when they moved to Harvard University. But it was not for long, because the Arrows (with their two boys, David and Andrew) returned to Stanford in 1979, where Ken was appointed Joan Kenney Professor of Economics and Professor of Operations Research. He retired from his Professorships in 1991, but continued to work in the Department of Economics in the afternoons, right to the end. Selma, who had subsequently trained as a psychotherapist, practised well into her 80s. She died in 2015.

I got to know Ken in Spring 1973, when he was visiting Cambridge. He had taken an

interest in a typescript I had recently prepared on John Rawls' just principle of saving. Because he felt an alternative model would better fit Rawls' intentions (we published our papers separately), he made it a point of seeking me out so as to discuss the principle with me. It was a terrifying experience. His mind not only moved at an incredible speed, he also spoke rapidly so as to keep pace. He also had the habit of changing gear mid-sentence to improve upon what he had been intending to say, on occasion recognising even while he was formulating a theorem that it wasn't quite right and correcting it by the end of the sentence. I found this overwhelming. It meant I had do something if I were to retain whatever self-confidence I then had. I took to crossing the street to avoid him if I saw him approaching. But I couldn't do that all the time. Over the weeks I realized that he felt our conversations had helped to improve the paper he was writing. It was only some years later that I realized Arrow was under the impression that most others he met were equal to him in intellect. In all the years I knew him that was the one fact about the world on which I knew him to be wrong.

Arrow was one of the architects of modern economics, including the theory of public policy. But unlike his writings on social choice, risk and uncertainty, and general equilibrium theory, his publications on the theory of public policy are discursive, both in style and focus. Some are essays, with no mathematics to aid the exposition, and are written in an informal style that guide rather than direct readers toward ways in which the questions could be most fruitfully framed. Others are mathematical, have a sharper focus, and are enlivened by theorems. Arrow's style of discourse on the theory of public policy fitted his intentions. They have shaped the way the literature has developed and continue to develop.

He took public policy to be society's reasoned response to failure of markets to allocate goods and services efficiently and equitably. Utilitarianism guided him, but by paying greater attention to individuals' expressed preferences than is welcomed by moral philosophers, he avoided the authoritarian streak that has frequently marked Utilitarian writings. A deep meditation (*The Limits of Organization*, 1974) on the constraints on motivation and actions that dispersed information imposes on people reads as a tussle between the democrat and the Utilitarian in him. Arrow's democratic instincts curbed his Utilitarian leanings; his Utilitarian convictions in turn kept him far removed from Libertarianism. Arrow did not advocate dispensing with markets, his work led him to characterise well-functioning mixed economies.

Although confident about the relevance of his models when establishing theorems, he

was hesitant when lifting them to speak to the world we have come to know. This was a reflection of his pluralistic values. He opened his monograph of 1974 with the words of the great first century sage, Rabbi Hillel: "If I am not for myself, then who is for me? And if I am not for others, then who am I? And if not now, when?" That tension is present not only in the monograph, but also in his other writings on public policy.

His Utilitarianism isn't the one to be found in Henry Sidgwick's great work, *The Methods of Ethics*. Arrow was an Intuitionist, at direct odds with Sidgwick, who had devoted an entire chapter criticizing Intuitionism. Arrow arrived at his Utilitarian thinking from fundamental ethical axioms. That is why his version of Intuitionism is also called Value Pluralism. In this he was influenced by Tjalling Koopmans, who had provided an axiomatic foundation for Utilitarianism in an intergenerational setting. Value Pluralism encourages one to iterate between the choice of ethical parameters and the consequences of those choices for public policy. Without such experiments seemingly plausible expressions of ethical preferences can commend policies that are in deep conflict with other values the decision-maker may hold.

At the personal level, though, Arrow was far from being a Utilitarian. You all will have felt his uncompromising stance on what he felt to be one's duties. Although he never spoke to me about it, I can't help thinking that on personal conduct it was family influence at work.

But above all, what made him entirely distinctive was that he never abandoned the intellectual life of the graduate student. For him no problem was too trivial to explore, no topic too boring to pursue. His love of mathematical calculations never deserted him. Once he had formulated a problem and uncovered a truth, he was done. He disliked writing papers.

Ken told me that after reaching age 80 he would come to PASS meetings only when absolutely required. We at PASS know of his concerns over the global environment. And we at PASS have been much engaged in recent years in trying to understand Humanity's common responsibility toward Nature. At Stanford Arrow was for many years much engaged in seminars on global conflict and the ready availability of nuclear material. We also know of his concerns about humanity's treatment of the biosphere. I shall end this remembrance tribute with a brief account of some of his activities in the period when his visits to PASS became rare.

Arrow's involvement with what we now call "ecological economics" dates back to 1990, when he joined a monthly seminar organised by a group of ecologists and economists at Stanford University. That involvement was reinforced by his subsequent association with the Beijer

Institute of Ecological Economics in Stockholm. In 1993 the Institute' Director, Karl-Goran Maler, initiated an annual workshop that was to be held in the Summer at the marine field station on the island of Asko in the Trosa archipelago. Each year the designated group, comprising equal numbers of ecologists and economists (members of the Institute's Scientific Board and a few invited scholars), chooses a theme for discussion and prepares a brief report. The records show that Arrow attended all but six meetings in the years since then, until his last, in September 2016. By then he was bent and weak and needed to pause after every few steps. We queued to carry his back pack and luggage, while Paul Ehrlich, his neighbour and friend, locked arms with his to prevent him from stumbling over the uneven fields of the island. Despite his frail state, Arrow not only took part in the discussion, he was insistent that the policies we discuss for reducing our reliance on environmental natural resources should be built on liberal values. He also took part in socializing, joining Swedish members of the Asko group in singing drinking songs in his imperfect Swedish.

In one way or other, the Asko meetings have addressed the idea of sustainable development - its meaning and its implications for the way we should live. He was signatory to eighteen policy briefs that emerged from those meetings and he co-authored a number of scientific articles that formulated the notion of sustainable development and then put the notion to work on data so as to explore whether nations in recent years have followed development paths that are likely to be sustainable.

Above all else, it was his tireless involvement with ecological economics that will be remembered by those many scholars who have met him at conferences and listened to him at the teaching and training workshops on environment and development that the Beijer Institute organised over the years in various parts of the developing world (South Asia, Latin America, sub-Saharan Africa). Networks of mainly young economists in the developing world that were established with the help of the Institute found Arrow in their midst, listening to their presentations, reading their works, and commenting on them on the margins of their manuscripts.

Kenneth Arrow is renowned in the West and Far East as a teacher and mentor, not simply as that greatest of social scientists. What may not be known elsewhere is that his death is being mourned by scholars in the developing world, who not only heard him lecture, but were also helped by him to formulate problems they had found on their own ground. We all have cause to mourn.