

## **Kenneth J Arrow (1921-2017)**

The definitive appreciation of Ken Arrow's bequest to humankind will not be written by a health economist. Most of us (I'm one), being merely moderately competent second-raters in a sub-discipline, stand in awe of him. But being awestruck is not a good emotional platform for assaying worth. Or perhaps, au contraire, to strike awe is a measure of the highest worth a person can have. In any event, the perspective of a health economist is impossibly narrow for the definitive appreciation of the genius we all know as Ken Arrow, the greatest economist of our time and the intellectual father of health economics.

### ***Grounds for gratitude***

As health economists we can be grateful on at least three distinct grounds. One is gratitude for KJA as an economist's economist, one of those great paradigm shifters who teach us not only what to think but how to think it. The pantheon includes (alphabetically) Gary Becker, Milton Friedman, Daniel Kahneman, Abba Lerner, Karl Marx, Ludwig von Mises, David Ricardo, Paul Samuelson, amongst dozens, as well as KJA. A second ground for gratitude is for his creation of some wonderful intellectual constructs we call "models" and, further, also for their sensible interpretation and application – in particular, teaching us to avoid thinking that model and reality (or the thing being modelled) are one and the same. That is a common crime we lesser mortals all too often commit. The third is for creating so many of the building blocks of our sub-discipline. I conjecture that many of us do not know how much of our subject is Arrovian in origin. Most of us have learned our economics from textbooks, that is, at second-hand. That way, authors' individual identities are absorbed into a collective synthesis. The roots of standard analysis of insurance may lie in the work of Friedman and Savage, or of QALY construction in Hicksian utility theory, or supplier-induced demand in Arrovian information asymmetry – but knowing such connections is the business of historians of thought, not the business of health economists. Most of us have the tools presented to us on a plate. Cooked to a turn. After all, who amongst health economists has read *Social Choice and Individual Values* (1951 or 2012)? Or – dare one ask it? – who amongst health economists today reads "Uncertainty and the welfare economics of medical care"? Who puts it on their students' required reading lists? Of those who do, how many of their pupils actually get down to reading it? It's much easier (= lower opportunity cost) to get the benefit (= a close substitute for the real thing) from a facilitator (= teacher, textbook writer) and of course the facilitators know this. Otherwise, the geniuses live on only as labels: think Arrow-Debreu equilibrium, Arrow Impossibility Theorem, Arrow-Pratt measure of risk aversion, Arrow Social Welfare Function. As original sources they are buried in the dusty archives.

Or maybe Arrow is a great exception. After all, the book (now in its third edition) and the 1963 article have arguably spawned – and continue to spawn – more new research, theoretical and applied, than anything else in the history of economics.

### ***Astonishment of Impossibility and Welfare Economics***

Writing about someone's intellectual bequest is one way of exposing what the smudging hands of facilitators mask. Take the Impossibility Theorem. It is surely an astonishing thing to prove that given:

*Completeness*: in a choice between *alternatives* A and B, A is socially preferred to B, or B is preferred to A, or there is a social indifference between them.

*Transitivity*: if A is socially preferred to B and B is preferred to C then A is also preferred to C.

*Non-dictatorship*: social preferences should not depend upon the preferences of only one individual, if every individual prefers A to B then socially A should be preferred to B.

*Independence of irrelevant alternatives*: the social preference for option A compared with B should be independent of the preference for C,

there is no rule (majority voting is but one) for deriving social preferences from arbitrary individual preferences of the kind usually assumed by economists. And health economists need to know this since so much of the core of their subject matter concerns collective decision making. And they need to know the various “ways out” of Arrow’s proof. And to know that there is no right escape! It really is impossible.

Or take the two “fundamental theorems” of welfare economics:

Fundamental 1

Given: *complete markets*: zero transaction costs and perfect information

*price-taking*: no actor can affect prices by its own behaviour, free entry to any market

*non-satiation*: more of at least some things is always preferred,

a competitive market will tend toward a Pareto optimal equilibrium;

Fundamental 2

Given Fundamental 1:

appropriately set lump sum transfers can enable any existing Pareto optimum (there are countless numbers of these) to be transformed into another.

A trouble is that these “givens” are constantly violated in the “real” world. They are violated in two broad ways. One way is that one or more of the “generative” assumptions underlying them is not maintained empirically. For example, many of the axioms of utility theory (aka the arbitrary individual preferences of the kind usually assumed by economists, like transitivity) are violated in actual behaviour: not necessarily always, but often enough to teach caution in attaching a heavy weight to “rational preferences” or “willingness to pay” when prioritizing health care investments in general or designing health benefits packages for poor countries. The other broad way is that the “auxiliary” assumptions, for example those that define the circumstances under which the theorem is expected to work (like “price-taking” or “complete markets”), do not apply: again not always but carelessness in not checking whether these conditions are actually met can easily result in bad policy design and social catastrophe. It is indeed quite common to hear assertions by professional economists, let alone amateur ones, about the efficiency of markets that are simply illogical because they predict outcomes using theory (often only implicitly) based upon strict conditions (like price taking) that simply happen not to apply in a world of, say, non-profit hospitals having local monopolies and for-profit insurers having imperfect information. Predictions of the speed of fall of objects assuming a vacuum will not work where there are gale force winds.

### ***Arrow in the real world***

Ken Arrow did not fall into such traps. His 2005 OHE lecture provides a beautiful example of how a masterly theoretician comes to deal with all the real world violations of the theory (both his and that of others): violations that force one to invent new solutions. Consider how he discusses just one class of assumption violation (externalities) in understanding the global health problem of malaria. I quote extensively:

*“[An externality exists] when something you do affects other people negatively (your train sends sparks in farmers’ fields as it passes) or positively (your honey bees pollinate neighbouring orchards as they collect nectar) ... In a well-functioning market you normally have to compensate a landowner*

*for using his land for your own purposes and thus the cost to him is borne by you. You will naturally take that into account in your production decisions, including decisions about whether to produce anything on that land in the first place. But it is difficult or impossible to establish markets for everything and this is especially true when there is no private ownership, as there is not for the air we breathe...*

*Resistance is another example of a global externality. If resistance develops anywhere it spreads and that is just what happened in the case of chloroquine. Resistance first developed in South-East Asia and was possibly exported to Africa by travellers. People carried the mutant parasites, they were bitten by mosquitoes, and it spread in that way. It was a global externality and no one country and certainly no one individual had any incentive to prevent it. Treating any communicable disease creates a positive externality by reducing the chances that other people will contract the disease. The immunized person benefits - but so do many others whose chances of falling ill are now lower. None of these other people has an incentive to pay for their 'share' of the cost of treating someone else their benefit comes as an unintentional gift. They get a 'free ride'. This is what economists call a "public good".*

*There is another externality; but this time of a local kind. As the number of people who are free of malaria rises, when the mosquitoes strike the probability rises that they will drink parasite-free blood and so not acquire the parasite and thus not transmit it to other people. Reducing the number of people with malaria thus decreases the probability that other people will be infected.*

*These externality arguments suggest a case for public subsidy. In the case of malaria, the argument for public financing would justify making transfers only to governments. There is also, however, an international externality... [The] spread of resistance to neighbouring countries and then on to more distant ones by travellers and migrant workers is inevitable. The universal adoption of combination therapy is therefore in the interests of the global community. The value of this international public good is extremely difficult to quantify, but it must include the value of averting all the cases of malaria that would result (including the treatment and productivity costs that are averted). So there is an argument for proceeding on a collective and international basis rather than locally, because no locality has a sufficient incentive to tackle the problem."*

He goes on to elaborate the nature of the required subsidy. This is to *apply* theory: abstract theory and concrete actions based on it. He gave us so much of the framework and the vocabulary we need to understand and create feasible solutions in a world we actually inhabit.

### ***The birth of health economics***

Externalities and public goods/bads are only one way in which appropriate roles for the state (national or global) and the market can be figured out, central though such matters have been in health economics past and present. Other fundamentals of health economics are also directly attributable to Ken Arrow and most of them had an early airing in the 1963 paper which accounts for 1963 often being regarded as the birth of health economics itself. So many key themes are picked up in this brilliant piece: fundamental uncertainty about aetiology, effectiveness and the quality/value of treatments in the minds of the public, patients and clinicians; its asymmetry, doctors still usually knowing more about likely time paths and the likely consequences of intervention or non-intervention but patients knowing more about consequences for personal circumstances; other asymmetries – different capacities as between consumers, or amongst providers; asymmetries between insurers and the insured; the potential for exploitation and injustice arising from asymmetries; agency relationships – initially patient as principal and doctor as agent but later whole chains of principal-agent interactions up to health ministers and down to juvenile dependents;

economics of information – the recognition that medical markets can be seen as markets for information; ability of consumers/patients to understand and process information to enable “rational” choices; externality, physical (as in communicable disease), financial (as in medical bankruptcy) and psychic as in caring for people with misfortune and dependence; excess demand generated by insurance (both public and private); moral hazard (ex ante and ex post) and the use of co-payments, coinsurance and non-monetary means of rationing; adverse selection and community rating; the role of trust and non-commercial relations in health care contracting; professional regulation and ethical standards; learning-by-doing and economies of scale and scope. All of these topics had their first thoughtful airing in the 1963 piece or others published around that time – some are listed in the short bibliography below.

He was once asked (by Conor Clarke in *The Atlantic*) how much of his 1963 paper was still a good representation of the problems the health market faces. His response was not what one might have expected from one of the most technically gifted economists of all time: *I think the basic analysis hasn't changed. There are wars over the details, but the basic analysis is accepted. Some specifics have changed. If you look closely at my argument there is a sociological structure. There is a kind of sociological thesis. The market won't work – it doesn't work well in the health context. But something else supplements the market, and the thing I put stress on in the paper are the elements that put a non-economic influence on the market: professional commitments to provide a service, to engage in services that aren't self-serving. Standards of caring decided by non-economic actors.*

### **Arrow's legacy**

Those who knew him well tell of a kind and generous man, politically in the liberal left, marvellous with young people, a phenomenal memory, a renaissance polymath, a quicksilver mind, an astonishing technical master. He should have got two Nobel prizes rather than just the one (he is still the youngest laureate ever).

How much the richer we are for having had Ken Arrow amongst us for 95 years. Now how much the poorer.

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