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Good Housekeeping

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William Petty and the Ambitions of Political Arithmetic by Ted McCormick
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In 1667, the Royal Society's first historian described the early Restoration as 'this *Age* of *Experiments*'. He was advertising the society's new scientific programme and he was making a joke. One of the society's most prominent members had designed and built a new sort of ship – a 'Double-Bottomed' vessel, a kind of catamaran – intended to require less draught, to sail faster and with a smaller crew than anything then at sea. It was meant to be a world-changing technology, revolutionising trade and naval warfare. The designer was the polymathic William Petty (1623-87) – mathematician, mechanic, physician, cartographer and statistician – and one of his prototypes was called the *Experiment*.

The ship was an experiment in science, technology and entrepreneurship. No one had ever seen such a vessel; it violated the conventions of the shipwright's art; and among the knowledgeable it was generally an object of ridicule and opposition. There was, Petty acknowledged, 'scarce a good word for it' from anyone in the business. Most experts thought it wouldn't work, and some worried that, in the unlikely event it did, it would be a technology too far. Samuel Pepys, the Navy Board's clerk of the acts, was a supporter, while the master shipwright Anthony Deane said Petty's design 'must needs prove a folly'. The navy commissioner Peter Pett told Pepys that the double-hulled ship was 'the most dangerous thing in the world': if it was successful, the secret would get out, and it would be the ruin of English trade and sea power. The Dutch, with whom England was about to fight the second instalment of a series of naval wars, might use the shallow-draught ship to sail right up the

Thames and lay London waste.

Petty's entrepreneurship was at once scientific, economic and political. Shortly after the Royal Society was founded in 1660, its leaders asked Petty and Christopher Wren 'to consider the philosophy of shipping', and the king himself urged Petty to turn his mind to naval matters. The mix of science and statecraft was compelling: Petty got down to work straight away. He wrote to the king, saying that 'there was no greater, no more stately ... nor more intricate engine in the World than a Ship,' and that advances in naval technology would be a great experiment in mechanical philosophy, an exercise 'in the whole Doctrine of Number Weight & Measure'. Petty's *Experiment* was meant to be a ship of state. His plan was to translate new science into a new ship and a new ship into enhanced state power. These were, literally, transformations of 'state' and not of substance.

The double-bottomed ship was from the start intended to be a public-private partnership: Charles II initially gave it vocal support but no money; Petty ventured some of his own funds; Viscount Massereene, a big Irish landowner, put in some more. The Royal Society, which was itself still hoping for Crown subvention, appointed an elite committee, including naval administrators, to perform due diligence on the initial designs. But it declined to take over research and development work, pointing to an ambiguous boundary between what belonged to science and what to the Crown: 'The matter of navigation being a state concern was not proper to be managed by the society.' Science was thought to end at the point it became folded into statecraft.

Petty's invention was a gamble. The first small-scale sailing version was constructed in Ireland in 1662 and he tried to cover some of his investment by wagering on a race in Dublin Bay between his double-hulled vessel and all comers. Other prototypes were built and sailed between Dublin and Holyhead; more wagers were made, and won, by Petty. Finally, he brought it to the Thames and recklessly offered 'to take odds against the king's best boats'. But Charles had by then soured towards the project – and on the Royal Society's utilitarian promises in general – and Pepys recorded that 'the king would not lay.' Though Charles wouldn't subscribe, Petty formed a syndicate to back his third, and largest, double-bottomed ship. The *Experiment* was launched in the Thames just before Christmas 1664. It sailed to Portugal in April the following year; in October it set out on the return journey to England but encountered a storm in the Bay of Biscay and sank with the loss of all hands.

Petty was an optimistic entrepreneur: 'This adversitie will fire and steady the resolution ... I am not much discouraged.' He solicited backing for another version, but it was a long time before he could persuade investors to try again. Almost 20 years later, neither the nautical Duke of York nor the Royal Society, then presided over by Pepys, was keen, but Petty put together a syndicate with a large, mainly Irish group of subscribers and launched yet another double-bottomed ship in 1684. This proved seriously defective – 'she performed soe abominably, as if Built on purpose to disapoint,' one observer wrote – and Pepys now offered to bet against its eventual success. That was the end of Petty's experiments in the natural science and technology of shipbuilding. It was reckoned that he had spent £1500 of his own money and £3500 of his friends', and three years later he was dead. The project failed, Ted McCormick writes, 'not because it was bad science or bad policy but because it fused science and policy in a way neither political nor scientific institutions were prepared to accommodate'.

The *Experiment* was a failure, but some of Petty's other experiments in 'fusing science and policy' were among the most spectacularly successful of 17th-century science. These were experiments in social and not natural science, and historians don't usually consider the human sciences in connection with the modernity-making changes of the Scientific Revolution. But they should. One of the virtues of McCormick's fine intellectual biography is that it suggests how historians might think in new and interesting ways about the importance of the social sciences in early modernity, indeed how to think about what counts as natural science and what as social. This is the first serious modern intellectual biography of Petty, and, since McCormick makes such a persuasive case for the significance of his work, it probably won't be the last.

The most common way of remembering Petty is through his connection with the Cromwellian planting of Ireland. Ireland had been planted before. After the Conquest it had been planted with the settlers who eventually became known as the Old English; planted again with New English under the Tudors; and yet again with Scottish and English Protestants in Ulster under James I. None of the plantations fully took root: some of the Old English went native, and the 'meer' (or 'wild') indigenous Irish remained vigorous. The Irish Rebellion of 1641 resulted in the slaughter of Ulster Protestant settlers: in England, a figure of 300,000 dead quickly circulated, though the true number was much lower. Petty himself reckoned that the number of dead from the Rebellion until the end of Cromwell's ruthless reconquest was 616,000 (or

40 per cent of the total population), of whom 500,000 were Catholics. The exact figures are in doubt; the bloodiness and brutality are not.

The '*Romists*' and the 'Common *Irish*' started the war, Petty later wrote, trying to 'get all the *Englishmens* Estates', and making a great gamble against what they should have known were overwhelming odds. They lost the gamble and so the English had – in his sporting metaphor – 'a Gamester's Right' to their land. The Irish problem needed to be permanently sorted out, and the way to do that was to replant Ireland thoroughly with an English and Scottish population: the final solution was a transformation of its human nature. Cromwell's wars had been financed substantially through promises of confiscated Irish land for the English 'adventurers' who paid for them and the soldiers in the New Model Army who fought them. Those directly implicated in the Rebellion were executed; others were sent into slavery in the West Indies; Irish soldiers were given the opportunity of going abroad to fight in foreign armies; and huge tracts of land were seized and allocated to the new Protestant planters: the 1652 Act of Settlement transferred all land east of the River Shannon to the Crown. About 8,400,000 acres were reassigned from Catholic to Protestant owners. (After the Restoration, Charles II promised swathes of it to the Royal Society – financing science with the proceeds of conquest – but this came to nothing.) The former Irish proprietors could either accept transportation to poorer land reserved for them in Connaught, or, since the ethnic cleansing of the rest of the island was impractical, remain as tenants of the new Protestant owners. Catholic ownership plummeted from 60 per cent of the land before the Rebellion to less than 10 per cent after 1652. It was a great experiment in the movement of populations and the locus of social power.

It was also an experiment that marshalled massive amounts of scientific expertise. This was where Petty came in. Arriving in Ireland in 1652 as physician-general to the army, he set about making himself useful to the Cromwellian forces. He started with the reform of military medicine, but the project on which he soon set his stamp was the mapping of land, surveying the boundaries of holdings and assessing relative values. This became known as the Down Survey, which McCormick plausibly describes as the first imperial survey of a land conquered by Britain and the 'greatest single state-supported scientific project of its day'. The term of art for the type of representations Petty helped produce is a cadastral map: cadastral data concern the boundaries of property and information about its value. Cadastral mapping in

general, and Petty's Irish survey in particular, have been worked over before by scholars concerned with the practices of modern state-making – notably by Mary Poovey, Patrick Carroll and any number of Foucault-followers writing about 'governmentality' – but McCormick does something substantially new: he interprets Petty's work in Ireland both biographically and as a project emerging out of, and redefining, the nature of 17th-century science.

The state needed to know what Ireland *was* and what it *had*. It needed to know, and to know with accuracy, how land was parcelled out, how it should be classified according to its natural history, geology and productive uses, whether it was 'profitable' ('arable, meadow and pasture') or 'unprofitable' ('wood, bog and mountains'). A natural historical project had already been launched before Petty's arrival, and it was carried on well after the Down Survey was completed. What sorts of thing did arable and pasture land produce and what was that produce worth? Was there iron under the ground and, if so, where and how much? What were the stocks of hardwood, fish, cattle, sheep, silver and building stone? And, above all, how many people were there? Of what sorts? How were they housed, what did they do and what were they worth? How did you assemble and collate the results of these inventories, array them in standardised forms, circulate them, render them credible, and mobilise them for use in practical statecraft? The results, some of them contained in Petty's *Political Anatomy of Ireland*, were descriptions and tabulated numbers informing the state of what it had. If the state wanted to grow great, it had to count and to account for itself; it had to archive its numbers and use them as the basis of rational statecraft. The word 'statistics' wasn't in circulation until about a century later, but that's what Petty was doing: he was making systematic surveys, often in organised numerical form, of what a state needed to know, and to make visible, about its nature, its people, its institutions, itself.

The state needed urgently to know about Irish land and its virtues because the 'adventurers' who financed the expedition and the soldiers who fought held debentures of different values for land to be transferred to them from the native owners. The Down Survey was the major vehicle for translating promissory notes into Irish land of appropriate worth. It standardised the measure of estates, in size and in value, and, as McCormick says, 'commodified Irish land'. Petty himself was a major holder of these debentures: he wound up literally dirt rich. When he arrived in Ireland, he had maybe £500 in assets, but things soon looked up. According to

one estimate, he came to own 50,000 acres in County Kerry alone. John Aubrey estimated his rental income at its height at £18,000 a year – perhaps £27 million in today's money. In a nice closing of the causal circle, Irish land capitalised the rest of Petty's career, including the projects in political arithmetic that occupied him from the 1660s. He easily managed the transfer of loyalties from the Commonwealth to the Restoration monarchy. Charles II knew the value of a skilled mechanic and inventor to the Crown and knighted Petty in 1661, even if Sir William had to spend much of his energy trying to extricate himself from actions brought by envious English associates, who claimed that he was corrupt and his Irish acquisitions were illegal.

The Down Survey was a triumph of scientific expertise, but much of the ingenuity consisted of devising and applying the human sciences of organisation and management. It had been thought that the job would take between seven and 20 years, but Petty brought it in under budget in little more than one. The trick was a kind of Fordist division of labour. Petty simplified the surveying instruments and divided the complicated task into bits that could be handled by men 'not of the nimblest witts', that is, by the soldiers themselves, who were also tough enough to deal with angry landowners and 'with the severall rude persons in the country, from whome they might expect to be often crossed and opposed'. The Down Survey was a testing platform for Petty's later work in political arithmetic, in which he reflected systematically on the advantages of the division of labour and economies of scale.

Petty was one of many scientific utopians ranged round the German émigré intelligence agent Samuel Hartlib. They came to see Ireland not quite as terra nullius but certainly as a great space for social and natural experiment, a blankish slate on which a new, rational and virtuous society might be inscribed. The Hartlibians had previously considered Lithuania, Virginia and New England as experimental sites – but all circumstances now pointed to Ireland. The Down Survey was needed for the final plantation, but it was just one step towards its transformation from 'barbarism' into a productive and peaceful realm, never again a danger to Protestant England. There were several ideas among England's best and brightest about how this might be done, and all of these involved some idea of transmutation, a fundamental change of human state. Military means of pacifying Ireland were expensive and nasty, so Petty preferred to look for ways of 'transmuting one People into the other', and when this had been achieved, England would be secure from Irish threat.

How could that be done? Transplantation into Connaught was authorised, but it was not the strongest measure contemplated. You could just get rid of the Irish altogether and replace them with English and Scottish stock. Petty noted that this plan had influential backers: 'Some furious Spirits have wished, that the *Irish* would rebel again, that they might be put to the Sword.' But he had scruples: 'I declare, that motion to be not only impious and inhumane, but withal frivolous and pernicious even to them who have rashly wish'd for those occasions.' Petty believed that mixed settlements could be made to work. So there were plans for the constitutional transmutation of the native population. These came to little, but he did explore the idea of breeding the 'meer Irish' out of existence. Why not transport 10,000 Irishwomen of marriageable age to England every year and replace them with a like number of Englishwomen? Let Nature then take its course. 'The whole Work of natural Transmutation and Union would in 4 or 5 years be accomplished.' The Englishwomen would run Irish households on much more civilised lines: 'The Language of the Children shall be *English*, and the whole Oeconomy of the Family *English*, *viz*. Diet, Apparel, *&c*.', and 'the Transmutation will be very easy and quick.' The Irishwomen in the scheme, spread out among English parishes, would, McCormick writes, 'take an extended immersion course in good housekeeping'; and the whole cost of this exercise in experimental breeding and the transfer of manners would be a fraction of what England was spending to support the military occupation.

Custom was, indeed, a second nature, and the civilising process could itself transmute one form of human nature into another. That process should become a tactic of statecraft, politically speeded towards its natural goal. Petty was just enough of a traditional Galenic physician to accept that people were what they were because of their natural circumstances. He accounted for the character of the Irish partly through what he called 'their original Constitutions of Body' and then 'from the Air; next from their ordinary Food'. You are what you eat. Institutions and ways of living had their causal role too, but you did not have to depart from a Galenic medical vocabulary to deal with these sorts of thing. Over time, miserable housing and superstition-mongering Catholic priests had deplorable effects on physical and mental constitutions, so these too needed political correction. What was widely called 'situation' was another important consideration. Did a nation have easy access to the sea and did it possess navigable ports? Were its climate and soil conducive to agriculture or husbandry? Did the people's diet make for bilious or choleric temperaments? Petty knew that

these considerations must have been involved in the Old English 'degeneration' into Irishness and had to be considered in the wished for transmutation of the Irish into English, but, precisely because custom and nature were causally linked in this way, it was the business of government scientifically to manage the transformations between what was policy and what was natural.

Ireland was the laboratory for Petty's development of a general science of political economy. What was the wealth of nations and how could sound policy understand its natural bases and manage its increase? How a nation was physically situated was important, but its prosperity and security were also determined by its people's 'industriousness'. In a common way of speaking, the first belonged to nature and the second to morality and economics; the first was the province of natural and the second of social science. Like any other scholar of the time, Petty was fluent in the use of these conventional categories. When he turned from mechanics and medicine to political anatomy and political arithmetic, he understood that he had crossed a boundary and should explain himself to his associates in the Royal Society. He said that he had 'wandered out of the study of Medicine, with those other Mathematical, Mechanical and Natural Exercises, in which I was once a Busie-body' because he 'hoped hereby to enlarge my Trade of Experiments from Bodies to Mindes, from the motions of the one, to the manners of the other'.

Yet Petty's 'transformative natural philosophy' (as McCormick calls it) disturbed that conventional distinction between the natural and the social. Each was, philosophically speaking, a hybrid entity and their hybridity was crucial to the practice of statecraft. So, for example, the English were deeply interested in what made the Dutch so powerful, and Petty was not alone in drawing attention to the 'situation' of the country: the nation was small and its land was not rich, but the ocean that lapped the shores of the United Provinces was both a threat to the integrity of the land and a stimulus to fishing and commerce. Seamanship was a uniquely productive form of human activity: the more seamen a nation had, the wealthier it would be. Dutch success was considered to be, McCormick writes, 'the result of artifice, but this artifice was itself a natural response to their situation ... Dutch "Art and Industry" had triumphed over nature's limitations, yet in a *natural* way, by exploiting the opportunities given to them.' The English (in England, in Ireland and in America) should observe and emulate: natural science was needed to take the measure of natural opportunities; political

science was needed to transform them. The natural and the political were conventional categories of early modern culture, but the political was properly to be thought of as proceeding from natural states, observing natural laws, and in turn aiming to reconfigure nature.

The economic and political transformations that Petty had in mind were framed in terms familiar from the sciences of nature. It was an article of the new mechanical philosophy that every sensible quality in the physical world could, and should, be traced to underlying mathematical properties – as Petty repeatedly put it, to 'number, weight and measure'. That knowledge was understood as power: if you could describe material bodies in terms of their mathematical properties, you might plausibly hope to transform one type of body into another. All you had to manage were changes of state, not of substance. Petty meant to show the intellectual propriety and political advantages of doing the same with human states, practices, institutions and dispositions. How much of one equalled how much of some other? 'Labour is the Father and active principle of Wealth, as Lands are the Mother,' Petty wrote in his *Treatise of Taxes and Contributions* (1662). And in *The Political Anatomy of Ireland* he asserted that the 'most important Consideration in Political Oeconomies' was 'how to make a *Par* and *Equation* between Lands and Labour, so as to express the Value of any thing by either alone'. That was the language of practical statecraft. How to describe the wealth of a nation; how to know what human activities were the bases of that wealth; how to manage the practical transformations between land, labour and money? How, in general, to make a state and its inventories legible in the language of number? And how to use that legibility to govern? The double-bottomed vessel had failed, but Petty's experiments in political arithmetic were wild successes. He built the prototype of a ship of state that now sails on seas of science.

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