

**The Advancement of Policy:  
Art and Nature in William Petty's Political Arithmetic<sup>i</sup>**

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This paper explores one way that empire, science and political economy came together in seventeenth-century England and Ireland: specifically, how a form of political economy, the “political arithmetic” of Sir William Petty, emerged through the application of scientific ideas to colonial as well as metropolitan political and economic problems.<sup>ii</sup> Rather than positing scientific and colonial contexts for or influences on Petty’s “economic” thought, however, I would like to suggest that political arithmetic *was* a sort of applied natural philosophy, a way not only of knowing but more importantly of operating upon nature, including human nature, in the interests of the state.

Its intellectual origins were heterogeneous, but the most important source was, broadly, Baconian, combining the experimental methodology and operative view of science laid out in Bacon’s works with the neo-Baconian vision of “reformation” Petty encountered in the Hartlib Circle. The political circumstances political arithmetic addressed were likewise complex, but centered initially on the stabilization of English colonial power in Ireland.<sup>iii</sup> In short, political arithmetic was not an embryonic political economy informed by a scientific outlook. It was a Baconian science of colonial improvement and social engineering.

**1.**

Political arithmetic is usually understood as a *method* of economic analysis.<sup>iv</sup> Karl Marx saw it as the methodological foundation of classical political economy, and Petty’s successor Charles Davenant defined it as “the Art of Reasoning by Figures, upon Things relating to Government.”<sup>v</sup> Petty’s preface to the book *Political Arithmetick* supports this view:

The Method I take... is not yet very usual; for instead of using only comparative and superlative Words, and intellectual Arguments, I have taken the course (as a Specimen of the Political Arithmetick I have long aimed at) to express my self in Terms of Number, Weight, or Measure; to use only Arguments of Sense, and to consider only such Causes, as have visible Foundations in Nature[.]<sup>vi</sup>

Political arithmetic would posit no occult causes, no hidden springs of action; it would favor conceptually spare explanations derived from observable data. It would also be mathematical, as Petty grandiosely informed his friend Robert Southwell:

Archimedes had Algebra 1900 yeares ago but concealed it. Diophantus had it in great perfection 1400 yeares since. Vieta, DesCartes, Roberval, Harriot, Pell, Outread, van Schoten and Dr. Wallis, have done much in this last age. It came out of Arabia by the Moores into Spaine and from thence hither, and W[illiam] P[etty] hath applied it to other than purely mathematicall matters, viz: to policy by the name of Politicall Arithmetick, by reducing many termes of matter to terms of number, weight, and measure, in order to be handled mathematically.<sup>vii</sup>

It was a mixed mathematical science, a mechanics for the body politic. This fit neatly with Petty's background in Harveian physiology, as his *Political Anatomy of Ireland*, *Political Arithmetick's* companion volume, indicated:

Sir Francis Bacon, in his *Advancement of Learning*, hath made a judicious Parallel in many particulars, between the Body Natural, and Body Politick, and between the Arts of preserving both in Health and Strength: And it is as reasonable, that as Anatomy is the best foundation of one, so also of the other; and that to practice upon the Politick, without knowing the Symmetry, Fabrick, and Proportion of it, is as casual as the practice of Old-women and Empricks.<sup>viii</sup>

Number, weight and measure; symmetry, fabric and proportion – political arithmetic would anatomize society's parts and functions. But I want to argue that analysis itself was just the beginning. The very mathematical, mechanical and medical analogies Petty used suggested that the point of political arithmetic was not to describe the world but to change it – in Petty's phrase, "to practice upon the Politick".

## 2.

Petty's intellectual background makes this clear.<sup>ix</sup> Born in 1623 to an artisanal family in southern England, Petty found his way to a Jesuit collège in Normandy, where his studies included Aristotelian philosophy and mixed mathematics. By the early 1640s he was following courses in philosophy and medicine at Utrecht and Leiden, at the height of the debate over the teaching of

Cartesianism. For much of 1645 he studied chemical medicine in Amsterdam, before meeting Hobbes, Mersenne and Gassendi, among others, in Paris, and helping Hobbes with his work on optics. When he returned to England in mid-1646, Petty was thus familiar with Aristotelian, mechanical and materialist ways of thinking, competent in at least some varieties of mixed mathematics and trained in Harveian physiology and chemical medicine. He knew several major philosophers, mathematicians and physicians personally. Direct evidence of his own thinking, however, appears only with his connection to Samuel Hartlib and his circle in London.

The Hartlibians famously aimed at a “Universal Reformation”, conceived in Baconian terms: a systematic reform of material, intellectual and spiritual life through the advancement of learning and the cultivation of practical improvement.<sup>x</sup> Hartlib met him early in 1647 and described him to Robert Boyle soon after as “not altogether a very dear Worsley” (that is, Benjamin Worsley),

but a perfect Frenchman, and good linguist in other vulgar languages besides Latin and Greek, a most rare and excellent anatomist, and excelling in all mathematical and mechanical learning; of a sweet natural disposition and moral comportment.<sup>xi</sup>

Doubts later arose about Petty’s moral comportment, but between 1647 and 1652 he participated in nearly every aspect of the Hartlibian reform program. He tested an “engine” for planting corn, worked on a furnace for brewing and a machine for draining water, patented a “double-writing instrument” and designed a portable printing press. He ground lenses for telescopes and microscopes, conducted anatomical and chemical experiments with his brother Anthony, translated Cyprian Kinner’s tract on educational reform and was asked to translate Johann Rudolph Glauber’s work on “philosophical furnaces”.<sup>xii</sup> He was a fully-fledged and very active member of the group.

### 3.

Petty embraced both the Hartlibian program and the Baconian philosophy behind it. He spoke of Bacon as “one of the chiefest men for... Reall Learning”, a greater philosopher than Thomas More and a greater man than Walter Raleigh; Hartlib’s papers contain a translation, in Petty’s hand, of a well-known passage from the *New Organon* praising “The Introduction of Noble Inventions” as “the Cheife of all humane actions”:

For the Benefit of new Inventions may extend to all Mankind Vniversally but... the good of Civill atchievement can respect but some particular Cantons of Men, these latter doe not endure aboue a few ages, the former for euer, Moreouer the Reformation of States in civill affaires for the most part is not compassed without Violence and disturbances, But Inventions make all Men happy without either Injury or dammage to any one single person, Further New Inventions are as it were New Creations and are Imitacious of Gods owne Works.<sup>xiii</sup>

Petty's brief but colorful correspondence with the Cambridge Platonist Henry More, in 1648, ran in a similar vein. Responding to More's praise for Descartes, Petty replied:

I accompt him the best philosopher that... is best acquainted with nature's Workes, & knoweth how to rule them in order to the procurement of good to Mankind, wherefore God made them. Now whether or noe or how much des Cartes his philosophy conduceth hereunto, Wee may know... by Enquiring how much the Telescopes are mended, since the writing of his dioptricks; whether any man can foretell the weather by his discourse of Meteors? ... Or who, that hath followed his principles, hath drawne any new usefull or pleasant art or reall conclusion from them?<sup>xiv</sup>

Seeking "usefull arts" in "lucriforous Experiments" rather than clever axioms, Petty contrasted "the sweetnes of experimental knowledge" with "the Vaporous garlick & Onions of phantasmaticall seeming philosophy."<sup>xv</sup> Real learning would improve the world.

*The Advice of W.P. to Mr. Samuel Hartlib for the Advancement of Some Particular Parts of Learning*, his first printed work, appeared the same year.<sup>xvi</sup> Borrowing its title from *The Advancement of Learning*, Petty's proposal for new scientific institutions echoed *The New Atlantis*, as well as Hartlibian utopias like Gabriel Plattes's *Macaria*, at many points. An "Office of Address" would collect "all... Reall or Experimental Learning", compiling "one Booke or great Worke" that would comprehensively track the changing boundaries of human knowledge.<sup>xvii</sup> "Literary work-houses" would provide children with practical and vocational, rather than merely "verbal", educations.<sup>xviii</sup> A "Gymnasium Mechanicum or Colledge of Trades-men", would allow "the Prime most Ingenious Work-man" in each trade to improve his art and promote his products.<sup>xix</sup> Finally, a "Nosocomium Academicum" would combine the functions of a teaching hospital with an "Epitome or Abstract of the whole world":

a complete *Theatrum Botanicum*, stalls and Cages for all strange Beastes and Birds, with Ponds and Conservatories for all exotick Fishes... a Repositorie of all kind of Rarities Naturall and Artificiall pieces of Antiquity, Modells of all great and noble Engines, with Designes and Platforms of Gardens and Buildings. The most Artificiall Fountaines and Water-workes, a Library of Select Bookes, an Astronomical Observatory for celestiall Bodies and Meteor[s], large pieces of Ground for severall Experiments of Agriculture, Galleries of the rarest Paintings and S[t]atues, with the fairest Globes, and Geographicall Maps of the best descriptions[.]<sup>xx</sup>

The Nosocomium would also foster collaboration between physicians, surgeons and apothecaries, systematically gathering case histories and even employing “judicial astrology” to track the effects of weather on the health of the wider population.<sup>xxi</sup> Petty’s application of experimental science to human populations would take a slightly different form in political arithmetic. But from the start, Petty made improvement – of nature and of the nation – the business of the state.

#### 4.

Buoyed by his Hartlibian connections, Petty moved to Oxford, finishing his medical studies in 1650 and taking up a Lectureship in Anatomy. In 1651 Hartlib secured him a professorship at Gresham College, this time in music, a form of mixed mathematics Petty had apparently done some work on earlier. Yet Petty never took to academia – perhaps because medicine was more lucrative (or “lucriferous”) – and at the end of 1652 he went to Ireland as Physician-General to the conquering Cromwellian Army. He was also personal physician to Oliver Cromwell’s son Henry, the man now tasked with reestablishing English Protestant power in Ireland after a decade-long Catholic rebellion.<sup>xxii</sup>

The main plank of Ireland’s new order was a land settlement. This paid off the Commonwealth’s creditors and Cromwell’s soldiers with debentures for confiscated Irish Catholic estates, the foundation of a new and extensive colonial plantation.<sup>xxiii</sup> The land had first to be surveyed, but the ongoing survey (overseen by Benjamin Worsley) would take years to complete. With Henry Cromwell’s backing, Petty proposed a new survey of the confiscated land, employing soldiers rather than professional surveyors and taking just thirteen months to complete. Against the opposition of Worsley and his supporters – which permanently

embittered Petty's relations with the Hartlib Circle – Petty won the contract.<sup>xxiv</sup> The result was, in one scholar's words, “the first full field survey and *mapping* of any European country” and a major instrument of English colonization and Protestant Ascendancy in Ireland.<sup>xxv</sup> Petty himself poured his earnings into discounted debentures, acquiring over ten thousand acres of land. As both an architect and a beneficiary of the Irish land settlement, Petty now had a major stake in the fate of English empire in Ireland.

## 5.

The intellectual origins of political arithmetic go back to the Hartlib Circle, and its political roots lie in Cromwellian Ireland. But it took definite shape in response to political, commercial and religious debates in the early 1670s, in which both the possibilities of improvement and the limitations of the Irish settlement played a role. Anxiety about Dutch economic and French military power on the Continent matched renewed fear of popery and arbitrary government at home, both stoked by Charles II's alliance with Louis XIV against the Dutch, his pursuit of religious toleration and independence from Parliament in England and – most worryingly – his brother and heir the Duke of York's ever more open Catholicism.<sup>xxvi</sup> These developments encouraged Irish Catholic leaders to lobby for the revocation of the land settlement. An unholy conjunction of French victories in Europe, English military and economic failure and surging Irish and Catholic influence at court threatened not only Protestant Ireland but perhaps even England itself.

It was with the fate of the Irish settlement in mind that Petty wrote to an old friend from the 1650s, the Earl of Anglesey, in December 1672.<sup>xxvii</sup> Petty's letter described, for the first time, two things he was working on, “political anatomy” and “political arithmetic”, which together constituted Ireland's “political medicine”. This medicine included the two large manuscripts that saw print after Petty's death as *Political Arithmetick* and *The Political Anatomy of Ireland*. But it also included dozens of smaller, shorter manuscript proposals, which circulated alongside the larger works through a network of friends, contacts and potential patrons with power or influence over policymaking in England and Ireland alike. In fact, from 1672 until his death in 1687, Petty's “political medicine” would embrace not only Ireland but England and the Atlantic colonies as well. In key respects, political arithmetic reformulated Petty's Hartlibian aspirations as a project for an “improv'd Empire”.

## 6.

Petty had first turned his attention to economic matters a decade earlier, with the 1662 *Treatise of Taxes and Contributions*, but his economic thinking now took on a more philosophical hue. *Political Arithmetick* argued “That a small Country and few People, by its Situation, Trade, and Policy, may be equivalent in Wealth and Strength, to a far greater People and Territory”, echoing Bacon’s own argument in his essay “Of the True Greatnesse of Kingdomes and Estates”.<sup>xxxviii</sup> For Petty, Dutch commercial success was due not to some inherent commercial sense, but rather to a calculated use of natural advantages, in this case access to waterways. “Situation hath given them Shipping”, as Petty put it, “and Shipping hath given them in effect all other Trade.”<sup>xxxix</sup> The French, on the other hand, pursued naval superiority despite their relative lack of natural harbors, fighting “Natural and Perpetual Impediments” with a policy doomed to fail.<sup>xxx</sup> Yet the “Impediments of Englands greatnesse” were “contingent, and remouable”, arising “rather from the nature of their Government, than from the Intrinsick and Natural causes of Wealth and Power.”<sup>xxxi</sup> The trick was to “superstruct” the right policies on England’s natural situation – to “let Nature work”, in Petty’s pet phrase. A policy that “let Nature work” would not only prosper in the short run but would ultimately improve situation itself – expanding the space for future policy.<sup>xxxii</sup>

Framing policy thus required a thorough knowledge of the constraints situation imposed: a political anatomy. *The Political Anatomy of Ireland* tackled this for one island, and Petty proposed that the same be done for the other, calling in manuscript of late 1671 for “an exact accompt... of the whole people by there [sic] number, age, sex, trade, Office, place of habitation, and by all other there [sic] circumstances & qualifications, whereby they improve or impaire the publique wealth[.]”<sup>xxxiii</sup> This would show “the proportions which any one person beareth to an other in value”, and how each should be taxed, enabling a host of further improvements “For the People”, “the King”, “the City of London” and “the State”, including measures encouraging religious toleration, improving the ministry, encouraging trade, lowering interest rates, extending roads and waterways, reforming poor relief and education while securing for King Charles an annual income of £200,000, a new “Grand Militia”, and a navy three times larger than he presently had.<sup>xxxiv</sup> Many of these were common policy ideas, but for Petty what linked them all was their logical relationship to his analysis of England’s situation. They were empirically “natural” policies.

The most striking instance of this was Petty's proposal "To transmute the Irish into English", the transformation of Ireland's idle, poor and fractious Catholic population into 800,000 loyal and industrious subjects, and of Ireland itself from a failed kingdom into a successful colony.<sup>xxxv</sup> Designed like Petty's other proposals to replace unnatural existing policies, the transmutation of the Irish into English relied in part on the same sort of material improvements Petty recommended for England: turning the "wretched cabins" of the Irish into well-maintained and productive households suitable for making "marchantable" butter and linen, encouraging agricultural improvements by settling disputed land titles, extending roads and canals, establishing ironworks and fisheries and cementing an Anglo-Irish legislative union. But at the center of it all was a crucial piece of demographic engineering: an "Exchange of Women."<sup>xxxvi</sup>

The idea was simple, if ambitious. Reducing Anglo-Irish differences to matters of "manners, language and... religion", Petty targeted the households that instilled these characteristics. He suggested removing Ireland's "unmarried marriageable women" at the rate of 10,000 per year, sprinkling them across England (for training in "English manners and huswifery") and supplying Ireland with an equal number of young English women. Once married to Irish men, these women would naturally tame their husbands' passions and just as naturally (being English) raise English-speaking, perhaps Protestant, children. As Petty put it,

when the Priests, who govern the Conscience, and the Women, who influence the other powerful appetites, shall be English, both of whom being in the Bosom of the Men, it must be, that no Massacring of the English... can happen again. Moreover, when the Language of the Children shall be English, and the whole Oeconomy of the Family English... the Transmutation will be very easy and quick.<sup>xxxvii</sup>

Within a generation or two, religious and national differences would disappear altogether, leaving only a shared interest in peace and prosperity and a common loyalty to the state that promoted them. Paradoxically, Petty's most violent proposal in human terms was also the prime example of what the state could do by working through Nature.

## 8.

In Baconian terms, Petty's demographic transmutation – like the corpuscularian chemical transmutation he modeled it on – both constrained nature and let it work, forcibly transplanting subject populations but relying on eminently natural processes – sex and motherhood – to



“superinduce” new natures upon them, effecting a “natural” union of peoples.<sup>xxxviii</sup> Yet in this sense transmutation was just the starkest example of a tendency exhibited throughout Petty’s so-called political economy: the search for “natural” policies grounded in empirical, quantitative analysis but designed to expand the capacity of human art to improve nature, and the capacity of the state to imitate God. For the later Petty, the Crown was the “best philosopher” of all.

In this last respect, Petty out-Baconed Bacon. The passage from *The New Organon* quoted earlier distinguished between “the Benefit of new Inventions”, which extended “to all Mankind Vniversally” and lasted forever, and the fruits of “Civil atchievement”, which were partial and fleeting. But Petty’s experiences in colonial Ireland heightened his appreciation of civil concord, and while his policy proposals were inevitably partial to the government he served, the economic, social and scientific control they conferred on that government was meant to be permanent. Political arithmetic’s goal of national peace and plenty was correspondingly narrower than the Hartlibian aim of universal reformation, but it more thoroughly integrated the advancement of learning, the pursuit of material improvement and the maintenance of political stability, tying each and all to the power of the imperial state. Before his brush with empire, Petty had made science a matter of policy. Political arithmetic made policy a science.

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<sup>ii</sup> I began to explore this theme in Ted McCormick, “Sir William Petty, Political Arithmetic, and the Transmutation of the Irish, c.1652-1687” (Ph.D., Columbia University, 2005). I am currently completing an intellectual biography of Petty, parts of which supply the argument presented here.

<sup>iii</sup> Political arithmetic’s place in the history of English thought about Ireland is the subject of Ted McCormick, “A Proportionable Mixture’: Sir William Petty, Political Arithmetic, and the Transmutation of the Irish”, in Coleman Dennehy (ed.), *Restoration Ireland: Always Settling and Never Settled* (Aldershot: Ashgate, forthcoming July 2008).

<sup>iv</sup> See for example William Letwin, *The Origins of Scientific Economics* (London: Methuen, 1963), 123-157; Peter Buck, “Seventeenth-Century Political Arithmetic: Civil Strife and Vital Statistics”, *Isis* 68:1 (1977), 67-84; R. Olson, *The Emergence of the Social Sciences, 1642-1792* (New York: Twayne Publishers, 1993) 57-70; Aspromourgos, “The Mind of the Oeconomist: An Overview of the ‘Petty Papers’ Archive”, *History of Economic Ideas* 9:1 (2001), 39-102; Paul Slack, “Government and Information in Seventeenth-Century England”, *Past and Present*, 184 (2004), 33-68.

<sup>v</sup> Charles Davenant, *Discourses on the Publick Revenues, and on the Trade of England* (London: J. Knapton, 1698), 2.

<sup>vi</sup> William Petty, *Political Arithmetick* (London: Robert Clavel, 1691), Preface.

<sup>vii</sup> Petty to Southwell, 3 November 1687, in Marquis of Lansdowne (ed.), *The Petty-Southwell Correspondence* (Cambridge: Cambridge University Press, 1928), 318-322.

<sup>viii</sup> William Petty, *The Political Anatomy of Ireland* (London: Robert Clavel, 1691), Preface. Tony Aspromourgos, “An Early Attempt at Some Mathematical Economics: William Petty’s 1687 Algebra Letter, Together with a Previously Undisclosed Fragment”, *Journal of The History of Economic Thought* 21:4 (1999), 399-411, also recognizes political arithmetic as a form of mixed mathematics.

<sup>ix</sup> Here and throughout the details of Petty’s biography are taken from my work in progress, but see also Edmond Fitzmaurice, *The Life of Sir William Petty, 1623-1687: One of the first Fellows of the Royal Society, sometime Secretary to Sir Henry Cromwell, maker of the ‘Down Survey’ of Ireland, author of ‘Political Arithmetick’ &c.* (London: John Murray, 1895), and Lindsay Sharp, “Sir William Petty and Some Aspects of Seventeenth-Century Natural Philosophy” (D.Phil., University of Oxford, 1976).

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- <sup>x</sup> Charles Webster, *The Great Instauration: Science, Medicine and Reform 1626-1660*. (London: Duckworth, 1975); Mark Greengrass, Michael Leslie and Timothy Raylor (eds.), *Samuel Hartlib and the Universal Reformation: Studies in Intellectual Communication* (Cambridge: Cambridge University Press, 1994).
- <sup>xi</sup> Webster, *Great Instauration*, 81 n.168; Hartlib to Boyle, 16 November 1647, in Hunter et al. (eds.), *Correspondence of Robert Boyle*, 1:63-64.
- <sup>xii</sup> Kinner [trans. Petty], *A Continuation of Mr. John-Amos-Comenius School-Endeavours. Or A Summary Delineation of Dr. Cyprian Kinner Silesian His Thoughts concerning Education: Or The Way and Method of Teaching* (London: R.L., 1648). This was a translation of Kinner's *Cogitationum didacticarum Diatyposis summaria*. Glauber's *Furni novi philosophici* was eventually translated by another of Hartlib's circle, John French: [Johann Rudolph Glauber (trans. John French)], *A Description of New Philosophical Furnaces, Or, A New Art of Distilling* (London: R. Coats & T. Williams, 1651).
- <sup>xiii</sup> Hartlib Papers, 28/1/19b and 63/12a. The passage translated is from *Novum Organum*, I.cxxxix; see Bacon (ed. Jardine and Silverthorne), *New Organon*, 99-100. It is interesting that another Hartlibian, Cressy Dymock, would later quote the same translation of this passage – though whether Petty had Englished it is impossible to say; [Cressy Dymock], *An Invention of Engines of Motion, Lately Brought to Perfection* (London: Richard Woodnoth, 1651), sig. A2r-A2v.
- <sup>xiv</sup> Petty to Hartlib [early 1649], Hartlib Papers, 7/123/1b.
- <sup>xv</sup> Petty to Hartlib [early 1649], Hartlib Papers, 7/123/1b-2a.
- <sup>xvi</sup> Petty, *The Advice of W.P. to Mr. Samuel Hartlib For The Advancement of some particular Parts of Learning* (London: n.p., 1647 [1648]).
- <sup>xvii</sup> Petty, *Advice*, 1-3.
- <sup>xviii</sup> Petty, *Advice*, 3-6.
- <sup>xix</sup> Petty, *Advice*, 7.
- <sup>xx</sup> Petty, *Advice*, 8-9.
- <sup>xxi</sup> Petty, *Advice*, 9-17.
- <sup>xxii</sup> T.C. Barnard, *Cromwellian Ireland : English Government and Reform in Ireland 1649-1660* (Oxford: Oxford University Press, 2000).
- <sup>xxiii</sup> The classic account is John P. Prendergast, *The Cromwellian Settlement of Ireland* (London: Longman, Roberts & Green, 1865; rpr. Constable, 1996); see also Karl S. Bottigheimer, "The Restoration Land Settlement in Ireland: A Structural View", *Irish Historical Studies* 18:69 (1972), 1-21; Kevin McKenny, "The Seventeenth-Century Land Settlement in Ireland: Towards a Statistical Interpretation", in Jane Ohlmeyer (ed.) *Ireland from Independence to Occupation, 1641-1660* (Cambridge: Cambridge University Press, 1995), 181-200.
- <sup>xxiv</sup> The most detailed account is Petty's own: Petty (ed. Thomas Aiskew Larcom), *History of the Cromwellian Survey of Ireland, A.D. 1655-6, Commonly Called "The Down Survey"* (Dublin: Irish Archaeological Society, 1851).
- <sup>xxv</sup> William J. Smyth, *Map-making, Landscapes and Memory: A Geography of Colonial and Early Modern Ireland c. 1530-1750* (Cork: Cork University Press, 2006), 167.
- <sup>xxvi</sup> See in general Tim Harris, *Restoration: Charles II and his Kingdoms, 1660-1685*. (London: Penguin, 2006); on specific themes see Tim Harris, Paul Seaward and Mark Goldie (eds.), *The Politics of Religion in Restoration England* (Oxford: Oxford University Press, 1990); Steven C.A. Pincus, *Protestantism and Patriotism: Ideologies and the Making of English Foreign Policy, 1650-1668* (Cambridge: Cambridge University Press, 1996); John Miller, *Charles II* (London: Weidenfeld and Nicolson, 1991).
- <sup>xxvii</sup> Petty to Anglesey, 17 December 1672, BL MS Add. 72858, f.73.
- <sup>xxviii</sup> Petty, *Political Arithmetick*, 1; Francis Bacon, *Essays* (London: Oxford University Press, 1937), 118-131, especially 120ff.
- <sup>xxix</sup> Petty, *Political Arithmetick*, 20-21.
- <sup>xxx</sup> Petty, *Political Arithmetick*, 51-63.
- <sup>xxxi</sup> Petty, *Political Arithmetick*, 86-87.
- <sup>xxxii</sup> See, e.g., Lansdowne (ed.), *Petty-Southwell Correspondence*, 305; McGill Library, Osler MS 7612, ff.354-5.
- <sup>xxxiii</sup> BL MS Add. 72865, ff.24-28.
- <sup>xxxiv</sup> BL MS Add. 72865, ff.140-142.
- <sup>xxxv</sup> See for example BL MS Add. 72865, f.141, but components of the program are scattered throughout Petty's papers, as well as *Political Arithmetick* and *The Political Anatomy of Ireland*.
- <sup>xxxvi</sup> See for instance BL MS Add. 72879, f.71.
- <sup>xxxvii</sup> Petty, *Political Anatomy*, 31.
- <sup>xxxviii</sup> See Bacon, *New Organon*, 102. I have examined Petty's use of alchemical concepts in Ted McCormick, "Alchemy in the Political Arithmetic of Sir William Petty (1623-1687)", *Studies in History and Philosophy of Science* 37:2 (June 2006), 290-307.