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## Food, Thrift, and Experiment in Early Modern England

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### ABSTRACT

This essay uses the framework of “thrifty science” to highlight commonalities between two early modern endeavours that seem distinct today – experimental science and cookery. Comparing Isaac Newton’s experiments on light using glass prisms with Anne Shackleford’s recipes for fruitcakes I argue that for early moderns the culture of domestic thrift united the two enterprises more than we might imagine. Thrift and frugality were values of “oeconomy” or household management and encouraged householders to diversify the uses of things, a motive for experimentation across various endeavours, including what came to be defined as cookery and natural philosophy. While the home was a common ground for diverse experiments, efforts to institutionalise experiment divided it into more distinct forms, prompting a separation of practices that came to seem self-evident later on.

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In 1767, the Winchester culinary writer Ann Shackleford presented a recipe for “clear Cakes of any Fruit” in her book *Modern Art of Cookery Improved* (1767), a text which she said was based on “long experience . . . oeconomy and prudence.”<sup>1</sup> A candied fruit juice of gooseberries or plums should be placed “upon glass plates, or pieces of glass” and dried inside an oven, “or by setting them in a window where the sun comes, keeping the window shut.”<sup>2</sup> In 1666 the Cambridge natural philosopher Isaac Newton “procured me a Triangular glass-Prisme” and “having darkened my chamber, and made a small hole in my window-shuts, to let in a convenient quantity of the Suns light, I placed my Prisme at his entrance, that it might be thereby refracted to the opposite wall.”<sup>3</sup> Newton shone light through the prism to generate a spectrum of colors, isolated one color and demonstrated that a second refraction did not divide it further, showing it to be fundamental. White light was made up of a series of colors.

How do these two performances differ? The answer is seemingly quite obvious – one is a cookery recipe, and the other is a famous scientific experiment. One is not very interesting, unless you like fruitcakes, and the other constituted a profound discovery. As Pope’s epitaph for Newton famously recorded, “Nature and Nature’s laws lay hid in night: God said, Let Newton be! and all was light.”<sup>4</sup> But there are equally similarities. The performances took place in the home – Shackleford’s recipe would presumably have been enacted in a kitchen and Newton conducted experiments in his house in Woolsthorpe Manor, Lincolnshire, and in Trinity College Cambridge. Both made use of glass items

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that were ready to hand (prisms from a local fair in the case of Newton and pieces of glass in the case of Shackleford). Both used a window to manage light, either in terms of generating a beam of light or to dry out the fruitcakes. Both Newton and Shackleford produced texts to record these events so that someone else might repeat them.

Newton's experiments have never been discussed as recipes, but perhaps these endeavors were more similar than is traditionally supposed.<sup>5</sup> In recent years historians of science have given increasing attention to food history, examining how scientists and physicians have positioned themselves as experts in food governance, advising on nutrition, diet and digestion, agriculture and livestock management, regulations and public health.<sup>6</sup> Historians with a focus on domestic history have shown the significance of recipes and household cookery for science. Against a longstanding assumption that "scientific" experiments are self-evidently different from recipes, historians such as Wendy Wall, Elaine Leong and Anita Guerrini have insisted that domestic and culinary practices in the early modern period should be seen as a form of natural inquiry in what has been called "household science."<sup>7</sup> Men and women routinely made investigations into the natural world through labors in cookery, the preparation of medicines, house-keeping, and distilling; and there was much overlap between these domestic labors and the investigations of experimental philosophers like Newton. Historians vary in their interpretations of the precise distance between domestic recipes and scientific experiments. Elaine Leong, for example, identifies recipes as one of many kinds of "experimental style" connected with, but having different aims to experimental philosophy.<sup>8</sup> Wendy Wall argues that scientific and recipe cultures overlapped but were distinct, and suggests that early modern men of science appropriated the knowledge of artisans, gardeners, and housewives while forms of scientific and culinary discourse diverged over subsequent generations.<sup>9</sup> Anita Guerrini has shown that the kitchen incorporated many techniques serving cookery, anatomy, experiment, and medicine: so much so that the kitchen was a Foucauldian "heterotopia," a place where "cooks, surgeons, physicians and natural philosophers met and performed tasks that might be viewed as analogous, but for utterly different ends." "They employed many similar tools', writes Guerrini, "and their actions merged and diverged."<sup>10</sup>

This essay considers the connection between recipes and experiments by focusing more on the competing views of early modern actors regarding the status and relationship of recipes and experiments. Rather than try to define "recipes" and "experiments" and then consider the degree to which they were equivalent, this essay asks how early moderns themselves viewed the issue of their proximity. The argument will be that in the seventeenth and eighteenth centuries some people did indeed see what look to us like cookery and scientific experiments as much closer together than they might appear today, but they also debated that similarity and some rejected it. These positions become apparent by using the framework of "thrifty science," an account of particular ways in which early modern householders interacted with material culture.<sup>11</sup> This approach, applied to seventeenth and eighteenth-century Britain, suggests how both Newton and Shackleford's performances could be viewed in their time as "experiments" which "made use" of things ready to hand in the service of good "oeconomy" or household management. The first half of this essay examines how many early modern householders were happy to see domestic experiments of the kind that used prisms and fruitcakes as part of the same enterprise. By contrast, the second half of the essay considers how, in the

seventeenth century, a community of male scholars sought to distance experiments from the home, claiming them as a new kind of natural philosophical enterprise. These “experimental philosophers” had to do work to make their experiments appear distinctive from those of the home and this work generated the sense of division that we perceive today between Shackleford and Newton’s performances. The essay therefore highlights the common culture of thrift into which making fruitcakes and investigating light might fit, and traces some of the labors that over time made “experiment” appear synonymous with science and distinct from recipes in cookery.

### Experiment and Domestic Thrift

Many early modern actors – and a growing number of contemporary historians – understood the home to be the site of what the emigré intelligencer Samuel Hartlib called “domestick experiments”; that is, investigations and trials of recipes and inventions in cookery, husbandry, gardening, housewifery, cleaning, and the preparation of medicines. Domestic experiments formed a part of “oeconomy” or household management which extended across this variety of pursuits.<sup>12</sup> Good oeconomy entailed the proper management by householders of their family and possessions, and was considered a Christian virtue which applied across all classes, since it meant making the most of God’s gifts. Printed and manuscript books on oeconomy primarily addressed to men gave advice on how to organize the household, care for an estate, and manage accounts. Other works were directed at female audiences, and ranged from works on managing servants to collections of culinary and medical recipes. The title of a 1662 collection of recipes for preserves, perfumes and medicaments by the prolific seventeenth-century author on household management Hannah Woolley makes apparent how such labors were identified as “experiments”: *The Ladies Directory, in Choice Experiments & Curiosities of Preserving in Jellies And Candying both Fruit & Flowers*.<sup>13</sup> In the 1650s, Alethea Talbot, Countess of Arundel, and Elizabeth Grey, Countess of Kent, published compendia of medical recipes which they described as collections of “experiments.”<sup>14</sup> In 1661, Edward Fountaine could refer to “experimentall receipts” in a book on medicaments.<sup>15</sup> In the same year the American alchemist George Starkey, mentor of Robert Boyle, argued concerning physicians that “whatever they have that may do good, they have it from the accidental experiments of old wives, and good folks.”<sup>16</sup>

Oeconomy encouraged experimentation. This is because a central value of oeconomy was “thrift” or “frugality.” Thrift could mean saving money, as it does today, but it could also mean finding a balance between buying *new* commodities and making the most of those commodities that you already had. One could buy new clothes, for instance, but one should wear and repair old ones as well. Oeconomy was what the *Gentleman’s Magazine* in 1731 called, “Wisdom applied to the Practice of private Life; it is situated betwixt Profuseness and Avarice, and consists in a just Medium of Concern, as to exterior Goods, between being over Careful and having no Care at all.”<sup>17</sup>

Thrift was a positive value – it led to “thriving,” and this was achieved in part by making good use of one’s possessions. Writers on oeconomy encouraged householders to “make use” of things, or to find out how to get the most out of existing possessions. The emphasis here was on the making in “making use,” a sense we have lost today when we conflate the verbs “use” and “make use.” Making use was a valuable activity. As Thomas

Tusser's thick manual of household advice set in verse *A Hundreth Good Pointes of Husbandry* put it, "Good vsage with skill, being sober with all/ make huswiues to shine as the sunne on the wall."<sup>18</sup> Householders should get the most out of the material world, conceived of as a divine gift. After the Protestant Reformation in England, to make use of things could be understood as a form of worship.<sup>19</sup> As the Puritan churchman Richard Baxter wrote in his *Christian Directory* of 1673, "We must see that nothing of any use be lost through satiety, negligence, or contempt; for the smallest part is of God's gifts and talents, given us, not to cast away, but to use as he would have us."<sup>20</sup> Thrift applied, as a result, across classes. Obligations to thrift varied (the poor were forced to do it, the rich chose not to be thrifty in circumstances requiring ostentation) but the Christian value was widely held. As Baxter put it, "it is a duty which the richest man . . . is not exempted from, to be frugal."<sup>21</sup>

The need to *make use* was then a motivation for experiment. To experiment was to try out the possibilities of things, to reveal and learn about the capacities that God had implanted in material bodies, to worship Him by putting things to good use. Householders engaged in all manner of trials, tests, experiments, and experiences to achieve this. Newton and Shackelford's investigations may be counted among them. Domestic experiments were divided in theory along gendered lines, with men focusing on "husbandry" and women on "houswifery" as the names imply. Husbandry involved agriculture and estate management, oversight of the family, and the application of thrift, the "husbanding" of resources. Housewifery took in cooking, housekeeping, the preparation of medicines, distilling, and the recording of recipes. In practice there was much crossover and collaboration in these roles, with women husbanding resources, growing fruit and herbs in the garden, or keeping accounts, for instance.<sup>22</sup>

What kinds of experiments did good oeconomy entail? The first thing to be "made use of" was the house itself. Owners and renters of homes exploited the rooms of their house for their particular properties to serve experiment. Newton made use of the walls of his childhood homes in Woolsthorpe and Grantham to draw diagrams and make sundials. He was supposed to have been able to tell the time simply by knowing well the shifting locations of the shadows on the walls. Newton performed the prism experiments in Woolsthorpe, making use of the wall and window, just as Shackleton proposed making use of sun beams from the window to dry fruitcakes. Numerous experiments involved using windows to manage light, heat, and wind entering the home.<sup>23</sup>

The house itself was an experiment at this time, undergoing a transformation in the seventeenth century known today as the "Great Rebuilding."<sup>24</sup> From a single-story medieval house with a central fireplace, early modern houses added a story, set fireplaces in the walls and eventually began differentiating rooms to specific purposes. The process was gradual, however, so that houses and rooms were open-ended, their layout and uses not yet worked out and so fundamentally experimental as spaces. Kitchens, for example, were sites of food preparation but any room with a fireplace would do for making dinner.<sup>25</sup> As Sara Pennell has observed, kitchens might also contain beds, birdcages, and guns.<sup>26</sup> The open-ended, fluid character of kitchens made them perfect locations for experimenting.

Certainly, many early moderns identified kitchen practices as experimental. As Alonso-Almeida and others have noted, compilers of recipe books wrote "probatum est" to show a recipe had been tried, and crossed out recipes that proved unsuccessful.<sup>27</sup> Authors used a wealth of knowledge to compose and test recipes. In a study of early

modern recipes for pickled walnuts, Lucy Havard has proposed that a rich “domestic knowledge” of tacit skills and understanding lay behind even the simplest recipes, attested by the many lacunae in recipe books which kitchen re-enactments serve to complete.<sup>28</sup> Open-endedness in recipes testifies to the expectation that experimenters would vary them. They routinely “made use” of ingredients in diverse ways to generate new dishes and experiences. If recipes later became distinguished from “scientific” experiments, the boundaries were by no means clear in the seventeenth century. The chymist Robert Boyle, often seen today as one of the founders of “experimental method,” kept a series of work diaries in the 1650s recording an assortment of chymical, experimental, medical, and culinary procedures. His 1656 workdiary, for instance, contained receipts for a Morell-cherry-infused wine, ways of preparing quinces, walnuts, and French beans, narcotic opium infusions, and recipes for coloring glass red and making a cement for “Glasse fountains.”<sup>29</sup> One of Boyle’s experiments involved observations of the way light and colors were refracted by the bubbles in egg whites. These became a kind of natural mirror for Boyle, so there was really no boundary between cooking with eggs and studying their properties in relation to light:

We may take notice, That the White of an Egg, though in part Transparent, yet by its power of Reflecting some Incident Rays of Light, is in some measure a Natural Speculum, being long agitated with a Whisk or Spoon, loses its Transparency, and becomes very White, by being turn’d into Froth, that is into an Aggregate of Numerous small Bubbles, whose Convex Superficies fits them to Reflect the Light every way Outwards. And ‘tis worth Noting, that when Water, for instance, is Agitated into Froth, if the Bubbles be Great and Few, the Whiteness will be but Faint, because the number of Specula within a Narrow compass is but Small, and they are not Thick set enough to Reflect so Many Little Images or Beams of the Lucid Body, as are requisite to produce a Vigorous Sensation of Whiteness.<sup>30</sup>

Thrifty approaches to material things applied not only to cookery but across a wide range of domestic endeavors. The care applied to household things, efforts to adapt them to new uses, keep them in good repair, and extend their lives by passing them down the generations, applied equally to microscopes and meat cleavers. Material things passed between culinary and medical uses, as in the use of the porringer. Physicians put these metal bowls, traditionally used for eating porridge, into service for collecting blood during blood-lettings, presumably being about the right size for the quantities involved. Over time, the bowls became dedicated medical instruments, with lines engraved inside to indicate different quantities of blood.<sup>31</sup> Newton’s prism was an adapted toy from the local fair, and Shackleton said her fruitcakes should be dried “upon glass plates, or pieces of glass,” presumably kept when some vessel or window had broken. This reuse was typical of household thrift. The chemist Antoine Lavoisier made use of broken glass vessels to store chemicals and instrument-makers kept pieces of broken glass in their workshops in order to recycle them.<sup>32</sup> Kitchen utensils were proliferating in the early modern period, an analogue to the differentiation of rooms in houses.<sup>33</sup> Any number of wine glasses, decanters, coffee pots, colanders, spoons, and saucers could be adapted to serve all sorts of experiments. To take just one example, in the seventeenth century Sir Kenelm Digby made alchemical use of a kettle to prepare an incombustible sulfur by boiling slackened quick-lime and flowers of sulfur. Elizabeth Grey, Countess of Kent, prepared “Mr. Ashley’s ointment” for pain in the joints by boiling in a kettle a disconcerting mixture of grease, rosin, turpentine, and herbs after it had been set in

a “dunghill of horse muck” for three weeks. For Hannah Woolley, a kettle served for boiling gammon and making quince marmalade, gooseberry cakes, and brawn.<sup>34</sup> Kettles varied in size and shape, but all could be made use of in a variety of ways.

Newton and Shackleford used glasswares on multiple occasions, it being a thrifty value to “use again” (what we would call re-use). Substitution was another common practice. Householders experimented with substitutes out of necessity or to vary some recipe or procedure, whether it involved cooking a pie or charging a Leyden Jar. When Newton substituted arsenic for silver in his recipe for a metal alloy to make telescope mirrors, he stumbled on a mixture that would remain in use for two hundred years.<sup>35</sup> Experimenting was a process of *bricolage*, putting together what was at hand to create something new, whether it was the goodness of a new meat dish or the capacity of chocolate to conduct electricity. In the eighteenth century, experimenters tried to determine which materials would conduct the recently discovered “electric fire.”

Chocolate . . . as it cools in tin pans . . . becomes strongly electrical: when turned out of the pans, it retains for some time this property, but soon loses it by handling. Melting it again in an iron ladle, and pouring it into the tin pans as at first, will for once, or twice, renew the power; but, when the mass becomes very dry, and powdery in the ladle, the Electricity is revived no more . . . but if then a little olive oil be added . . . it will be found to have completely recovered its electric power.<sup>36</sup>

Thrift also entailed keeping things in good order for as long as possible, because this maximized the uses to which they could be put. Any number of recipes explained how to preserve and pickle foodstuffs, from mangoes to walnuts.<sup>37</sup> Preservation was equally important for householders themselves. Early moderns did not speak of “objects” and “subjects” but “bodies,” referring to both material things and people. This is one of the reasons why manuals of oeconomy included advice on both the family and possessions, on repair work and medicine. Householders were maintained in good health through a good diet, medicaments and regimen.<sup>38</sup> Preservation pervaded many endeavors today seen as scientific, from pickling specimens to keeping electrical machines free from dust. All of these activities were understood by men and women at the time as “experiments,” to be performed in the home.

## Turning Experiment into Science

While many people would have agreed that household activities in the early modern period were *experiments*, they by no means agreed on whether these constituted *science* or *natural philosophy*. A small group of householders in the period styled themselves as “experimental philosophers” and while they depended heavily on household practices as a basis for their investigations, they worked hard to show that these were *not* equivalent to domestic experiment. Their efforts help to explain the apparent division between activities like Newton’s prism experiments and Shackleford’s recipe for fruitcakes today. In the eighteenth and nineteenth centuries, domestic experimenting would not decline, but its status as science was much diminished.

The community of persons exploring nature in the seventeenth century was diverse, ranging from husbands and housewives to artisans, clergy, physicians, university scholars and wealthy ladies and gentlemen. Within this community there was much debate and

disagreement about what constituted an experiment, what constituted science, and who was authorized to produce natural knowledge. Regarding the value of domestic enterprises for science, two positions are notable. One held that any sort of household or artisanal experiment might be treated as valid and useful knowledge. This seems to have been the approach, for example, of the German emigré Samuel Hartlib in the 1650s and is evident in the use of the term “experiment” in Hannah Woolley’s *Ladies Directory*. Hartlib was less concerned to generate new ways of making knowledge than to amplify the circulation of what was already being learnt. He called for an “office of intelligence” as the central institution of a new science which found a model in part in the existing culture of household recipe exchange and husbandry.<sup>39</sup>

Another position was to argue instead for a new way of making knowledge, involving a hybrid of university natural philosophy and experiment. Francis Bacon argued that scholasticism in the universities lacked practical utility, while experiment was being carried on unsystematically. If the two were wed into a systematic “experimental philosophy” then this would lead to real progress in science. Domestic experiments figured prominently in Bacon’s writing. He was much enamored of the kitchen (and died experimenting on frozen chickens). “The preparation of meats, bread, and drinks” he said, “is of very great importance [to natural philosophy]. And although it be a thing mechanical and savoring of the kitchen and the cellar, yet it is worth more than the fables of gold, precious stones, and the like.”<sup>40</sup> Domestic experiments were not valuable, however, until they were married with the systematic inquiry characteristic of scholastic investigations into natural causes. Culinary practices were therefore resources for scholarly understanding, but were not scientific in themselves.

Ralph Austen, a commentator on Bacon’s work and member of Hartlib’s circle, shared this view. As he noted in his *Treatise of Fruit Trees* of 1665, making use and experiment were valuable, but must be combined with speculation, reason, and judgment.

*Experience* (as a Philosopher says) is the *Root of Art*, and it may well be so called, from which springs a numerous multitude of new *Experiments*: for from one *Root*, or single *Experiment*, (though perhaps a poor and mean one in it self) if thoroughly weighed with reason and judgment, may arise many rich and rare inventions.<sup>41</sup>

Austen dedicated the second edition of his treatise to Robert Boyle. Although his private notebooks made little distinction between different kinds of recipes, in his publications Boyle took a similar view to Bacon and Austen. Boyle was definitely a thrifty householder and thrifty values pervaded his work. In 1671, for example, he penned a book on the “Usefulness of Experimental Philosophy” exploring, among other things, “Men’s Great Ignorance of the Uses of Natural Things: or, That there is scarce any one Thing in Nature, whereof the Uses to human Life are yet thoroughly understood.”<sup>42</sup> Boyle insisted that “making use” should be a central feature of a new experimental philosophy in the sense that it must be a goal of science to learn the capacities of materials and things in order to make the most of them. Domestic spaces like the garden and the kitchen were ideal places to investigate new uses for things because they involved householders in interactions with nature. Boyle thus examined the uses of eggs, coriander seeds, distilled liquors, wine, beer, vegetables, jars of oil, and vinegar. But like Bacon he was at pains to say that domestic or artisanal practice in itself was inadequate as a form of experiment. Most people, he said, never noticed how everyday recipes and ingredients could be put to new



uses: “probably many more qualities or other attributes would be taken notice of, even in those natural things, that are reckoned among the most known, if men did not want a measure of curiosity that might justly be expected.”<sup>43</sup> Rather than appeal to university learning as a means to avoid this, Boyle championed the unique capacity of leisured gentlemen like himself to discern these features of experiments. Since gentlemen had time and the wealth to be impartial, they could observe, judge, and inquire into the uses of things in ways that everyday householders could not.

Bacon and Boyle’s arguments struck many observers in the period as odd, because they were claiming, controversially, that very mundane, household stuff and thrifty practices should be elevated to the grand heights of scholarly knowledge. Critics lampooned the idea that mundane experimentation could be science, normally the province of university professors studying Aristotle and Ptolemy. Food provided a perfect focal point for their satires, eating being a common experience that the experimental philosophers seemed to treat in a completely inappropriate way. In his well-known play *The Virtuoso* of 1676 Thomas Shadwell presented a spoof experimental philosopher who used a phosphorescent leg of pork as a reading light. He was mocking Boyle’s experiments on the phosphorus which his servants had noticed appearing on rotten meat in the kitchen. Jonathan Swift lampooned experimenters extracting sunbeams out of cucumbers in *Gulliver’s Travels* and Samuel Butler’s experimental philosopher in *Hudibras* (1663–1678) was mocked for making scientific knowledge out of common foods,

For he by Geometrick scale  
 Could take the size of Pots of Ale  
 Resolve by Sines and Tangents straight  
 If Bread or Butter wanted weight<sup>44</sup>

Experimenting was familiar enough, but claiming it was science seemed ridiculous. To give experiments some credit, therefore, figures like Boyle sought to ally them with the existing trappings of scholarly knowledge and gentlemanly sociability.

This entailed numerous strategies. First experimental philosophers took experiment out of the home and relocated it in spaces of accreditation, where domestic, artisanal, and other forms of experiment might be performed, witnessed, and authorized by gentlemen, whose leisure secured their trustworthiness as accreditors of knowledge. According to this model the family, the domestic combination of husbands, housewives, children, and servants, might thus experiment at home, but only the gentlemen of an academy could accredit their experiments as producing scientific knowledge. Hence the foundation, in 1660, of the Royal Society at Gresham College in London, to which experiments were brought from diverse places to be performed and witnessed by an exclusively male audience. The Royal Society’s values still reflected thrifty household oeconomy. One of the Society’s stated goals, for example, was to “make use” of things, to ensure that “the Inventions of chance will be spread into all their various uses, and multiply’d into many new advantages.”<sup>45</sup> But the Society circumscribed who could be credited as a legitimate participant in science. Artisans, because they were paid, did not have the leisure to be impartial judges and so could not be the authors of creditable natural knowledge.<sup>46</sup> Housewives were treated in a similar manner, as if their labors to maintain the home denied them the leisure that a gentleman required to make legitimate knowledge.

Consider for example a letter of 1666 from Royal Society fellow John Beale to Robert Boyle, recording how he learned the properties of heat.

Last autumn, I had leave to spend a whole day in observing the Sweete Chymistry of a Lady, Who is most perfect in the Arte of making Marmalads, & conserving fruited in all their approved colors; And she hath taught me to confesse The miracles of Heate; Tis sure the philosophers stone that can doe & undoe all things.<sup>47</sup>

The lady presumably experimented in the kitchen as she undertook the typically thrifty domestic practice of conserving fruit. Beale reckoned this taught him the power of heat as a means to transform substances. But while the lady labored in the kitchen, it was the gentleman Beale who had “leave to spend a whole day in observing” and report to the Royal Society. This leisure gave him credit in the Society, while an apparent lack of leisure excluded women from membership. Women could only participate in paid serving roles. As Abraham Cowley proposed in his ideas for an experimental academy in England, it would include “Four old women, to tend the Chambers, keep the House clean, and such like services.”<sup>48</sup> Creating this space of accreditation therefore split experiment from the home and places new constraints who could count as a valid experimenter.

Another method for distinguishing “scientific” from domestic knowledge involved efforts to fix knowledge, often in the form of texts. The home carried with it a sense of open-endedness, revision, and reworking. Most of the time, the life of the home was not recorded in texts, but unfolded through practice – the routines of everyday life, arrangements of furniture, repairs, and reworking of household goods and spaces. Some aspects of domestic life were recorded – in receipts for certain kinds of labor, inventories of possessions, and recipe books, for example. But the goal of the home was not to produce knowledge of the home – it was to enable a family to thrive. The goal of experimental philosophers, by contrast, was knowledge, in a form that was communicable and preserved for posterity. The production of texts was thus paramount, and in places like the Royal Society, this translated into the patronage of book publications and the establishment, in 1665, of the first scientific journal, the *Philosophical Transactions of the Royal Society*. Domestic knowledge reflected the home’s open-endedness. Recipe books were typically manuscripts, written and rewritten and subject to revision and addition, sometimes over generations. Texts published by the Royal Society, in contrast, were fixed, printed in a form which was ideally unchanging. It might be argued that the “literary technology” of experiment, the style and rhetoric of scientific reportage, was also generated in part as a means of distinction from the literary technology of recipes.<sup>49</sup> Unlike domestic (or artisanal) recipe books, the published reports of experimental philosophers could be prolix, insist on the serial exposition of experiments, include hypothesizing about invisible causes, and were distinct in their grammar, using the past historical tense to describe what was done, rather than what should be done. The contents of printed books reflected a division between scientific and domestic knowledge. As Anita Guerrini has shown, in the seventeenth century natural history texts and cookbooks might both discuss animals and birds and their culinary uses, but by the 1730s, “the overlapping discourses about animals in cookbooks and natural histories increasingly diverged.”<sup>50</sup>

The practice of experimental philosophy reflected this desire for closure and fixity. Robert Hooke, as the person responsible for providing the Society with experiments in

the last decades of the seventeenth century, would “try” experiments at home, figuring them out and varying them, rather like a recipe. But when he performed them at the Royal Society they constituted a “show,” a finished and well-disciplined experiment with no room for error.<sup>51</sup> Scholars, meanwhile, disdained the thrifty re-use of texts. A cook might “make use” of old papers to line pies and cakes in the oven. But scholars tried to rescue such papers to be archived, to capture and fix their meaning once and for all.<sup>52</sup>

Experimental philosophers thus sought to recast experiment as a method of making scientific knowledge which was both physically and methodologically distinct from experimenting in the home. Another means to do this lay in the choices of material objects used in experimenting. Thrifty experimenting at home entailed balancing the use of new or specialized items with more everyday items one already possessed. Boyle investigated air pressure (“the spring of the air”) using a new, specialized instrument, the air-pump, together with an assortment of bladders, birds, mice, feathers, and glassware. In the eighteenth century, men and women might purchase an electrical machine for parlor experiments, an expensive new instrument, but made use of wine bottles, silk threads, straw, and tinfoil when experimenting with it. Male experimental philosophers identified themselves as the protagonists in these enterprises, with women as audiences.<sup>53</sup> Over time, however, experimental philosophers placed increasing value on instruments that could only be used for scientific investigations, eschewing the practice of making use of household items to study nature. Already in the seventeenth century, while Newton relied on toys from fairs to investigate light, he also spent much time devising prisms that removed the assorted bubbles and distortions found in the popular version, much to the frustration of his interlocutors.<sup>54</sup>

Natural philosophers started calling household goods “common,” to imply distinction from more specialized apparatus.<sup>55</sup> The traditional balance of old and new, homely and specialized, was temporalized, coming to be seen, and valued, as a historical process.<sup>56</sup> Instruments improvised at home began to appear as merely the first stage in a development into “proper” instruments made by some expert instrument-maker. Women and children were connected to homely instruments, while men were represented as working with specialized instruments in the laboratory. Domestic experimenting thus continued, but was now demoted to being an amateurish starting point for a more professional, male science. To disdain an experimenter then became a question of allying their work to the home. In a satire on Hans Sloane’s *Voyage to Jamaica* of 1710, the Tory satirist William King criticized Sloane’s medical writing for being “more like a House-Wife’s Receipt Book” than the observations of an eminent physician.<sup>57</sup> Proper science could no longer be equivalent to a recipe.

One final way that experimental philosophers sought to distinguish themselves from everyday householders lay in their bodies. If domestic experiment was rooted in the care and preservation of bodies and a homely culture of cooking and eating, scholars sought to represent themselves as transcending the needs of the body through acts of abstinence, self-neglect, and absent-mindedness. Certainly experimental philosophers indulged themselves in food and drink like everyone else. But self-representations allied them with a restraint and bodily denial that should emphasize their intellectual powers. Newton, as Shapin has reminded us, liked to appear to forget about his dinner, being supposedly lost in thought. When his biographer William Stukeley got bored waiting for Newton in his dining room, he ate Newton’s chicken dinner. When Newton arrived he

took the cover off his dinner plate to find it empty, saying, “How absent we philosophers are. I really thought that I had not dined.”<sup>58</sup> Not only was experimental science not like a recipe, but its protagonists didn’t even eat!

## Conclusion

Until the end of the eighteenth century, the efforts of some experimental philosophers to draw a division between domestic and scientific experiments remained novel, peculiar, and had little influence. In practice, many women contributed to the experimental inquiries of Royal Society fellows, even if they were not credited by, and could not accredit knowledge in the institution.<sup>59</sup> Writers continued to use the terms “experiment” and “recipe” interchangeably. Even after Shackelford’s recipe for fruitcakes appeared in the 1760s, it was still common to discuss experiments in cookery books. Susanna MacIver noted in her book on *Cookery, and Pastry* of 1774 that her situation in life “afforded her ample opportunity of knowing the most approved methods [in cookery] and also of making experiments of her own.”<sup>60</sup>

Nevertheless, over time the thrifty equivalence of experiments like those of Newton and Shackelford diminished. What began in the efforts of experimental philosophers to create a distinctive space for experiment in places like the Royal Society would become increasingly prevalent in the nineteenth century, driving a division between “recipes” and “experiments.”<sup>61</sup> In the twentieth century it became a term of abuse to accuse someone of doing “cookbook chemistry,” or a form of passive rule-following in science that could never generate innovation or discovery. Merely “following a recipe” was not science.<sup>62</sup>

Historians have begun to break down the barrier between food history and the history of science and this essay has sought to explore some common framing for both. Both Newton and Shackelford’s endeavors followed typical thrifty conventions of their time. Both made use of the house and its furnishings as means of experiment. Both adapted ready-to-hand materials to try out something new. Both explored the properties of things and used them creatively to generate new knowledge. Both were written up as recipes and circulated. Contemporaries initially encouraged this equivalence, seeing the communication of all manner of domestic experiments as conducive to good oeconomy and to the ideals of thrift and “thriving.” But there was equally a move in the opposite direction, to insist on a division between domestic and natural philosophical experiments, which over time generated a sense that the two were different kinds of enterprise. There have certainly been diverse paths in this process emphasizing or denying crossovers between science and cookery, but it is hard now to imagine recipes for fruitcakes as anything like physics experiments.<sup>63</sup>

It is only by pursuing the history of food and cooking alongside the history of science that we begin to appreciate this process of distinction and its consequences. Approaching Newton’s work as primarily an exercise in thought takes for granted its distinction from the domestic and obscures its actual proximity. Likewise to assume Shackelford’s recipe is “just” cooking is to erase the ingenuity and vitality of women’s domestic experimenting across at least two centuries. The history of household oeconomy and thrift has served here to make these efforts apparent. This account has made apparent how important it is not to conflate *experiment* with *science*. Some studies of this period have tried to say that recipes or cookery should be seen as science alongside experimental philosophy. But the status of recipes as

science was already a focus of early modern debate and not only something to be decided later by analysts. It was not a revelation to early moderns that domestic recipes and cookery were experimental. But for many it was surprising that they might be denoted as science.

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## Notes

1. Shackelford, *Modern Art of Cookery*, Preface.
2. Shackelford, *Modern Art of Cookery*, 193.
3. Newton, “A Letter of Mr. Isaac Newton.” Newton’s experiments were subsequently the basis of Newton, *Opticks*.
4. Pope, *Major Works*, 242.
5. On Newton’s prism experiments see Sabra, *Theories of Light*; Westfall, *Never at Rest*, 156–175; Shapiro, “Introduction”; Shapiro, “Gradual Acceptance”; Schaffer, “Glass Works”; Zemplén and Demeter, “Being Charitable”; and Jalobeanu, “Constructing Natural Historical Facts.”
6. Spary, *Eating the Enlightenment*; Spary, “Food Matters”; Adelman and Haushofer, “Food as Medicine”; Spary and Orland, “Assimilating Knowledge”; and Cobbold, *Rainbow Palate*.
7. Wall, *Recipes for Thought*; Leong, “Making Medicines”; Leong, “Collecting Knowledge”; Leong, *Recipes and Everyday Knowledge*; Guerrini, “The Ghastly Kitchen”; and Cooper, “Homes and Households.”
8. Leong, *Recipes and Everyday Knowledge*, 122–3.
9. Wall, *Recipes for Thought*, 246–50.
10. Guerrini, “The Ghastly Kitchen,” 92.
11. Werrett, *Thrifty Science*.
12. Harvey, *The Little Republic*; and Harvey, “Oeconomy and the Eighteenth-Century ‘House.’”
13. Wolley [sic], *The Ladies Directory*.
14. Talbot, *Natura exenterata*; Grey, *A Choice Manual*.
15. Fountaine, *The Experimentall Receipts*.
16. Starkey, *Via ad vitam*, 30.
17. Anon., “Oeconomie and Extravagance.” For a fuller account of the thrifty practices outlined below, see Werrett, *Thrifty Science*.
18. Tusser, *A Hundreth Good Pointes of Husbandry*, 28.
19. Barnett, “Reforming Food.”
20. Baxter, *A Christian Directory*, 146.
21. Baxter, *Christian Directory*, 146.

22. See e.g. Herbert, *Female Alliances*, 86.
23. On Newton's time in Woolsthorpe and Grantham, see Westfall, *Never at Rest*, 40–65; and Iliffe, *Priest of Nature*, 24–45.
24. Hoskins, "The Rebuilding of Rural England"; Johnson, "Rethinking the Great Rebuilding"; and Werrett, *Thrifty Science*, 44.
25. Baked goods, confections and pancakes might be made in bedchambers. Herbert, *Female Alliances*, 83.
26. Pennell, "'Pots and Pans History,'" 208; Guerrini, "The Ghastly Kitchen," 80; and Pennell, *The Birth of the English Kitchen*.
27. Alonso-Almeida, "Genre Conventions," 79–80; Wall, *Recipes for Thought*, 216–17; Leong, *Recipes and Everyday Knowledge*, 101–103.
28. Havard, "Preserve or Perish"; see also Leong, *Recipes and Everyday Knowledge*, 6.
29. Hunter and Wiggins, eds., "The Workdiaries of Robert Boyle." For the recipes see workdiary no. 15, entries 29, 34, 35, 36, 38, 41, 57, 61.
30. Boyle, "The Experimental History of Colours," 701.
31. Werrett, *Thrifty Science*, 70.
32. Werrett, "Household Oeconomy," 49; and Werrett, *Thrifty Science*, 126.
33. Dannehl, "To Families Furnishing Kitchens."
34. Digby, *A Choice Collection*, 126; Grey, *A Choice Manual*, 82–3, 163–4; and Woolley, *The Accomplish'd Ladies Delight*, 3–4, 8, 155.
35. Roos, "A Speculum of Chymical Practice," 111; and Werrett, *Thrifty Science*, 76.
36. Cavallo, *A Complete Treatise on Electricity*, 22–23; and Werrett, *Thrifty Science*, 52.
37. Wall, *Recipes for Thought*, 167–208; Wilson, *Waste Not Want Not*; Shephard, *Pickled, Potted, and Canned*.
38. Eden, "The Art of Preserving."
39. Werrett, *Thrifty Science*, 33–35; and Greengrass et al., *Samuel Hartlib and Universal Reformation*.
40. Bacon quoted in Werrett, *Thrifty Science*, 51; see also Werrett, "Recycling in Early Modern Science," 632.
41. Austen, *A Treatise of Fruit Trees*, "To the Reader".
42. Boyle, "Of Men's Great Ignorance," 470–94.
43. *Ibid.*, 478.
44. Butler, *Hudibras*, 7; Shadwell, *Virtuoso*; Swift, *Travels into Several Remote Nations*; see also William King's satire on Martin Lister in King, *The Art of Cookery*.
45. Sprat, *History of the Royal Society*, 396.
46. Shapin, "Invisible Technician."
47. Beale, quoted in Werrett, *Thrifty Science*, 47.
48. Cowley, *A Proposition*, 15–16.
49. Shapin, "Pump and Circumstance." On the rhetoric of recipes, see Appelbaum, "Rhetoric and Epistemology."
50. Guerrini, "A Natural History of the Kitchen," 21.
51. Shapin, "The House of Experiment," 399–402.
52. For examples, see Werrett, "The Sociomateriality of Waste and Scrap Paper," 57–58.
53. Fara, *An Entertainment*.
54. Schaffer, "Glass Works".
55. See e.g. Petty, "A Miscellaneous Catalogue."
56. Werrett, *Thrifty Science*, chapter 8.
57. Delbourgo, *Collecting the World*, 169; Guerrini notes how the term "butcher" was used to denigrate anatomists in the seventeenth century. Guerrini, "The Ghastly Kitchen," 87.
58. Newton, quoted in Shapin, "The Philosopher and the Chicken," 21.
59. DiMeo, *Lady Ranelagh*.
60. MacIver, *Cookery, Pastry*, A2.
61. Werrett, *Thrifty Science*, chapter 8 discusses this process in detail.
62. See e.g. Aaron Goff, "Emphasizing the Unknown," 291.

63. Lieffers, “The Present Time is Eminently Scientific.”

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