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Experience and experiment:

The domestic cultivation of silkworms in eighteenth-century Britain and Ireland

The eighteenth-century home was a complex and networked space, containing many and various materials, objects and apparatus. The household was also comprised of diverse and specially adapted rooms for conducting a wide range of activities, from cheese-making to sleeping, and it was populated by individuals with the tacit knowledge necessary to conduct a repertoire of material processes. One such activity was the cultivation of silkworms for the purposes of producing silk and reducing Britain and its colonies' dependence on expensive foreign imports. In France and Italy, rearing silkworms was typically undertaken by women as a 'cottage industry' and, as a consequence, British and Irish advocates for home silk production also engaged with questions of gender, labour, domesticity and productivity. However, whilst public debate recognised the untapped potential of homes, and especially their female inhabitants, to produce a valuable raw material for the looms of London's Spitalfields or the Liberties of Dublin, they overlooked the role of domestic practice and personal curiosity in this national endeavour.

Here, the study of domestic practice is proposed as a productive approach to understanding the nature of enquiry in eighteenth-century society. This approach also helps us to see who engaged in intellectual life in this period, in terms of both gender and social status. Since our intellectual histories abandoned narratives that privileged the 'great men of science' and their 'discoveries' to the exclusion of other actors and social contexts, scholars in a range of disciplines have identified materials,¹ spaces² and marginalised people³ as being critical to the production of knowledge in this period. Whilst these studies have influenced this research in important ways, this article takes a different approach. Instead of looking to materials, spaces and actors to get to the question of knowledge production, this research argues instead that

enquiry was just one of many domestic practices and that the relationship between domestic labour and intellectual work was enmeshed. What follows is an exploration of the experience of engaging in investigative work in domestic settings as described by obscure, female ‘scientists’ and a reflection on the ways in which these marginal experimenters situated themselves within dominant narratives about the production of knowledge. The obscurity of these experimenters can be explained, in part, by the connotations of home as a place of manual work and unsophisticated education.⁴ By contrast, the homes discussed here were dynamic and flexible spaces in which specialised skills were honed and investigative work was undertaken.

By training our gaze on the home, intellectual activities such as reading, writing, collecting, experimenting, analysing and theorising can be seen in relation to the regimes of labour associated with keeping house. Here, the work of home encompasses domestic œconomy and enquiry; the quotidian and the intellectual are of a piece.⁵ The early modern home was the site of experiment not just for natural philosophers of this era, but for a broader population of householders who adapted this environment to their intellectual needs.⁶ Female lives were specifically domestically situated - both in the reality of hours spent at home and in the cultural imagination, which rooted idealised femininity in the particulars of home.⁷ However, home was also a key site of production in this period offering opportunities for experimental activity. As Sara Pennell highlights, the household could be a ‘potentially productive space for women’, servants and mistresses, aiding the development of a wide range of aptitudes, not least literacy.⁸ Households offered the curious spaces and equipment that could help them to answer questions about natural history, the qualities of specific substances or chemical processes and much more besides. In this way, the characteristics of the eighteenth-century household shaped intellectual work.

Institutional support for silk production

In the eighteenth century, silk was produced almost entirely abroad but remained in high demand by consumers at home who acquired this product at considerable expense. As such, silk production offered an opportunity for innovation that could lead to the development of a new and profitable domestic (in both senses) industry. Since the early 1600s, there had been an appetite in England for this venture but it had been slow to develop.⁹ In fact, seventeenth-century settlers in North America had been cheered by the recognition that mulberry bushes (the preferred food of silkworms) seemed to grow well in this region – as a consequence these migrants had foreseen a flourishing silk industry, but it wasn't until the eighteenth century that efforts became more coordinated to plant the correct variety of mulberry plants for this purpose.¹⁰

In Britain and Ireland, meanwhile, silk weaving alongside other textile production had become well established in the Liberties area of Dublin and Spitalfields in East London during the previous century, although the raw material was still mainly imported.¹¹ Two new eighteenth-century organisations, the Society for the Encouragement of Arts, Manufactures and Commerce in London and the Dublin Society took up this cause.¹² Like many of the other subjects of interest to these societies, the production of silk was really about import substitution. Where Britain and Ireland remained dependent on expensive foreign products, efforts were made to produce substitutes at home. However, in many cases efforts were thwarted by the variables of climate, ingredient or technique. The London Society's records note that whilst 'propagating Silk Worms, and obtaining Silk in England, was an early Subject of the Society's consideration', sourcing sufficient mulberry leaves to feed silkworms remained a major challenge.¹³ In 1768, the London Society offered prizes, called 'premiums', for activities relating to silk production, including for 'the greatest quantity of merchantable Silk', 'an account of the best method of breeding and treating Silk Worms, in order to the obtaining

Silk, verified by experiments’ and ‘For raising the greatest number of white or black Mulberry Trees’¹⁴ Between the years 1768 and 1790, there were nine formal calls for submissions relating to silk, which would have been advertised in the print press as well as through the Society’s own communications and publications.¹⁵ By contrast, the Dublin Society published papers on the subject but did not issue any premiums, instead relying on ad hoc submissions which they might choose to reward. In both cases the domestic cultivation of silkworms capable of producing silk for the home market was enthusiastically taken up by interested individuals.

When householders ventured on this task, they engaged with zoology, botany, technology and matters of business, considering the cultivation of both worms and the mulberry trees upon which they depended alongside issues of equipment and labour that would affect the scale and profitability of this enterprise. As Reverend Samuel Pullein commented to the Dublin Society in 1750, it was thought that: ‘many thousand Spinsters of a more curious Nature, without the Expence of Wages’ could become the workforce for this new silk manufacture and by doing so ‘be of publick Good to their Country’.¹⁶ Indeed, the mission of putting ‘useful arts’ to the service of the national good was at the heart of both of these eighteenth-century institutions.

The Dublin Society was established to conduct philanthropic work ‘to promote and develop agriculture, arts, industry and science in Ireland’ and was founded by members of the Dublin Philosophical Society, principally Thomas Prior and Samuel Madden. The London Society was founded by the drawing teacher and inventor William Shipley to encourage creative thinking that could be put to public uses. Both societies distinguished themselves from other intellectual institutions, such as the Royal Society, through their focus on the practical application of new knowledge. The Dublin Society emphasised the mission to provide ‘useful’ knowledge as opposed to ‘laboured speculations’ or the enrichment of ‘the learned world’.¹⁷

They wished instead ‘to direct the industry of common artists; and to bring practical and useful knowledge from the retirement of closets and libraries into public view’.¹⁸

The stated ambitions of these societies grew out of an early eighteenth-century surge in the formation of local voluntary societies with scientific, philosophical and antiquarian interests.¹⁹ The individuals who established such clubs and societies had often coalesced around topical debates in coffee houses and inns, drawing on information made increasingly accessible by new daily or weekly periodicals.²⁰ Both the Irish and English societies offered premiums for submissions which responded to particular calls and bounties for those that were unsolicited. For example, in 1757 the Dublin Society awarded premiums for ploughing rough land; the best drawing; the best crockery wares, the best ream of printing paper; for green glass manufacturing and for spinning wool amongst other challenges.²¹ The London Society devised six categories under which individuals could submit proposals, these were agriculture, manufactures, chemistry, mechanics, polite arts and colonies and trade.

Whilst the founding members of both societies were drawn from the landed, professional and merchant classes, the memberships they amassed were more diverse.²² By 1764, only ten percent of the London Society’s 2136 strong membership were individuals with titles and under ten percent were designated as medical, clerical, naval or military in background. Many more members were artisans, manufacturers, farmers or traders, including substantial representation from watch-makers and printers.²³ The Dublin Society had a much smaller membership numbering 267 in 1734. Not all of those named on the membership list played an active role and so a limited membership of 100 committed individuals was established thereafter.²⁴ Beyond the membership were an even wider section of the population who submitted proposals and designs to the societies, including those whose literacy was extremely basic.²⁵ Women certainly existed within their number and a recent analysis of the London Society’s holdings (1755-1852), across all categories (excluding the Polite Arts which

incorporated premiums aimed specifically at women), found just over three percent of submissions were penned by women.²⁶ Both societies were certainly committed to making their calls for submissions accessible to as many as possible and some of their ventures were explicitly aimed at women.²⁷ In fact, the societies' archives trace the remnants of a large, international network of correspondents. The work of these geographically and socially disparate individuals survive in part as original letters sent into the London Society (unfortunately none survive for the Dublin Society) and as recorded within the organisations' proceedings, minutes and transactions.

Female home experimenters in Britain and Ireland were drawn to this challenge, perhaps encouraged by the pamphlets of Pullein and others arguing that this was a pursuit that could be conducted by women in domestic settings.²⁸ A record survives of the work of Irish women within the Dublin Society's *Proceedings*, but sadly none of their original letters to the Society remain. However, it is possible to determine that Elizabeth Cortez of County Cork, Elizabeth Gregg of County Clare, Mrs Campbell and Martha Charlotte Menzies of Dublin and a Miss J. Fitzgerald were all involved in rearing silkworms between 1765 and 1804. On 19 December 1765, Cortez sent the Dublin Society 'A considerable Quantity of Cocons and raw Silk' from her home in Inishannon.²⁹ The Society had the specimen examined by a dealer, who declared the cocoons 'fuller than usual, and the Silk perfectly good in it's Kind, and worth 1 l. 3 s. per lb.'³⁰ Cortez's correspondence with the Society lasted several years and her efforts were rewarded with sums of money on at least three occasions.³¹ A Huguenot who settled in Inishannon, Cortez formed part of a group of refugees who were helped to establish business in Ireland by La Société pour les Protestants Réfugiez. Support of the Inishannon textile manufactory, for which Cortez's raw silk was intended, was an important focus of this initiative.³² On 10 March 1774, it was reported that she had also furnished the Society with a copy of her 'Memorial of her Observations on the breeding of Silk Worms'.³³

Other women were less successful in securing a cash reward for their work. Elizabeth Gregg, similarly writing in the 1760s, tried several approaches to gain the notice of the Dublin Society. In 1768 she sent ‘A considerable Quantity of raw Silk produced by Silk Worms in the County of Clare’, which was judged ‘perfectly good in its Kind’ but a proposed bounty of twenty guineas was ultimately rejected.³⁴ Unperturbed, Gregg’s work came in front of the Society less than a year later when a wealthy patroness, Lady Anne O’Brien, presented ‘a Piece of *Irish* flowered Silk’ made from Gregg’s raw product.³⁵ Unfortunately, despite the bounty of twenty guineas being re-proposed and the decision twice postponed, it was still rejected on 10 May 1770 by a majority of two thirds.³⁶ Similarly, in 1804, all Miss J. Fitzgerald could secure for her specimen of raw silk ‘equal [in quality] to any imported’ was ‘the Society’s thanks for her patriotic exertions.’³⁷

Two women based in Dublin achieved more than Gregg and Fitzgerald both in the scale of their operations and the recognition they were able to extract from the Society: Mrs Campbell and Martha Charlotte Menzies, both writing in the first years of the nineteenth century. Campbell worked on this project with her daughters from 45 Charlemont Street and on 9 July 1801 she applied for funds to ‘purchase machines and procure hands to assist, by which means she has no doubt of becoming a complete silk glove manufacturer, and be able to sell silk gloves much cheaper and better than they can at present be bought in *Dublin*’.³⁸ Similarly, Menzies of Pembroke Quay in Dublin had studied ‘with the strictest attention and perseverance’ both ‘the feeding and manageing of Silk-worms, and the proper method of winding and preparing the silk for the weavers’ use’.³⁹ However, she needed the Society’s help to ‘enable her to carry on the raising of the worms in an extensive manner’, specifically by affording to take on two or more child apprentices.⁴⁰ Both women secured significant contributions to their enterprises: Campbell ten guineas in 1801 and a further five in 1802 and Menzies 20 guineas in 1802. The emphasis they placed on the need to teach others the

techniques they had learned was echoed in the earlier submissions of Elizabeth Cortez who had, likewise, stated her willingness ‘to instruct [a] young Person in the Management of Silk Worms, and the Art of winding Silk after the Manner practised in France’ and ‘taught her Art of Raising Silk Worms to Mrs Anna Bell, who was now so well experienced therein, as to be able to instruct others’.⁴¹

It is difficult to trace the social status of all of the women mentioned in the Dublin Society’s *Proceedings*, but it is clear that Martha Charlotte Menzies was a member of the landed gentry.⁴² Elizabeth Cortez was part of the Huguenot community in Ireland and while French Calvinism had found believers amongst all ranks of society, this form of Protestantism was particularly prevalent amongst literate craftspeople, hence the Huguenots’ reputation for bringing technical expertise to Britain and Ireland. It is likely, therefore, that Cortez hailed from this section of society. It also seems significant that both Cortez and Elizabeth Gregg sought the support of members of the landed class in putting their case to the Society - Gregg gained the support of the wealthy O’Brien, and the MP and landowner, Thomas Adderley, was enlisted to present Cortez’ work, suggesting both of these women stood to gain from this elite endorsement.⁴³ As Celina Fox has noted, in relation to the London Society, lower status individuals often secured a respectable person in their community to act as a guarantor of the quality of their work.⁴⁴

In the English sources, two avid silkworm experimenters stand out: Mrs Ann Williams who lived in Gravesend in Kent and Miss Henrietta Rhodes (1756-1817/8) of Bridgnorth in Shropshire. Both women submitted many letters to the London Society describing their home experiments in cultivating silkworms, which offer detailed descriptions of their activities and motivations – these form the focus of the analysis below.⁴⁵ At the time of her writing to the Society, Williams was the postmistress at the Gravesend Post Office, she lived alone – her father having died several years earlier - but she made use of at least one servant.⁴⁶ The manner

in which Williams managed her experiments suggests that her domestic environment was relatively confined as she adapted key living space to serve experimental ends. By contrast, Rhodes lived at Cann Hall, a sizeable mansion dating back to the sixteenth century most likely occupied by lower gentry.⁴⁷ She never married and, over her lifetime, undertook a number of literary and intellectual pursuits, publishing several works.⁴⁸ Henrietta Rhodes referred more frequently to re-deploying domestic servants to her silkworm project, suggesting greater access to this resource, although she likewise conducted the lion's share of the work by herself.

Whilst Williams was concretely middling sort, with a job to hold down, Rhodes was a leisured gentlewoman with considerable time and space to put to the task of rearing silkworms. As *The Annual Biography and Obituary* informed its readers, 'although never successfully wooed herself, yet she wooed the muses'.⁴⁹ In this volume, and an obituary in *The Gentleman's Magazine*, she was acknowledged as having published three works, including poems and essays, a novel and an account of Stonehenge. Both obituaries were agnostic on the quality of her literary output, suggesting that whilst she 'possessed a comprehensive mind' her novel divided public opinion and her poetry 'did not rise above mediocrity'.⁵⁰ That said, her eighty-page *Poems and Miscellaneous Essays* (1814) was funded by subscription, revealing an extensive network, 'many of the first nobility and gentry of the land' and, as *The Gentleman's Magazine* observed, 'such a profusion of illustrious names is rarely to be seen, being principally obtained through the interest and connexions of a few particular friends in the higher circles, who were much devoted to her welfare.'⁵¹

The societies in London and Dublin might have provided an impetus for women to develop their domestic investigations and – importantly for historians - report upon them, but these experimenters were rooted in their local contexts and this institutional apparatus only provided one dimension to their endeavours. As David Livingstone's seminal work has shown

us, 'Each site provides repertoires of meaning' and as social and material interactions shape discourse, so 'scientific knowledge bears the imprint of its location.'⁵²

Experience and ways of 'knowing'

This article is focused on domestic practices that could lead to increased understanding of natural phenomena. But, here, the emphasis is placed on the experience of experimenters as opposed to the results of their enquiries. As Lorraine Daston and Elizabeth Lunbeck have highlighted, histories of experience have tended to focus on meaning or feeling rather than on knowledge.⁵³ The rise of cultural history at the end of the twentieth century brought new subjects firmly into the foreground of historical scholarship, including the body and sexuality, popular culture, representations and material culture. Likewise, the consolidation of gender history as a field, and its entry into the mainstream of historical debate, underlined the importance of the experiences of marginalised groups to our practice of history and our understanding of the past.⁵⁴ Whilst historians of culture and gender have often amplified personal experience and subjectivities, they have also articulated how individual experience was shaped by larger structures and power relationships. The subject of this article owes a debt to these historiographical and methodological developments and aims to contribute to a social and cultural history of intellectual life.

In this vein and over the last three decades, historians of science have rapidly advanced research into the social contexts, practices, objects, environments and embodied experiences of scientific enquiry.⁵⁵ For example, the domestic spaces of famous experimenters such as John Dee and Robert Boyle have been seen as the canvas for their enquiries, attention being drawn to their use of household personnel and the adaptation of their homes for these specialised purposes.⁵⁶ Even the gardens of the medical men, John Hunter and Edward Jenner, have

received attention as spaces of active scientific investigation.⁵⁷ The kinds of historical experience that these scholars trace is ‘contrived and disciplined’, it conditions the body and mind in specific ways, uses materials, apparatus, technique, methods of representation and networked communication to achieve intellectual ends.⁵⁸ Forms of experience such as observation or experimentation could be converted into verifiable knowledge, depending on the context in which they occurred and the status of the actors involved. Correspondence and print culture underpinned this process by promoting intellectual community, the repetition of observation or experiment and the exchange of specimens, books and ideas.

Women’s experiences of scientific enquiry were, of course, conditioned by their circumstances and the gendered prescriptions of the day. That said, a range of scholarship has illuminated the important role many women played in prominent observations, experiments and ‘discoveries’ of the eighteenth century.⁵⁹ Patricia Fara has shown that some women engaged in enquiry through ‘supporting’ a male relative in his research, playing ‘indispensable parts in achieving the results for which their men became renowned.’⁶⁰ The uncovering of female hands and minds in the history of science came alongside the recognition of other marginalised actors’ contributions, including those of technicians, instrument makers, laboratory assistants and household servants. Here, the intellectual work undertaken by these people is viewed as embedded in, rather than additional to, routines of household labour.

Whilst the Dublin Society was open to the idea of idle ‘spinsters’ putting their hands to work in the service of the nation, on the whole women were not expected to participate meaningfully in the more elevated projects of refining technique and producing knowledge. Moreover, as Ludmilla Jordanova has argued, ‘as fields with a privileged relationship to nature’ the natural sciences ‘play a major role in explaining and disseminating gender as a naturalized category.’⁶¹ For early modern women who had an interest in these subjects, the terms of engagement and the perceptions of their activity were necessarily filtered in specific and often

prejudicial ways. Nevertheless, women did involve themselves in the natural sciences and navigated their own paths through the prescriptions of science and society, often co-opting or adapting gendered discourse to serve their own purposes.⁶²

Having touched upon the issue of *who* conducted enquiries into natural knowledge in the eighteenth century, it is important to consider *how* that knowledge was conceived of and constructed. As Michael Polanyi famously observed: ‘we can know more than we can tell.’⁶³ A twentieth-century scientist turned philosopher, Polanyi had been struck by the fact that humans could recognise a face amongst many thousands of other similar faces, without being able to describe with any degree of specificity its features. In this example he recognised the importance of tacit knowing and argued that it played a central role in the development of scientific knowledge. Sara Pennell’s exploration of the early modern kitchen has argued that it was ‘the best room in the house to think about the tacit and embodied dimensions of consuming, dwelling, knowledge- and home-making being explored through theories of practice.’⁶⁴ She emphasises that whilst the spatial dimensions and material contents of the kitchen influenced the way this space was used and experienced, the ‘routine purposive tasks’ the kitchen afforded its inhabitants also shaped the way those people understood the world they lived in. Pennell’s analysis foregrounds the experimental potential of a room that has been dismissed, in this period, as a space of mundane and largely female drudgery crying out for a technological improvement to elevate its status and usage. Kitchen know-how was most often ‘unspoken, tacit and stored sensorily’, but the material processes it made possible formed the bedrock of scientific experiment in this period, whether you were Robert Boyle or an inquisitive individual with some time to spare.

This understanding of the productive rooms of the household as spaces of potential innovation is underlined by recent scholarship on recipe books. Not only do these manuscript sources reveal skills and competencies, but also the ephemeral material culture, of cloth, string,

paper and twigs, that was commonly employed in domestic production.⁶⁵ Recipe books can also be viewed as evidence of collaborative, cross-generational activity in amassing practical knowledge – a form of ‘home-based natural enquiry’.⁶⁶ In a similar vein, recent scholarship has articulated the forms of knowing that are inherent to craft and the connections that exist between artistic, artisanal and ‘scientific’ practices that all rely upon combining haptic knowing with more abstract notions and which advance via a series of generative repetitions.⁶⁷

Ursula Klein has identified the early modern period as a time when new forms of knowledge were acknowledged, including ‘ineffable bodily skills’, ‘connoisseurship of materials’, ‘tacit and verbal, to articulated know-how’ alongside the elaboration of methods of data collection and classification.⁶⁸ This phenomenon was made possible, Klein argues, by the shared material culture of academic and artisanal (or commercial) spaces where experiments took place.⁶⁹ In eighteenth-century Britain and Ireland, academic or artisanal spaces were also often domestic ones.

Activities such as distilling, smelting, heating, cooling and dissolving were undertaken in many domestic spaces, often with specialist equipment, and could be used for diverse purposes, including making food and drink, medical or pharmaceutical preparations or the production of goods (earthenware, metalwork, architectural structures). As Klein puts it, ‘the ancient separation of hand and mind ... was restructured and slowly abolished in this mixed expert tradition.’⁷⁰ Whilst this analysis acknowledges that for many eighteenth-century scholars, manual labour would have remained an alien activity, for many others (members of learned societies, anatomists, chemists, assayers or pharmacists) a tactile engagement with the objects of study was absolutely essential to their practice. Rather than asking how high-profile natural philosophers used their homes as laboratories, this article considers how the spatial and material conditions of home were exploited by householders more generally. In this way, the

home can be seen as a site for the production and circulation of both consumable goods *and* knowledge.

Home experiments

In 1778, the London Society gave a bounty of twenty guineas to Mrs Ann Williams and, seven years later, a silver medal to Miss Henrietta Rhodes for their efforts in rearing silkworms and producing silk. Both women were engaged with literature concerning the production of silk, had discussed this project with others and Rhodes referred directly to Williams' submissions to the Society, revealing that she was also a reader of its *Transactions*.

Establishing a colony

On 14 October 1777, Williams sent her first letter on this topic, reporting that she had 'forty-seven Silk worms spinning, which were but one month old yesterday; the first span on Friday last, and are in fine cocoon; those of Saturday, Sunday, and yesterday, are forming them.'⁷¹ Whilst Williams thought she could have hatched more, she declared this a sufficient 'specimen of what may be done by a watchful attendance and industry.'⁷² She also offered to 'send my Silk up next week by a friend, under three different classes, that of my first brood, that of my second, and some reeled off the eighteenth, nineteenth, and twentieth of November' for inspection by Society officials.⁷³ Similarly, when Henrietta Rhodes began to write to the Society in 1784 she provided details of her practice, which had started in the summer of 1782 when a friend sent her 'a dozen and half of Silk-worms'.⁷⁴ Rhodes admitted to being, at this time, 'totally ignorant of the method of treating them' but by the following May of 1783:⁷⁵

I found my stock increased to about thirteen hundred, and I was so fortunate as to lose very few during the whole time of feeding; for I had twelve hundred and seventy very fine Cones, and they produced me near four ounces of silk. I preserved all the eggs from

these; and on the 12th of last May, placed them in the sun: they were hatched in incredible numbers; and, by the most accurate calculation, I was mistress of more than ten thousand.⁷⁶

Rhodes also enclosed a sample of her own silk, the evidence required to be considered for a prize, claiming that ‘many good judges’ had declared it ‘superior to any that has, yet been manufactured in England, and equal to that which comes from Italy’.⁷⁷ In this way, both women used a combination of reported experiments and samples of their product to evidence their enterprise and prove their eligibility for the Society’s notice.

Throughout these letters, the pressing need to secure a reliable supply of food for the worms was apparent and both women experimented in this regard. During the several years that Rhodes had been rearing silk worms, her colonies had grown rapidly and she was forced to harvest mulberry tree leaves in a ten-mile radius of her home and employ the help of friends to secure sufficient quantities: ‘I sought after Mulberry-trees with an anxiety I cannot describe, and the discovery of a new one was a real acquisition.’⁷⁸ Ann Williams tested a number of locally available options, including lettuces and blackberry leaves, as ‘food for my little family’, finding the latter ‘they eat surprisingly, and grew amazingly’.⁷⁹ However, Williams’ ‘researches ... did not stop here’, she ‘Next presented them with the young and tender leaves of the Elm, which they devoured with great avidity. Cowslip leaves, and flowers, they are very fond of’.⁸⁰ Once Williams was able to procure mulberry leaves she found that her worms ‘would not touch’ any of these other food stuffs.⁸¹

Later, Henrietta Rhodes would criticise Williams’ approach, commenting that ‘Mrs. Williams’s observations on the various kinds of leaves they will eat, admitting their truth, can never be of the least utility, unless to gratify the curiosity of the speculative philosopher’.⁸² Williams was certainly more concerned with observing the processes she put in motion than

making her activities immediately profitable, identifying herself as one of ‘those who love to pry into the secrets of nature’.⁸³ To this end, Williams pondered the reasons for the worms’ preferences, writing on 19 October 1777: ‘It is worthy remark, they will not touch a red flower; ... and they seemed to avoid them with a kind of horror. I suppose nature debars their feeding on them, as it might hurt the colour of the silk.’⁸⁴ Whereas Williams reflected broadly on the workings of Nature, Rhodes was more practically focused - trying ‘most of the different leaves to be found in a large kitchen garden’ when a ‘scarcity of food ... threatened me’ but remaining intent on procuring ‘sufficient quantities to serve a manufactory.’⁸⁵

Domestic material culture

Both Williams and Rhodes adapted spaces in and around their homes to cultivate their colonies. In her second letter, written just five days after the first, Williams described the conditions in which she kept her worms and the attention she paid them on a daily basis:

I keep them in a woman’s large hat box, feed them every day at Ten o’clock; at Four in the afternoon, and Eleven at night; keeping them very clean. When I clean them I remove them as follows: In a Morning they are always upon the leaves, I take them out gently upon them, and when the box is cleaned, I lay them in, on the same leaves, with fresh ones over them, (with the dew on, if I can get them) and the fibre side of the leaves up: when they are all on the upper leaves, I remove the old ones; by this method a quantity of silk is saved.⁸⁶

Imaginative re-purposing of existing household objects allowed the enterprise to fit neatly into the spaces offered by her home environment, which no doubt formed part of the Post Office premises she ran during this time. When Williams was concerned about the temperature of her brood affecting their hatching, she ‘put the papers with the Eggs, into a pidgeon-hole in a Cabinet, nearly opposite the fire. As soon as the frost set in, I covered the hole with paper

several times double, to keep out the night air'.⁸⁷ Furniture of everyday use was promptly repurposed as a home for silkworms, as the need arose, revealing that investigators like Ann Williams found the tools and affordances she needed amongst the material culture of her domestic space. In pressing these objects into the service of science, Williams' colony came to nestle at the heart of her household, next to the fireside.

Unlike Williams, Rhodes cultivated her silk worms in a space specially designed, which she referred to as a 'manufactory'. Living in this place, Rhodes' silkworms were 'so situated that they were exposed to all the sounds incidental to a country town, from the barking of dogs, up to a family concert; and I am sure they never were visibly affected by either.'⁸⁸ So, whilst this was a space external to the main house, the manufactory was certainly near to home, most likely a domestic outbuilding, and situated close to her local community in Bridgnorth. However, like Mrs Campbell of Dublin whose enterprise outgrew her household, leaving her with 'the necessity of destroying multitudes of these valuable creatures for want of room' - it seems that Rhodes' earliest endeavours had been conducted in the main house.⁸⁹ It was Rhodes' own home that offered sanctuary once again when disaster struck her colony during an unseasonal cold snap:

It was sufficiently obvious that the making of fires would remedy the evil; but they were unfortunately situated over a range of warehouses, which rendered that, not only dangerous, but impossible. To remove such numbers [of worms] into the house, was equally impracticable; but alas! they were soon sufficiently reduced for me to adopt that plan, and in one of the coldest days I almost ever felt, with the assistance of several of my friends, I removed them to their former apartment. Here I kept large and constant fires, and the Worms as they arrived at maturity, pursued their industrious occupations with alacrity.⁹⁰

When faced with calamity, it was the technology of home that could rescue the situation as fireside, once again, proved the place most likely to preserve the silkworms and keep them spinning. With reference to a manufactory, a ‘former apartment’ within the main house and a kitchen garden in which emergency food could be found, the household space open to Rhodes was much larger than that of Williams, and flexible in terms of its use. This description certainly accords with the evidence that Rhodes lived at Cann Hall, an old and substantial home considerably remodelled in the nineteenth century.

Regimes of labour

Rhodes also referred to the way her work with the silkworm manufactory fitted into her day, referring to the labour she undertook by herself and that with which she had the help of a servant. Rhodes ‘fed them three times a day with leaves which had been gathered in the morning’ and once a week ‘the pans were to be cleaned’ and ‘in that office I was assisted by a servant’.⁹¹ Rhodes was happy to report that this regime was not so onerous that it kept her from ‘other avocations’ or ‘amusement’.⁹² Indeed, obituaries of Rhodes referred to the full intellectual life she had led, taking on her own writing projects and contributing to those of others.⁹³ Williams, on the other hand, found herself more pressed for time, complaining in earlier letters to the Society that her Post Office duties kept her from preferred pursuits, comparing the work to ‘Egyptian Slavery’, offering ‘no rest night or day’.⁹⁴ Nevertheless, by the time she embarked on her silkworm project, Williams was able to feed her worms three times a day (at 10am, 4pm and 11pm), collect the leaves upon which the worms sat (first thing every morning, preferably with the dew still on them) and use these to replace the existing leaves.⁹⁵ In addition, there were periods when the silk required collecting and measuring and Williams also spent time observing the activity of the worms.

The routines outlined in these letters hint at the rationale for cultivating silkworms in domestic environments and for the role of women in this cottage industry. The worms required attention for short bursts of time at fairly regular intervals and multiple times a day. They thrived in warm, dry environments – easily accessible to the cultivator – that were common about a well heated household. Dubliner, Martha Charlotte Menzies also considered the work of silkworm rearing to be compatible with other domestic work when she planned to take on apprentices, committing to ‘instruct not only in the silk business in its season, but also in all kind of domestic and useful work, which would give them the means of obtaining by industry, a comfortable living’.⁹⁶ Silkworm rearing and silk harvesting was not only accommodated by the rhythms and routines of domestic labour, but also shaped them.

Constructing female authority

As we have seen, Ann Williams and Henrietta Rhodes evidenced their expertise by providing detailed reports of their observations and experiments - bringing to bear the ‘evidentiary weight of observation’ in their submissions to the Society.⁹⁷ Whilst women remained excluded from roles within the learned societies and universities of eighteenth-century Britain and Ireland, the century did offer other inroads to scientific enquiry and writing. Building on activity undertaken by, largely aristocratic, women of the 1600s in the fields of experimental science, medicine and technical writing,⁹⁸ in the 1700s a more diverse range of women were engaging with science in public fora, whether that was through periodicals or poetry.⁹⁹ Prevailing pessimism about women’s abilities to participate in intellectual life did not deter many women from entering this arena, either as a private domestic practice or as a documented – even published – scholarly pursuit.

Both Williams and Rhodes took care to present their findings as authoritative using a range of justification for the conduct and conclusions of their work. Ann Williams was particularly keen to offer a transparent account of her decision-making process, outlining the most effective strategies: 'As to Cocoons, I have none, for after my first essay of reeling off about a dozen, I observed the silk, the nearer it came to the cocoons, grew finer, stronger, and better coloured. It immediately occurred why might not the whole cocoon be reeled off.'¹⁰⁰ To this end, Williams tried: 'the experiment in water, so hot I could scarce keep my hand in' and it lived up to her hopes: 'The strong glutinous matter, which forms the contexture of the cocoon, immediately gave way, and I reeled off every single thread.'¹⁰¹ However, the women positioned their activities very differently from one another and their language reflected distinct constructions of female authority in relation to knowledge and skill.

Williams situated her enquiry as partly a natural historical one, commenting that she believed 'that half the benefit arising from this minute part of the grand Creator's works are not yet unravelled'.¹⁰² In a long letter dated 19 October 1777, Williams described the worms as they were about to produce silk, noting that the first indication was 'a transparency all over them, with a visible circulation of the blood, or glutinous matter'.¹⁰³ Williams 'humbly' inferred that this action 'forms the silk, and assists the spinning' adding that the substance 'is visibly seen circulating down the middle of the back.'¹⁰⁴ Next, she observed that:

they erect themselves on their bellies, with their heads in form of a sphinx, sometimes seeming to play, biting their sides and silken tail, then lying dormant: But the most certain criterion is, when they eat from side to side of the large fibres in a circular form, nibbling the leaves to atoms, and wasting them. At this period, they become of a fleshy colour, their backs appear very luminous, especially by candle light.¹⁰⁵

This passage of close observation is concluded with mention of the silkworms moving ‘in a circular manner from side to side of the box’ and the more practical assertion that ‘at this moment they are to be put in papers or all the labour will prove abortive.’¹⁰⁶

By delivering such detailed anatomical descriptions of the silkworms, Williams was contributing to a broader culture of women both collecting and documenting flora and fauna in this period. Famous examples included the exceptional naturalist and illustrator, Maria Sibylla Merian (1647-1717), and aristocratic collectors such as Margaret Cavendish Bentinck, Duchess of Portland (1715-85), but these were modes that could be adopted by lower profile and lower status individuals.¹⁰⁷ Whilst Williams did not lay claim to the title of naturalist herself, she saw her work as making a solid contribution to this realm of scholarly activity and as a reliable basis for future commercial enterprise. Occasionally, she acknowledged the limits to her understanding: ‘there are more males than females, the reason I leave to be determined by judgements superior to mine;’ but she followed up swiftly with a comment reasserting the importance of her own domestic observations: ‘but this I know, which is well worth the while of naturalists to investigate, that the female *Aurelia* is full of eggs before she changes her state to that of a *Chrysalis*.’¹⁰⁸

By contrast, Henrietta Rhodes emphasised the wider significance of her work in terms of the economic potential of large-scale manufacturing:

I am decidedly of opinion, that this great article of commerce, which use and luxury have rendered so essential to our comforts and conveniencies, and for which such immense sums are annually sent into other nations, may be cultivated at home with the greatest ease, and with the utmost certainty of success.¹⁰⁹

Rhodes argued that ‘from the recital I have given’ it is clear that thirty thousand silkworms would be required to produce five pounds of silk. She further reasoned that as twelve large

mulberry bushes ‘were scarcely adequate to the support of ten thousand’ in her possession, ‘any means to stimulate the spirit of making Mulberry plantations’ would be critical to success.¹¹⁰ She herself had managed ten thousand ‘with ease and success’, but she advised that if others were to follow in her steps and on a larger scale, ‘the expence of erecting a place for them would be very trifling’ but they would need two people to attend the enterprise.¹¹¹ These concerns are echoed in the Dublin Society’s records, as three women explicitly referred to their need to take on extra help, whether that was through training other women like themselves or by employing children from ‘the Public Schools’ as apprentices.¹¹² Rhodes also emphasised the ways in which her investigation responded very closely to the Society’s objective of developing practical knowledge. Whilst her letters occasionally evoked regimes of domestic care, her discourse emphasised problem-solving over nurture.¹¹³ Rhodes’ original motivation had been to produce ‘the quantity of Silk necessary for a dress’ and, whilst the subsequent years of experimentation allowed her to draw far broader conclusions, this urge to manufacture sat at the heart of her project.¹¹⁴

Rhodes used comparisons with her predecessor, Williams, to prove the pre-eminence of her practice. In defending the lower yields of her silkworms, she accused Williams of taking ‘waste or carding silk into the account’, a habit that Rhodes regarded as ‘incompatible with my ideas of truth and candour’ and out of line with the intentions of the Society when they offered their premiums.¹¹⁵ Rhodes’ reference to the lack of ‘truth and candour’ in Ann Williams’ reports offered an implicit contrast with her own work, which could be read as embodying both of these qualities. This was important because Rhodes was asking the fellows of the Society to trust the integrity of her practices and observations thereof. She also referred to measuring the silk from a cone ‘with the most critical exactness’.¹¹⁶ Accuracy of practice played an important role in both of the women’s efforts to present their accounts as authoritative. Many more

criticisms of Williams' work exist in Rhodes' letters, as she weighed up the range of evidence she had read in the Society's *Transactions* against her own experience.

The language used by the women is also telling, for example, both referred to their silkworm colonies as 'families' and Rhodes described her silkworms as 'industrious little animals who depend on me solely'.¹¹⁷ Overall, however, it is Williams' letters that most commonly deploy anthropomorphic or embodied references. For example, she stressed the importance of treating the silk worms with kindness and drew connections between her care of them and their productivity:

I do not approve of the method used ... of striking them with a feather off the leaves to which they strongly adhere, as every time that practice is used, they not only lose a quantity of silk, but are visibly in pain, which may be seen by their various contortions; by these means, and keeping them dirty, they do not rear one tenth part of what they hatch, nor bring them to any size¹¹⁸

Whilst Williams had clearly learned about the practices and methods common to the cultivation of silk worms, in the final analysis, she trusted to her own direct experience. She sometimes referenced her own embodied knowledge to make her point, for example when reporting that she 'only used milk warm water, in the first process.'¹¹⁹ Moreover, she built the case for her own success through language that evoked female regimes of care.

This approach corresponded with trends in science writing of this era, not least – as Londa Schiebinger has argued – the use of 'explicitly anthropomorphic thinking' in relation to botany 'ascribing to plants human form, function, and even emotion.'¹²⁰ More than once, Williams referred to her silk worms as 'my little family', she inferred from their behaviours that the silkworms were 'innocent', 'satisfied', that they were in 'pain', she noted when she thought they seemed to 'play' and when they reacted with 'horror'. She witnessed them seem

‘satisfied’ with their food and ‘nestle into the pipes and repose themselves.’¹²¹ Williams’ approach finds a reflection in the writings of the poet Anna Barbauld. As Mary Ellen Bellanca has shown, in the 1770s Barbauld (at this time Aikin) commented on her friend and natural philosopher Joseph Priestly’s experiments with mice, writing ‘The Mouse’s Petition’.¹²² This poem was written in the voice of the mouse and made a plea to Priestley to release him. As Bellanca argues, the poem ‘does not simply inscribe a showdown between scientific patriarchy and feminine sensibility’ as Barbauld fully supported scientific experiment and advance, but it does reveal her interest in promoting compassion towards animals – a cause that attracted support in her own era as well as later.¹²³ Barbauld’s wider work took up a position that, all at once, promoted scientific knowledge for both men and women, aimed to ‘reinforce cultural boundaries between the sexes’ intellectual territories’ and caution against the ‘excessive ambition of male scientists.’¹²⁴ Whilst Williams’ narrative assumes the legitimacy of her activities, the combination of authoritative observation and anthropomorphic allusion is striking. Ann Williams openly described the domestic items and know-how that she deployed in her ‘researches’, prioritising a nurturing, even maternal, approach, but she did so specifically to emphasise her own expertise.

First-hand accounts of silkworm rearing took centre stage in both these women’s letters, but occasional comments reveal that each of them discussed their venture with others and had read written accounts of the process. Local people, friends and experts were all referenced for the purpose of corroborating the efficacy of their approach. As discussed above, Rhodes was particularly well networked amongst the wealthy who could support her intellectual endeavours.¹²⁵ She had also read widely on this topic, mentioning on 24 August 1785 a ‘Treatise’ she had digested concerning plans to establish a silk manufactory in Georgia, the ‘ingenious hint’ of the ‘Honourable Daines Barrington’ on collecting leaves, which she had

probably found in the Society's own *Transactions*, and her disagreement with the French Jesuit Jean-Baptiste Du Halde's judgement that noise was 'prejudicial to the Silk-worm'.¹²⁶

Williams occasionally mentioned other actors, noting on 14 October 1777: 'Every person here, those who have kept them, as well as others, will have it that I have performed a miracle.'¹²⁷ Whilst it seems that Williams lived alone, she had clearly discussed her project with neighbours or friends, some of whom had tried silkworm rearing for themselves. Five days later, she reported:

A Gentleman has been at my office, who lived three years in Italy [where silk worms were commercially reared], he declared though he had seen many thousands spin there, he never saw finer Worms than mine, and expressed his astonishment at their spinning at this season [October].¹²⁸

Ann Williams also noted that she herself was able to make artificial flowers from her own crop of silk which she thought were 'equal in texture to those of Italy'.¹²⁹ This comment points to the community of interest that had cohered around the subject of silkworms and the access Williams had to information about silkworm rearing in other parts of the world.

Just as Williams' letters to the Society had no doubt prompted others to investigate, Henrietta Rhodes' 'elegant letters' were referred to in a subsequent submission by a Mr Swaine, of Puckleworth near Bristol. He mentioned that the 'letters of that ingenious young lady' had induced him to write to the Society not 'in the light of rivalry; but merely to corroborate the testimony there adduced.'¹³⁰ In this way, Williams and Rhodes participated not only in local communities of experimenters but also in a growing and diverse network, not of friends and relations, but of investigators reporting their findings to an institution, with the hopes both of a prize and the honour of contributing to this public project.

Conclusion

This article has argued that a focus on the home and its practices offers new insight into cultures of enquiry. Here, the home can be seen as a key site for scientific investigation rather than as a space of gendered exclusion. Moreover, its material composition is imaginatively adapted to produce the conditions required for convincing observation and replicable experiment.

The domestic experimenters discussed here, presented their personal experiences as authoritative in the framework of scientific observation and as useful to commercial innovation, but they articulated their authority in different ways. These were women of the middling sort and gentry who considered their own experience of breeding silkworms and harvesting their crop as valid evidence on account of the ‘truth and candour’ of their testimony. Williams’ testimony drew strongly on concepts of nurture and domesticity, extending the discourse of ‘familial care’ to encompass this task and simultaneously developing a vocabulary for describing and interpreting her findings. Whilst Rhodes chose to prioritise the language of production over that of care, like Williams she conducted her activities at home and transferred materials, equipment and technique from one domestic task to the next. Ultimately, the cultivation of these living creatures formed one part of the material and social life of home, which included the care of family members and the careful stewardship of domestic resources.

Ludmilla Jordanova has argued in favour of ‘a notion of context that has real analytical bite’ in the study of gender and science.¹³¹ Here, these bit players in the Society’s records can be seen to illuminate important features of intellectual life in this period despite occupying a marginal position in relation to the institutions and high-profile personalities of Enlightenment science. Their testimonies bring themes to the fore that are important for a full understanding of the experience and practice of ‘science’ in eighteenth-century Britain and Ireland. Just as Ursula Klein identified bodily skills, connoisseurship of materials, tacit, verbal and articulated

know-how, methods of measuring, data gathering, classification, analysis and representation as important skills and knowledge for early modern scientists, we can see all of these qualities and activities at work in the Williams and Rhodes letters.¹³²

These records offer a glimpse into middling and elite households in a period when access to reading material married with significant technical skill learned in the home, could provide the necessary resources for the enquiring mind to engage with research as an art, but also as an industry.

¹ U. Klein and E. C. Spary, *Materials and Expertise in Early Modern Europe: Between market and laboratory* (Chicago: University of Chicago Press, 2010).

² D. N. Livingstone, *Putting Science in its Place: Geographies of Scientific Knowledge* (Chicago: University of Chicago Press, 2003).

³ See, for example: S. Shapin, *A Social History of Truth: Civility and science in seventeenth-century England* (Chicago: University of Chicago Press, 1994), esp. chapter eight ‘Invisible Technicians: Masters, servants, and the making of experimental knowledge’, pp. 355-407 and P. Fara, *Pandora’s Breeches: Women, science and power in the Enlightenment* (London: Pimlico, 2004).

⁴ Michèle Cohen has shown that the home could be a place of highly sophisticated education for girls as well as boys, see M. Cohen, “‘To Think, to Compare, to Combine, to Methodise’: Notes towards Rethinking Girls’ Education in the Eighteenth Century”, in S. Knott and B. Taylor (eds), *Women, Gender, and Enlightenment* (London: Palgrave Macmillan, 2005), pp. 224-42.

⁵ For a discussion of the eighteenth-century meaning of ‘œconomy’ and its significance, see K. Harvey, *The Little Republic: Masculinity and domestic authority in eighteenth-century Britain* (Oxford: Oxford University Press, 2012), pp. 24-63.

⁶ S. Werrett, *Thrifty Science: Making the most of materials in the history of experiment* (Chicago: University of Chicago Press, forthcoming 2018) emphasises how household thrift shaped experimental practice.

⁷ A. Vickery, *Behind Closed Doors: At home in Georgian England* (London: Yale University Press, 2009); in the 1990s, eighteenth-century studies dwelt extensively on the proposed dichotomies of feminine/masculine and private/public, see for example A. Vickery, 'Golden Age to Separate Spheres? A review of the categories and chronology of English women's history', *The Historical Journal* 36:2 (1993), pp. 383-414 and L. E. Klein, 'Gender and the Public/Private Distinction in the Eighteenth-Century: Some questions about evidence and analytic procedure', *Eighteenth-Century Studies* 29:1 (1995), pp. 97-109.

⁸ S. Pennell, *The Birth of the English Kitchen, 1600-1850* (London: Bloomsbury, 2016), p. 7.

⁹ See J. Thirsk, *Economic Policy and Projects: The development of a consumer society in early modern England* (Oxford: Clarendon Press, 1978), pp. 7, 120-2, 130 and L. Levy Peck, *Consuming Splendor: Society and culture in seventeenth-century England* (Cambridge: Cambridge University Press, 2005), pp. 1, 14, 16, 31, 73, 85-92, 106-10.

¹⁰ Levy Peck, *Consuming Splendor*, pp. 89, 93, 99-103; A. Leighton, *American Gardens in the Eighteenth Century: 'for Use Or for Delight'* (Boston: Houghton Mifflin, 1976 – reprinted 1986), p. 233.

¹¹ For more detail on Irish silk manufacture, which suffered from the British government's policies on imports, see M. Dunlevy, *Pomp and Poverty: A history of silk in Ireland* (London: Yale University Press, 2011), pp. 29-60.

¹² Ireland and Scotland led the way with initiatives of this kind, as there was a short-lived Honourable Society of Improvers in the Knowledge of Agriculture established in Edinburgh (1723-45), the Dublin Society was founded in 1731 (becoming the Royal Dublin Society after 1820), and the Society for the Encouragement of Arts, Manufactures and Commerce was founded in London in 1754, acquiring its Royal charter in 1847.

¹³ Royal Society of Arts, *Transactions of the Society*, vol. 2 (1784), p. 153, included in the 'Summary Account of Rewards Bestowed by the Society' 1775-82; likewise the Dublin Society offered Anthony Crouset a £100 interest-free loan for 'raising white Mulberry Trees' on 15 January 1761, see Dublin Society Minute Book, vol. 6, 9 Mar. 1758 to 13 Aug. 1761.

¹⁴ RSA, PR.GE/112/13/5, p. 18.

¹⁵ Calls were issued in 1768, 1769, 1776, 1783, 1784, 1786, 1787, 1788 and 1789, demand intensifying around the time that Henrietta Rhodes wrote to the Society (1785-6), see RSA, PR.GE/112/13/5; RSA, PR.GE/112/13/6; and PR.GE/112/13/7.

¹⁶ S. Pulein, *Some Hints intended to Promote the Culture of Silkworms in Ireland* (Dublin, 1750), pp. 12, 15.

¹⁷ *The Dublin Society's Weekly Observations*, I, no. I, 4 Jan. 1736-7 (Dublin, 1739), p. 7.

¹⁸ Ibid., this approach broke with the discourse of ‘secret’ knowledge that had dominated cultures of knowledge in previous centuries, see E. Leong and A. Rankin (eds), *Secrets and Knowledge in Medicine and Science, 1500-1800* (Farnham: Ashgate, 2011), but had something in common with centuries-old efforts by governing circles to promote practical projects that could effectively exploit material things for the betterment of society, see Thirsk, *Economic Policy and Projects*.

¹⁹ Examples included the Spalding Gentlemen’s Society of Lincolnshire (1710), the Peterborough Society (1730), the Chamber of Arts for Preserving and Improvement of Operative Knowledge, the Mechanical Arts, Inventions and Manufactures (1720s) and, more substantially, the Dublin Philosophical Society (1683), see C. Fox, *The Arts of Industry in the Age of Enlightenment* (New Haven, Yale University Press, 2009), pp. 179-85.

²⁰ See P. Clark, *Sociability and Urbanity: Clubs and societies in the eighteenth-century city* (Leicester: Victorian Studies Centre, 1986); J. Kelly and M.J. Powell (eds), *Clubs and Societies in Eighteenth-Century Ireland* (Dublin: Four Courts Press, 2010); M. Ellis, *The Coffee House: A cultural history* (London: Weidenfeld and Nicolson, 2011).

²¹ Royal Dublin Society Minute Book, vol. 4, 3 May 1750-24 Nov. 1757.

²² The London Society’s founding members comprised nobility, gentry, clergy and merchants (including four Fellows of the Royal Society), the Dublin Society was founded by fourteen Anglo-Irish Dubliners, including medical men, two clergymen and a landowning lawyer, see Fox, *Arts of Industry*, pp. 182, 186 and J. Meenan and D. Clarke (eds), *The Royal Dublin Society, 1731-1981* (Dublin: Gill and Macmillan Ltd, 1981), pp. 1-3.

²³ Fox, *Arts of Industry*, p. 187.

²⁴ Meenan and Clarke, *Royal Dublin Society*, p. 5.

²⁵ Recent correspondence with Anton Howes (historian in residence at the RSA) revealed that, in his view, the class make-up of people writing to the Society for the Encouragement of Arts, Manufacture and Commerce varied across category, noting ‘a very high proportion of gentry and even nobility’ in Agriculture, but an ‘overwhelming majority’ of manufacturers or merchants in the fields of Manufactures, Mechanics and Colonies and Trade.

²⁶ Again, I am grateful to Howes for this information, which forms part of his research for a book-length study of the RSA and this percentage refers to all premiums, bounties and thanks given by the Society to individuals for their submissions. It has not been possible to ascertain comparable data for the Dublin Society during this period.

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- ²⁷ Fox, *Arts of Industry*, pp. 183, 187; from 1772 the Postmaster General committed to disseminating free of charge copies of the lists of premiums to all post offices in Great Britain, Ireland and America, see Fox, *Arts of Industry*, p. 191; from 1736 onwards the Dublin Society published a weekly paper on an aspect of their work in the Dublin Newsletter, disseminating their findings widely, see Meenan and Clarke, *Royal Dublin Society*, p. 5.
- ²⁸ Pullein, *Some Hints*, p. 16.
- ²⁹ *Proceedings of the Dublin Society*, vols I-II, 15 Mar. 1764 to 2 Oct. 1766, pp. 261-2.
- ³⁰ Ibid.
- ³¹ In 1765: 22 l. 3 s; 1766: 22 l. 15 s and 3 l. 18 s.
- ³² See G. Lawless Lee, *The Huguenot Settlements in Ireland* (Berwyn Heights, MD.: Heritage Books, 2008), pp. 83-5; Cortez may have arrived in Ireland 1752 as a result of efforts in the Languedoc to enforce Catholic baptism on Protestants.
- ³³ *Proceedings of the Dublin Society*, vol. X, Oct. 1773 to Aug. 1774, p. 367.
- ³⁴ Ibid., vol. V, Oct. 1768 to Jul. 1769, pp. 261, 285.
- ³⁵ Ibid., vol. VI, Oct. 1769 to Aug. 1770, p. 39; Anne O'Brien was the wife of Sir Lucius O'Brien of Dromoland Castle, Co. Clare who was a politician and member of the Dublin Society, Anne was a named patroness amongst a group of well-to-do women 'Encouragers of the Irish silk Ware-house'.
- ³⁶ *Proceedings of the Dublin Society*, vol. VI, Oct. 1769 to Aug. 1770, p. 183.
- ³⁷ Ibid., vol. XLI, 1 Nov. 1804 to 15 Aug. 1805, pp. 5, 9-10.
- ³⁸ Ibid., vol. XXXVII, 6 Nov. 1800 to 30 Jul. 1801, p. 170.
- ³⁹ Ibid., vol. XXXIX, 4 Nov. 1802 to 11 Aug. 1803, p. 2.
- ⁴⁰ Ibid.
- ⁴¹ Ibid., vols I-II, 15 Mar. 1764 to 2 Oct. 1766, pp. 261-2; vol. XII, Nov. 1775 to Jun. 1776, p. 3.
- ⁴² See the entry on Menzies in *Burke's Landed Gentry*, vol. II (London, 1847), p. 920, she was the daughter of John-Ryves Nettles (d.1785) of Toureen [Tourin], Co. Waterford and Bearforest, Mallow, Co. Cork. Her three brothers were army officers and she married Captain Menzies, of the 62nd regt., and died without offspring, aged 99, in July 1837.
- ⁴³ Thomas Adderley of Inishannon, Co. Cork, who applied on his own behalf to the Society for support for his cultivation of mulberry bushes and plans to develop a silk manufactory. Cortez also provided 'a Certificate of several credible Persons of that Country, that the Silk was produced under her Management at Inishannon', *Proceedings of the Dublin Society*, vols I-II, 15 Mar. 1764 to 2 Oct. 1766, p. 261.

⁴⁴ Fox, *Arts of Industry*, pp. 191-2.

⁴⁵ Williams is referred to as 'Mrs' in the Society's documents and as she does not refer to a husband it is likely that she was a widow, although it is not impossible that this title was used to offer an older woman respect, despite her unmarried status.

⁴⁶ Williams is recorded as a postmistress in the manuscript *Transactions*: RSA/PR/GE/118/11/935. In 1775 and 76, prior to writing to the Society about silkworms, Williams had reported her accidental discovery that cuckoo pint (*arum maculatum*) could be put to use in dyeing, see RSA/PR/GE/118/8/693-695, Williams received thanks from the Society for this contribution and these letters mention her use of a servant to help her remove the stains caused by cuckoo pint. I am indebted to Anton Howes for this finding.

⁴⁷ See http://search.shropshirehistory.org.uk/collections/getrecord/CCS_MSA271/ [accessed 5 June 2017], the property was adapted significantly in the nineteenth century and demolished in 1957. The wills of Henrietta Rhodes and her father Nathaniel Rhodes confirm their status as gentry, see National Archives, Prob 11/1602 and Prob 11/1198.

⁴⁸ See *The Gentleman's Magazine: and Historical Chronicle*, vol. 87, part 1 (London 1817), p. 374: <https://books.google.co.uk/books?id=k2M3AQAAMAAJ&pg=PA374&dq=rhodes+cann+hall&hl=en&sa=X&ved=0ahUKewjppmfx7TaAhWCPRQKHRbVA4c4FBD0AQgmMAA#v=onepage&q=rhodes%20cann%20hall&f=false> [accessed 12 Apr. 2018]; *The Annual Biography and Obituary for the year 1818*, vol. 2 (London, 1818), p. 385: https://books.google.co.uk/books?id=020EAAAAQAAJ&pg=PA385&lpg=PA385&dq=henrietta+rhodes+cann+hall&source=bl&ots=TYGoCYIncw&sig=W9uU502mtStO7_NFrnPY8cSglhU&hl=en&sa=X&ved=0ahUKEwji1qf1xbTaAhWCvRQKHbipBWcQ6AEIRzAN#v=onepage&q&f=false [accessed 12 Apr. 2018].

⁴⁹ *Annual Biography*, p. 385.

⁵⁰ *Gentleman's Magazine*, p. 374; *Annual Biography*, p. 385; her novel was titled *Rosalie: Or the castle of Montalabretti*, published in Richmond in 1811.

⁵¹ *Gentleman's Magazine*, p. 374.

⁵² Livingstone, *Putting Science in its Place*, pp. 6, 13. See also U. Klein, 'The Laboratory Challenge: Some revisions of the standard view of early modern experimentation', *Isis* 99:4 (2008), pp. 769-82; L. Stewart, 'Experimental Spaces and the Knowledge Economy', *History of Science* 45:2 (2007), pp. 155-77; A. Cooper, 'Homes and Households' in L. Daston and K. Park (eds), *The Cambridge History of Science*, vol. 3 (Cambridge: Cambridge University Press, 2006), pp. 224-37; J. Golinski, *Science as Public Culture: Chemistry and*

Enlightenment in Britain, 1760-1820 (Cambridge: Cambridge University Press, 1992); and contributing substantially to our wider understanding of science and its practice: B. Latour, *Science in Action: How to follow scientists and engineers through society* (Cambridge, MA.: Harvard University Press, 1987) and B. Latour, *Pandora's Hope: Essays on the reality of Science Studies* (Cambridge, MA.: Harvard University Press, 1999).

⁵³ L. Daston and E. Lunbeck (eds), *Histories of Scientific Observation* (London: The University of Chicago Press, 2011), p. 2.

⁵⁴ J. W. Scott, 'Gender: A useful category of historical analysis', *The American Historical Review* 91:5 (1986), pp. 1053-75; H. Barker and E. Chalus (eds), *Gender in Eighteenth-Century England: Roles, representations, and responsibilities* (New York: Longman, 1997), M. O'Dowd, *A History of Women in Ireland, 1500-1800* (Harlow: Longman, 2005), K. Daskalova, M. O'Dowd and D. Koleva, 'Introduction', *Women's History Review*, special issue: Gender and the Cultural Production of Knowledge 20:4 (2011), pp. 487-9.

⁵⁵ Bruno Latour's seminal work, *Science in Action*, has been foundational in terms of this turn to the social and technical context of science.

⁵⁶ D. Harkness, 'Managing an Experimental Household: The Dees of Mortlake and the practice of natural philosophy', *Isis* 88:2 (1997), pp. 247-62; S. Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis* 79:3 (1988), pp. 373-404; D. L. Opitz, S. Bergwik and B. Van Tiggelen (eds), *Domesticity in the Making of Modern Science* (London: Palgrave Macmillan, 2016).

⁵⁷ C. Hickman, 'The Garden as a Laboratory: The role of domestic gardens as places of scientific exploration in the long 18th century', *Post-Medieval Archaeology* 48:1 (2014), pp. 229-47. Hickman argues convincingly that by studying domestic gardens as a centre of scientific activity, the close connections between medical practice, chemistry, botany and agricultural practice become visible.

⁵⁸ Daston and Lunbeck, *Scientific Observation*, p. 3.

⁵⁹ See, for example, L. Jordanova, 'Gender and the Historiography of Science', *The British Journal of the History of Science* 26:4 (1993), pp. 469-83; L. Hunter and S. Hutton (eds), *Women, Science and Medicine 1500-1700: Mothers and sisters of the Royal Society* (Stroud: Sutton Publishing, 1997); R. Watts, *Women in Science: A social and cultural history* (Abingdon: Routledge, 2007); P. Phillips, *The Scientific Lady: A social history of women's scientific interests, 1520-1918* (London: Weidenfeld and Nicolson, 1990).

⁶⁰ Fara, *Pandora's Breeches*, p. 10.

⁶¹ Jordanova, 'Gender and the Historiography of Science', p. 482, this piece further argues that the potential of gender as an analytical tool for the history of science can only be realised if it is treated comparatively and contextually.

⁶² See, for example, A. B. Schteir, *Cultivating Women, Cultivating Science: Flora's daughters and botany in England, 1760 to 1860* (London: John Hopkins Press Ltd., 1996); S. George, *Botany Sexuality and Women's Writing, 1760-1830: From modest shoot to forward plant* (Manchester: Manchester University Press, 2007).

⁶³ M. Polanyi, *The Tacit Dimension* (Chicago: Chicago University Press, 2009 [1966]), p. 4.

⁶⁴ Pennell, *Birth of the English Kitchen*, p. 11; see also W. Wall, *Staging Domesticity: Household work and English identity in early modern drama* (Cambridge: Cambridge University Press, 2002).

⁶⁵ M. Shanahan, "'Whipt with a twig rod': Irish manuscript recipe books as sources for the study of culinary material culture, c.1660-1830", *Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature* 115C (2015), pp. 197-218.

⁶⁶ See E. Leong, 'Collecting Knowledge for the Family: Recipes, gender and practical knowledge in the early modern English household', *Centaurus* 55 (2013), pp. 81-103, p. 97 on connections between recipe book creation and early modern medicine and science and A. E. Herbert, *Female Alliances: Gender, identity, and friendship in early modern Britain* (New Haven: Yale University Press, 2014), pp. 78-116 for recipe books as evidence of cooperative labour and female networks.

⁶⁷ See R. Sennett, *The Craftsman* (London: Allen Lane, 2008); S. Werrett, 'The Techniques of Innovation: Historical configurations of art, science, and invention, from Galileo to GPS' in D. Daniels and B. Schmidt (eds), *Artists as Inventors: Inventors as artists* (Stuttgart: Hatje Cantz, 2008), pp. 54-69. On repetition as a source of artistic creation see, G. Deleuze, *Difference and Repetition* (London: Bloomsbury Academic, 2014).

⁶⁸ Klein, 'The Laboratory Challenge', p. 781; this shift in favour of embodied forms of knowing was particularly relevant to eighteenth-century science, but as Lissa Roberts has argued, by the mid-nineteenth century this was no longer privileged in the same way: 'The Death of the Sensuous Chemist: The "new" chemistry and the transformation of sensuous technology', *Studies in History and Philosophy of Science Part A* 26:4 (1995), pp. 503-29.

⁶⁹ Klein, 'The Laboratory Challenge', pp. 773-9.

⁷⁰ *Ibid.*, p. 780.

⁷¹ RSA, *Transactions*, vol. 2 (1784), p. 155.

⁷² *Ibid.*

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- ⁷³ Ibid., p. 162.
- ⁷⁴ RSA, *Transactions*, vol. 4 (1786), p. 149.
- ⁷⁵ Ibid.
- ⁷⁶ Ibid., pp. 149-50.
- ⁷⁷ Ibid., p. 149.
- ⁷⁸ Ibid., p. 150.
- ⁷⁹ RSA, *Transactions*, vol. 2 (1784), pp. 156, 157.
- ⁸⁰ Ibid., p. 157.
- ⁸¹ Ibid.
- ⁸² RSA, *Transactions*, vol. 4 (1786), p. 164.
- ⁸³ RSA, *Transactions*, vol. 2 (1784), p. 157.
- ⁸⁴ Ibid., p. 158.
- ⁸⁵ RSA, *Transactions*, vol. 4 (1786), pp. 156, 164.
- ⁸⁶ RSA, *Transactions*, vol. 2 (1784), pp. 158-9.
- ⁸⁷ Ibid., p. 156.
- ⁸⁸ RSA, *Transactions*, vol. 4 (1786), p. 167.
- ⁸⁹ *Proceedings of the Dublin Society*, vol. XXXVIII, 5 Nov. 1801 to 26 Aug. 1802, p. 106.
- ⁹⁰ RSA, *Transactions*, vol. 5 (1787), p. 144.
- ⁹¹ RSA, *Transactions*, vol. 4 (1786), p. 153.
- ⁹² Ibid.
- ⁹³ In particular, she edited a work by her nephew, see *Annual Biography*, p. 385 and *Gentleman's Magazine*, p. 374.
- ⁹⁴ RSA/PR/GE/118/11/939, see also RSA/PR/GE/118/11/937-948 for further references to the toll Williams' work commitments took on her pursuit of science.
- ⁹⁵ RSA, *Transactions*, vol. 2 (1784), p. 158.
- ⁹⁶ *The Proceedings of the Dublin Society*, vol. XXXIX, 4 Nov. 1802 to 11 Aug. 1803, p. 2.
- ⁹⁷ Daston and Lunbeck, *Histories of Scientific Observation*, p. 115.
- ⁹⁸ See Hunter and Hutton, *Women, Science and Medicine*.

⁹⁹ S. Costa, 'The "Ladies' Diary": Gender, mathematics, and civil society in early-eighteenth-century England', *Osiris* 17 (2002), pp. 49-73; D. Landry, 'Green Languages? Women poets as naturalists in 1653 and 1807', *Huntington Library Quarterly* 63:4 (2000), pp. 467-89.

¹⁰⁰ RSA, *Transactions*, vol. 2 (1784), p. 163.

¹⁰¹ Ibid., p. 164.

¹⁰² Ibid., pp. 167-8.

¹⁰³ Ibid., pp. 159-60.

¹⁰⁴ Ibid., p. 160.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid.

¹⁰⁷ See B. Friedewald, *A Butterfly Journey: Maria Sibylla Merian artist and scientist* (Munich: Prestel, 2015) and B. Fowkes Tobin, *The Duchess's Shells: Natural history collecting in the age of Cook's voyages* (London: Yale University Press, 2014).

¹⁰⁸ RSA, *Transactions*, vol. 2 (1784), pp. 164-5.

¹⁰⁹ RSA, *Transactions*, vol. 4 (1786), p. 158.

¹¹⁰ Ibid., p. 155.

¹¹¹ Ibid.

¹¹² Elizabeth Cortez trained up a Mrs Anna Bell and Martha Charlotte Menzies was keen to secure apprentices, see *Proceedings of the Dublin Society*, vol. XII, Nov. 1775 to Jun. 1776, p. 3 and Ibid., vol. XXXIX, 4 Nov. 1802 to 11 Aug. 1803, p. 2.

¹¹³ RSA, *Transactions*, vol. 4 (1786), p. 150.

¹¹⁴ RSA, *Transactions*, vol. 5 (1787), p. 146.

¹¹⁵ RSA, *Transactions*, vol. 4 (1786), p. 162.

¹¹⁶ Ibid., p. 163.

¹¹⁷ Ibid., p. 150.

¹¹⁸ RSA, *Transactions*, vol. 2 (1784), p. 159.

¹¹⁹ Ibid., p. 164.

¹²⁰ L. Schiebinger, 'Gender and Natural History', in N. Jardine, J. A. Secord and E. C. Spary (eds), *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), p. 170, this style contributed to the interest in sexual difference that was developing in the eighteenth century.

¹²¹ RSA, *Transactions*, vol. 2 (1784), p. 157.

¹²² M. E. Bellanca, 'Science, Animal Sympathy, and Anna Barbauld's "The Mouse's Petition"', *Eighteenth-Century Studies* 37:1 (2003), pp. 47-67.

¹²³ Bellanca, 'Science, Animal Sympathy', p. 49, for example, Mary Wollstonecraft appreciated Barbauld's line of argument.

¹²⁴ Ibid.

¹²⁵ Rhodes' *Poems and Miscellaneous Essays* (1814) was published by subscription revealing a large number of wealthy supporters.

¹²⁶ RSA, *Transactions*, vol. 4 (1786), pp. 162-3, 164, 167.

¹²⁷ RSA, *Transactions*, vol. 2 (1784), p. 155.

¹²⁸ Ibid., p. 161.

¹²⁹ Ibid., p. 164.

¹³⁰ RSA, *Transactions*, vol. 5 (1787), pp. 150-1.

¹³¹ Jordanova, 'Gender and the Historiography of Science', p. 472.

¹³² Klein, 'The Laboratory Challenge', pp. 781-2.