////// tematická studie / thematic article //////////////////////

FROM NEAR TO FAR: MARIA SHORT AND THE PLACES AND SPACES OF SCIENCE IN EDINBURGH FROM 1736 TO 1850

Abstract: *A relatively unknown woman named Maria Theresa Short opened a popular observatory in 1835 in Edinburgh – a time and place where men of science and property had long failed to make a viable space for astronomy. She exhibited scientific instruments to a general public, along with a great telescope and a walk-in camera obscura that projected live views of the city and continues to delight audiences to this day. To better understand Short's accomplishments, achieved as scientific and public life became increasingly closed to women, this study explores her largely untold story, and maps some of the places of science around it. Finding local contingencies, multiple sites and practices by diverse groups, it proposes that tensions within the connections between science and spectacle and the use of popularization to promote its professionalization produced gaps that even a marginal figure like Maria Short could inhabit and exploit.*

Keywords: *camera obscura; observatory history; optical instruments; popularization; professionalization; University of Edinburgh; women and science*

Zblízka do dáli: Maria Short a místa a prostory vědy v Edinburghu v letech 1736 až 1850

Abstrakt: *Relativně neznámá žena jménem Maria Theresa Short otevřela roku 1835 v Ediburghu lidovou hvězdárnu – v době a v místě, kde mužové vědy a majetku dlouho selhávali při vytváření životaschopného proctor pro astronomii. Short vystavovala pro široké publikum vědecké nástroje a také velký dalekohled i camera obscuru, do níž šlo vejít a pozorovat živoucí dění ve městě a která poskytuje divákům zážitky dodnes. Abychom lépe porozuměli úspěchům, jichž Short dosáhla, zatímco se vědecký a veřejný život ženám výrazněji uzavíral, tato studie probádává její z větší části nevyřčený příběh a kolem něj mapuje některá z míst vědy. Na základě nalezení lokálních podmíněností, vícenásobných míst a praktik různých skupin, tato studie přichází s propozicí, že napětí vznikající ze spojení vědy a spektáklu a z užití popularizace k podoře profesionalizace vytvářelo mezery, které mohla i marginální osobnost jako Maria Short obsadit a využívat jich.*

Keywords: *camera obscura; dějiny observatoří; optické nástroje; popularizace; profesionalizace; Univerzita v Edinburghu; ženy a věda*

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Introduction

Near the top of the Royal Mile and overlooking the grounds of Edinburgh Castle, sits a popular attraction called *The Camera Obscura and World of Illusions*. Its Victorian tower, replete with five stories of optical instruments and illusions, is topped by a rooftop periscope that projects live views of the city and its surroundings onto a white tabular screen located in a dark interior chamber. The device is a camera obscura and its principles have been known for thousands of years, with smaller, portable versions being commonly associated with histories of painting and photography.[1] Less theorized are the walk-in camera obscuras for sightseeing that appeared throughout the nineteenth century at picturesque locations in Britain, Europe and North America (see Figure 1). Like a real-time cinema but without the capacity to record or replay, the Edinburgh camera obscura has delighted audiences since 1855, and is unique for its urban prospects. Moreover its associations are not only spectacular. Historians of sociology and urban planning know the site for its previous incarnation as *Outlook Tower,* so-named by Patrick Geddes who adopted the building as his headquarters forty years after the camera's installation. Founder of the "regional survey movement" and the Sociological Society of Great Britain, Geddes bought the tower in 1892 and refitted it as a "utopian vision" that would have visitors shift their outlooks through its views and maps of Edinburgh and surroundings.[2] Intent on studying and improving the conditions of urban life, the "world's first sociological laboratory" provided a geographic model which, laid out from top to bottom as a series of displays depicting local to regional to global erudition, demonstrated the interactions of societal units.[3] While a "dramatic spatial articulation of Geddes's entire philosophy of knowledge," the tower's previ-

[1] Research on *camera obscuras* in general can be found in Martine BUBB, *La Camera obscura: Philosophie d'un appareil.* Paris: L'Harmattan 2010; Jonathan CRARY, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century.* Cambridge, MA: MIT Press 1990; Helmut GERNSHEIM – Alison GERNSHEIM, *The History of Photography from the Camera Obscura to the Beginning of the Modern Era*. London: Thames & Hudson 1969; J. H. HAMMOND, *The Camera Obscura: A Chronicle.* Bristol: Hilger 1981; Jack WILGUS – Beverly WILGUS, *The Magic Mirror of Life: An Appreciation of the Camera Obscura* [online]. 2008. Available at: <http://brightbytes.com/cosite/cohome.html> [cit. 18. 8. 2013].

[2] Nick BURTON – Hilary FRASER, "Mirror Visions and Dissolving Views: Vernon Lee and the Museological Experiments of Patrick Geddes." *Nineteenth-Century Contexts*, vol. 28, 2006, no. 2, p. 146 (145160).

[3] Charles ZUEBLIN, "The World's First Sociological Laboratory." *American Journal of Sociology,* vol. 4, 1899 no. 5 (577592).

ous history is no less intriguing, if much less known.[4] Its origin as *Short's Observatory*, devised to introduce scientific instruments to a broader public, forms the core of this study. This paper explores its early history, and some of the places and spaces of science surrounding and supporting the enterprise's original 1835 establishment on Calton Hill.

Figure 1. Interior of the New York Central Park camera obscura, *Frank Leslie's Popular Monthly,* 1877.

Drawing me to this story is the mysterious Maria Theresa Short, who opened and operated her eponymous popular observatory even as public and scientific life was becoming increasingly barred to most women. Transformed in the eyes of local authorities from a "helpless and unprotected female" to an public nuisance, her first venture closed in 1850 through

[4] David N. LIVINGSTONE, *Putting Science in Its Place: Geographies of Scientific Knowledge.* Chicago: University of Chicago Press 2003, p. 35.

a forcible eviction from Calton Hill by the Edinburgh Town Council.[5] Soon after, Short bought the building on Castlehill, erected a tower for her camera obscura and reopened. Short's Observatory operated for four decades more. While Geddes employed her rooftop device as one of Outlook Tower's chief attractions, Short's identity (though never certain) nevertheless receded from view.[6] *A First Visit to Outlook Tower,* the guidebook produced by Geddes and colleagues in 1906 reports,

> Tradition indicates the building itself as the town mansion of the "Laird of Cockpen"; but to our fathers and grandfathers it was known as "Short's Observatory," from the Edinburgh Optician of that name who first established the little museum of astronomical instruments and scientific toys which this succeeds.[7]

Constructing a history that excludes women (notably mothers and grandmothers), the pamphlet obscures the "Edinburgh Optician" and reduces her project to "littleness". However, in correcting such historiographic slights, investigations of enterprising women like Maria Short can be more than female entries in a "history of great men" that, as Londa Schiebinger cautions, "often retains the male norm as the measure of excellence [... without attending to] the more usual patterns of women working in science."[8] Opening historical analyses beyond the trope of "original discoveries" brings new questions and new possibilities to the field by revealing a dense set of activities that includes participation by women and others omitted or obscured by disciplinary exclusion.[9] This paper makes no claims about the

[5] Thomas FLEMING, "Subscription Letter." 1831. National Library of Scotland, Edinburgh / MS 3918 / 6566; "The LORD PROVOST said he had had more annoyance with this woman, during the last eighteen months, than with all the other business of the Council," in "Short's Observatory." *The Scotsman,* June 19, 1850, p. 3.

[6] Veronica Wallace questions the identity of Maria Short because she would have been much older than census records suggest, but there is no way to verify if Short had lied about her parentage or her age. See Veronica WALLACE, "Maria Obscura." *Edinburgh Review*, vol. 88, 1992, pp. 101–109. For other texts on Short (that cite Wallace), see Mary BRÜCK, *Stars and Satellites*: *Women in Early British and Irish Astronomy.* London – New York: Springer 2009; and "Maria Short." In: EWAN, E. *et al.* (eds.), *The Biographical Dictionary of Scottish Women: From the Earliest Times to 2004.* Edinburgh: Edinburgh University Press 2007.

[7] *A First Visit to Outlook Tower.* Edinburgh: Geddes and Co. 1906, p. 5.

[8] Londa SCHIEBINGER, *The Mind Has No Sex: Women in the Origins of Modern Science.* Cambridge: Harvard University Press 1989, p. 6.

[9] Avril MADDRELL, *Complex Locations: Women's Geographical Work in the UK 1850–1970.* Chichester, UK – Malden, MA : Wiley-Blackwell 2009, p. 338.

epistemological merits of Short's pursuits: Sir J.A.H. Macdonald who visited her establishment as a boy, recalled that the "scientific part of the exhibition was farcical to a degree."[10] Rather, an examination of her activities and their context can broaden understandings of the tensions between science and spectacle in nineteenth-century Britain. Extending the notion of popularization beyond the discursive, it widens perceptions of early optical media technologies by including operations and operators otherwise considered marginal, subversive and unauthorized.

While Geddes's Outlook Tower offered local to global views, Short's microscopes, telescopes, and camera obscura exhibited bodies from the minuscule to the celestial and this paper follows a similar pattern. It expands from narrow to increasingly wider angles of view-seeking spaces where an unknown and unmoneyed woman might have fit even where, by many accounts, she did not belong. Beginning at close range, details of individual biographies converge into a hapless history of local observatory-building. Little is known about Maria Short, but archives reveal a feisty personality emerging from a family that tangled with the university and city elite through numerous attempts to establish an observatory in Edinburgh and conflicts over a telescope made by James Short.[11] James (Maria's uncle) was the protégé of University of Edinburgh's Chair of Mathematics, the lauded Colin Maclaurin who had not only initiated the first efforts to build an observatory in the city but moreover began Edinburgh's scientific and medical ascendency with his appointment in 1725 (along with the hiring of anatomy

[10] J. H. A. MACDONALD, *Life Jottings of an Old Edinburgh Citizen*. Edinburgh: Ballantyne 1915, p. 200.

[11] Besides WALLACE's 1992 article and the few texts that reference it, the history of Maria Short (and her family) emerges in the footnotes of secondary literature on the history of astronomy in Edinburgh and biographies of James Short. See D.J. BRYDEN, "The Edinburgh Observatory 1736–1811: A Story of Failure." *Annals of Science,* vol. 47, 1990, pp. 445–474; David Myles GAVINE, *Astronomy in Scotland 1745–1900*. Unpublished PhD Thesis. The Open University 1981; Gerard L'E. TURNER, "Eighteenth-Century Scientific Instruments and their Makers." In: PORTER, R. (ed.), *The Cambridge History of Science: Eighteenth-century science*. Cambridge: Cambridge University Press 2003, pp. 511–535; and Gerard L'E. TURNER, "James Short, F.R.S., and His Contribution to the Construction of Reflecting Telescopes." *Notes and Records of the Royal Society of London,* vol. 24, 1969, no. 1, pp. 91–108. Beginning with the footnotes of some of these sources, additional archival material was uncovered in the Edinburgh City Archives (ECA), the National Archives of Scotland (NAS), The National Library of Scotland (NAS) and the University of Edinburgh Library and University Collections. Information about the history of Short's Observatory was also shared and exchanged with Andrew Johnson, the director and manager of Edinburgh's Camera Obscura and World of Illusions.

chair Alexander Monro *primus*).[12] As the city's foremost institutional place of science, the University of Edinburgh, its administrative structure and pedagogical approaches, as well as city's scientific societies feature in my second level of study that, like the camera obscura, offers local views. From this vantage, images of economic self-interest and popularity contests emerge from spaces dominated by the very men whose positions Maria Short used to legitimate her own. Pictured in Maria's Edinburgh and underpinning her projects are local responses to contemporary shifts in national and Western science, including an interest in opening science to lower classes, parallel to a growing resentment of elite dilettantism by those who sought recognition as scientific professionals. Movements described as the professionalization of science that may have helped drive citizens to Short's door, and include the involvement of actors such as Edinburgh physicist and polemicist David Brewster, however demand a larger scope. I complete this initial stage of study on Maria Short and her history with an expansive albeit brief view that examines the transformation of science through a feminist lens, seeking spaces of women who like her have been obscured in histories that are founded on the very notions of professionalization (*men* in pursuit of scientific discovery) that ignore them. From the eighteenth to early nineteenth centuries, women were involved in the diffusion, reception and practice of science throughout the Western world when Schiebinger argues that, "noble networks and craft production gave women a definite – if limited – place in science."[13] While further constrained through the separation of public and domestic space concurrent to professionalization, there are spaces for women that could help account for the training, network and audience that facilitated Maria Short's project to offer "the sublime truths of science" to a public that was no longer "confined to the wealthy and the learned."[14]

[12] Jack MORELL, "Science in Manchester and the University of Edinburgh, 1760–1840." In: CARDWELL, D. (eds.), *Artisan to Graduate: Essays to Commemorate the Foundation in 1824 of the Manchester Mechanics' Institution*. Manchester: Manchester University Press 1974, p. 40 (39–54).
[13] SCHIEBINGER, *The Mind Has No Sex*, p. 245.
[14] WALLACE, "Maria Obscura," p. 104.

Part I: Short Stories in Closeup

The Arrival of Maria Short

Maria Short arrived in Edinburgh in 1827 – unknown, long orphaned, and the last of her line – to claim as her inheritance the Great Telescope, an old but valuable instrument around which she would later create a business of spectatorship. The twelve-foot device had a metal reflector of superior optical quality that had been polished by Maria's uncle, the renowned telescope maker James Short, and brought from his workshop in London to Edinburgh by Thomas Short (James's brother and Maria's father). Thomas planned to display the instrument for profit in an observatory of his own. However, when the city and university offered to fund his project in 1776, Thomas agreed to bar any female relatives from inheriting the telescope or his Calton Hill lease.[15] A half century later a stranger claiming to be his daughter Maria mounted an aggressive campaign to reverse this arrangement and retrieve the telescope from the city's possession. She held Town Council responsible for her and her family's hardships. For in exchange for ownership of the instrument, the city's leaders had promised an observatory that would earn a living for the Short family. It remained unfinished until 1791 – long after Thomas had passed, and his wife and small children had been evicted from the site and its meagre earnings. In a letter dated March 22, 1828 to the Lord Provost of Edinburgh, Maria wrote,

> I feel it is unnecessary to state to you my Lord that a bargain is equally obligatory on both contracting parties, my Father's part in the Second Contract after having given up the Instrument was to exclude his Daughters, this he did by the bargain. The plain and obvious duty the Magistrate had to perform was to erect in a reasonable time a building sufficient for the proper application of the instrument. *This they did not do.* And it is on this circumstance and the losses to which it subjected my family I ground my Claim.[16]

Maria eventually won her case, perhaps out of recognition of the unacknowledged wrong. When changes in building plans had overrun the observatory budget and the Lord Provost that oversaw the scheme died in office, the Town Council under his successors stopped paying the bills. The half-finished observatory, with the telescope situated in Thomas Short's house, held little attraction for scientific researchers or general audiences.

[15] BRYDEN, "The Edinburgh Observatory," p. 461.
[16] Edinburgh City Archives, Bundle 105 D/8.

Never earning more than £8 annually, as Thomas grew frail with age, the employment of an assistant at a £10 yearly salary caused upkeep to exceed income.[17] An incomplete observatory in Edinburgh's history however was hardly an anomaly, and Maria Short's claiming of the Great Telescope was merely the last of a series of struggles over the prized instrument.

Observatory Building and False Starts

Observatory building in Edinburgh may aptly be called a "history of failure," with efforts thwarted by lack of funds, mismanagement, politics and general disinterest dating from 1736.[18] Soon after an initial proposal by Colin Maclaurin, local disruptions associated with the Porteous Riots, as well as the city's preference for building up facilities for the university's medical school, caused the first of many delays.[19] The professor nevertheless raised considerable capital for the project, beginning with a donation from the Earl of Morton in 1741, and he prepared to begin construction in 1744. The following year however saw Scotland preoccupied with the 1745 Jacobite Rising and Maclaurin, who helped organize Edinburgh's defence, fell ill and in 1746, passed away. His successor Matthew Stewart inherited the observatory fund, but apart from a wooden model commissioned to Alexander Short (most likely Maria's second uncle), no progress was made. Stewart spent much of the money on himself – a discovery made when James Short inquired into the state of the account during a 1766 visit. Stewart made "a twofold and negative contribution to the observatory project" and what little remained, would go towards the observatory of Thomas Short a decade later.[20]

The Brothers Short and the Great Telescope

The Great Telescope that inspired Thomas Short to build an observatory begins with his brother the celebrated optician, James Short. The third of the four Short brothers (orphaned in 1720), James studied at the University of Edinburgh, and was bound for an ecclesiastic career when he shifted

[17] BRYDEN, "The Edinburgh Observatory," p. 463.
[18] *Ibid*.
[19] The Porteous Riots culminated in the lynching of John Porteous in September 1736. A captain of the city guard, Porteous had ordered the firing of shots into the crowd during a public execution earlier that year. See "Porteous Riots." *Encyclopædia Britannica* [online], *s. v.* Available at: <http://www.britannica.com/EBchecked/topic/471069/Porteous-Riots> [cit. 18. 8. 2013]
[20] BRYDEN, "The Edinburgh Observatory," p. 457.

his academic interests towards science and began polishing reflectors for telescopes in the university rooms of his mentor, Maclaurin.[21] Much like his older brothers John and Alexander, James left Scotland to pursue his fortune. James first travelled to London as a royal tutor in 1736 (the year of the first observatory proposal and city riots), but soon gained official recognition for his talent as an optician. The following year at the age of 27, he became a founding member of the Philosophical Society of Edinburgh with Maclaurin and its president (James's main patron) the Earl of Morton, while the Royal Society of London elected him Fellow.[22] In 1838 James established a permanent workshop on Surrey Street in London and selling to observatories, expeditions and amateur astronomers all over Europe, he achieved outstanding success: his impeccable craftsmanship often enabled him to charge more than twice the normal price for his telescopes.[23] Thomas, who was one year younger, remained in Scotland, also working as an instrument maker. Though the brothers maintained contact, the quality of their relationship is uncertain and may have been strained by Thomas's incompetence, which Maclaurin had made note of in a cautionary letter written in 1743.[24] Upon his death in 1768, James (who had never married) willed only £100 of his fortune (valued at nearly £20,000) to Thomas – leaving most of his earnings to those who arguably did not need it (the children of their wealthy brother John in Virginia and Lady Mary Douglas, daughter of the Earl of Morton).[25]

[21] James Short may have ascended to the position of Astronomer Royal in 1765 had he not been blocked by his former supporter, the Earl of Morton, then also president of the Royal Society. Morton withdrew his support following disagreements over the problem of longitude. James Short was a vocal participant in scientific circles, he encouraged achromatic-telescope maker John Dollond and chronometer maker John Harrison, and participated as an official observer, writer, and telescope supplier in the global projects to chart the 1761 and 1769 transits of Venus. See TURNER, "James Short, F.R.S and His Contribution".

[22] *Ibid*., p. 92–94.

[23] TURNER, "Eighteenth-Century Scientific Instruments," p. 528; TURNER, "James Short, F.R.S. and His Contribution," p. 91.

[24] Tristram N CLARKE – A. D. MORRISON-LOW – Allen David Cumming SIMPSON, *Brass & Glass: Scientific Instrument Making Workshops in Scotland*. National Museums of Scotland 1989, p. 3-4.

[25] Both John and Alexander predeceased James so Thomas was his only surviving sibling. For details of James's legacies to his relatives, see TURNER, "James Short, F.R.S. and His Contribution," p. 95, notes 31–35. David Brewster reports that the £1000 left to Lady Douglas was reverted to Thomas Short, see David BREWSTER, "James Short." In: *The Edinburgh Encyclopaedia,* vol. 17. Edinburgh: J. & E. Parker 1832, p. 264. For information on the descendants of John Short, see "Some Notes on the Short Family of Stafford and King George Counties, Virginia." In: *Genealogies of Virginia Families, Volume IV*. Baltimore: Genealogical Publishing 1981, p. 802 (798–816).

Thomas challenged the will but was defeated by his sixteen-year-old nephew James (John's oldest son). Thomas nevertheless took over the Surrey Street workshop for eight years (possibly working for a time with young James) and completed his brother's outstanding orders.[26] After his nephew died, he was left with an unwanted but valuable telescope. James Short had been working on a large telescope reflector at the time of his death and since its original buyer, the king of Denmark could no longer honor the commission (which Thomas valued at 12,000 guineas), Thomas completed the instrument and took it back with him to Edinburgh.[27]

Thomas planned to construct a relatively modest building in Edinburgh to exhibit the Great Telescope and live off entry fees. The instrument boasted a greater magnification power than any other telescope in the world, so Town Council agreed to lease him property on Calton Hill for ninety-nine years for a one-penny payment, with the provision that they could set the admission price for university students.[28] However the observatory project expanded, beginning with Thomas seeking subscriptions to build a more ambitious building. Following a suggestion by anatomy professor Alexander Monro (*secundus*), the university offered what remained of its observatory fund and proposed a more elaborate edifice designed by James Craig (planner of Edinburgh's New Town).[29] A new agreement was struck, except the revised contract favoured only Thomas's two grandsons (James and Thomas Douglas) and any future sons and their sons as heirs.[30] Thomas remarried in 1777 and with his much younger bride, Jacobina Downie, began his second family. When building plans changed again after visiting architect Robert Adam suggested that the observatory be made to resemble a small fortress,

[26] On young James' death in Lisbon, see TURNER, "James Short F.R.S. and His Contribution," p. 95.
[27] BRYDEN, "The Edinburgh Observatory," p. 459. The king of Denmark was likely Christian VII who was judged mentally incompetent shortly after his accession in 1766. The 12,000 guinea valuation by Thomas short was a mistake or gross exaggeration published in the *Caledonian Mercury,* 3 June 1776. James made a 12–foot reflector in 1742 for £600, and another in 1752 for the king of Spain for £1200, see BREWSTER, "James Short," p. 264. Elizabeth Douglas, the wife of Thomas's grandson wrote that the telescope was worth £1200, see ECA Bundle 105, "Act of Council fixing fees to be paid by the Students for access to Observatory, 4th December 1793."
[28] ECA Bundle 105. "Act of Council Granting to Thos Short half an acre of Ground of the Calton Hill, 22 May 1776."
[29] GAVINE, p. 219.
[30] ECA Bundle 105. "Act of Council altering the terms of the Tack to be granted to Thos Short, 10 July 1776."

Thomas was happy to oblige as the new plan included housing for the Shorts. Funds were quickly exhausted and the observatory was left unfinished and unusable. Its gothic tower became home to the telescope as well as Thomas, Jacobina and their growing family, while legal battles over outstanding building fees waged on. In 1784, plumber William Scott took the telescope's reflector (the handiwork of James Short) as security and even though it was the city's property and the city's debt, the Shorts took Scott to court at their own expense to retrieve their only, albeit limited, source of income.[31]

With Thomas's sudden death in 1788, Jacobina Downie, by terms of the 1776 contract lost her home (the gothic tower) and only means of support (the optical instruments inside). Thomas's only surviving son died soon after his father (the small boy buried in his father's grave) and Downie, pregnant at the time of her husband's death gave birth to a girl.[32] Everything they had passed to Thomas's adult grandson James Douglas by his first marriage, much to Downie's chagrin. With her new suitor John McFadzen and other accomplices, the recent widow and new mother, tried to forcibly take back the building and its contents, "under cloudy night and armed with blunderbusses, pistols, swords, cutlasses and other lethal weapons."[33] Though found innocent of "riot and assault," Downie's situation worsened with fines, legal fees and McFadzen jailed. She died seven years later in 1796 – leaving her and Thomas's three young daughters at the mercy of litigious relatives trying to tap their small trust fund to pay their late mother's debts.[34] The Short girls

[31] BRYDEN, "The Edinburgh Observatory," p. 466.

[32] The SCOTLANDS PEOPLE database (housed at the National Archives of Scotland) has digitized records listing James Short (aged 3years 1 month) as having passed away 25 March 1788, twelve days after the death of Thomas Short. Jacobina's pregnancy and delivery that same year is recounted by her former lawyer for her criminal case in a civil suit he brought against her in 1789 trying to collect his legal fees, see "Answers for Robert RENTON writer in Edinburgh to the Bill of Suspension offered for Jacobina Downie, 29 August 1789." NAS CS271/30364.

[33] James BOSWELL, "Affairs in Scotland." *The Scots Magazine,* vol. 51, 1789, pp. 47–48. A transcript of witness testimonies at the trial of Jacobina Downie, John McFadzen, David Drysdale and William Smith is located in the Edinburgh City Archives, SL1233/1/4.

[34] The Scotland's People database lists Downie as the spouse of John McFadzen having died on 3 March, 1796. Downie and McFadzen were recognized as married in spite of their own objections in a suit brought against them by James and Margaret Douglas (Thomas Short's grandchildren) forfeiting Downie's right to a Short family trust fund due to her having remarried, see *Session Papers 1792*, vol. 64, no. 11 and 12 in the Campbell Collection at the Advocacy Library in Edinburgh. Regarding suits initiated by family members against the daughters of Jacobina Downie and Thomas Short, see NAS CS231/D6/2; CS235/M/9/10; CS232/M/18/6,.

slip from public record around 1799, when all remaining family members refused to act as legal guardians.[35] In the meantime, James Douglas and his family paid for the retrieval of the instruments that Downie had earlier removed, repaired the building and its contents, and completed the observatory in 1791. However being unable to attract serious use or investment from the university or Town Council, Douglas returned to sea by 1793 leaving his wife Elizabeth Beverly to act in his stead. Beverly, who had three children to care for, petitioned the City with documents that demonstrated how her family had personally paid for the maintenance of city property, asking to be recompensed and demanding that Town Council meet the terms set forth by the 1776 agreements.[36] Council did nothing but fix a maximum yearly admission fee for university students. Beverly died two years later with her husband still at sea and it appears that neither the Douglases nor their subsequent tenant, optical instrument-maker Robert Bowman, profited from admission fees.[37] With James Douglas still absent from Scotland in 1807, his tenant George Young complained about the storage of gunpowder within the Observatory walls and Town Council responded by proclaiming the original agreement forfeited and ordering his immediate removal.[38]

The Astronomical Institution, 1811

In 1811, when private citizens founded the Astronomical Institution of Edinburgh, the city still lacked a proper observatory. Seven years later, the association had the observatory Douglas had completed, demolished to make space for a newer construction. The Playfair building, designated as the Royal Observatory in 1822, was finally outfitted in the 1830s, though the quality of its instruments was much disparaged. David Brewster in his 1832 *Edinburgh Encyclopaedia* noted,

> It is sincerely to be regretted by every friend to science, as well as to the scientific reputation of Edinburgh, that, from want of funds, proper instruments have not

[35] NAS CS231/D6/2 Item 10.
[36] ECA Bundle 105, "Act of Council fixing fees to be paid by the Students for access to Observatory, 4th December 1793."
[37] BRYDEN, "The Edinburgh Observatory," p. 468–471. Beverly died 17 February 1795, see SCOTLANDS PEOPLE database. There is no record of death for James Douglas who may have emigrate or died at sea.
[38] ECA Bundle 105. "Decreet of Declarator and Removing agains Mssrs James and Thomas Douglas and George Young, 1807."

> yet been provided, nor a salary for an observer, that might enable him to devote his attention entirely to the pursuits of astronomy.[39]

The first Astronomer Royal for Scotland (Thomas Henderson) took office in 1834, but according to a later account by the fifth royal observer (Ralph Allen Sampson), the observatory equipment remained, "at that date, and indeed up to the year 1889 [...] meagre and defective."[40]

For well over a century, making space for astronomy in Edinburgh was fraught with missteps and setbacks arising from a hapless combination of bad timing and carelessness. That contemporary observatories – such as Leiden (1633), Paris (1667), Greenwich (1675), Berlin (1711), Uppsala (1741) and Dublin (1785) – were already long established may indicate a misalignment of priorities between those who wanted a proper observatory in Edinburgh and those with the ability to make that happen. The succession of conflicts over an old but powerful telescope suggests, at least symbolically, that the rightful heirs to tradition and long range vision for a time remained an issue far from settled.

Short's Observatory

Maria Short prevailed when Town Council granted her the Great Telescope, although they probably never imagined that she would employ the sixty-year old device in her own observatory, which according to that city's history, she would establish in record time. Maria however hadn't intended to exhibit the instrument; but rather hoped only to secure herself a comfortable income. Unable to find a single buyer willing to pay a sufficient amount, she attempted to sell the telescope by lottery and as well, entreated the Duke of Buccleuch to personally place her application for a royal pension (which had been endorsed by the Lord Provost of Edinburgh) into the hands of the British monarch.[41] Maria attempted a number of letter campaigns, appending to each printed reproductions of a message of goodwill that read,

[39] David BREWSTER, "Observatory." In: *The Edinburgh Encyclopaedia,* vol. 14. Edinburgh: J. & E. Parker 1832, p. 571.

[40] R. A. SAMPSON, "Astronomy." In: British Association for the Advacement of Science (eds.), *Edinburgh's Place in Scientific Progress: Prepared for the Edinburgh Meeting of the British Association by the Local Editorial Committee*. Edinburgh: W. & R. Chambers 1921. p. 31 (31–33).

[41] Regarding Short's application for a Royal pension, see Short's letters to the Duke of Buccleuch, the British monarch and John Tait found in NAS GD224/588/7 Papers of the

University Chambers
Edinburgh, 27th Febry. 1830

Madam,

We, the undersigned, most willingly concur in bearing testimony to your Uncle's high reputation as an Optician; to the great service he did to Astronomical and Optical Science, and to the honor that accrued to the British Nation in having produced so distinguished a Character.

We are etc etc
[signed] Geo H Baird D.D. Principal
John Leslie Prof. of Nat. Philosophy
William Wallace Prof of Mathematics
John Wilson Professor of Moral Philosophy[42]

When all other schemes failed, Maria Short used the professors' letter to gather subscriptions to raise the funds to buy additional optical instruments and construct her exhibition.[43] All this she completed within eight years of her first appeal to the City. What displeasure that must have caused signatory William Wallace, who had initially voiced doubts about Maria's identity and proposed that the telescope go to the university or the Astronomical Institution where he acted as interim observer.[44] At a Town Council meeting in 1834, complaints against Maria Short's plan to erect a popular observatory on Calton Hill, including a new letter from Wallace, were read along with a petition from the Astronomical Institution that argued,

> [T]he testimony in Miss Short's favour appended to her paper so industriously circulated, was given for a very different purpose from that which it has been employed. Its object was to enable her to sell in some way an old instrument

Montague-Douglas–Scott Family, Dukes of Buccleuch. Letters and documents sent out for Short's lottery scheme are among the papers of the Philosophical Society in NLS Acc4534/13.

[42] William WALLACE – John BAIRD – John LESLIE – John WILSON, "Letter to Maria Short." February 12, 1829

[43] A printed subscription package for Short's Popular Observatory with an illustration of the Great Telescope, a copy of the professors' letter and a letter from Short supporter Thomas Fleming (dated 21 May 1831) can be found in the Mills Union Catalogue of Walter Scott Correspondence at the National Library of Scotland Reference 15616, NLS MS 3918 / 65–66.

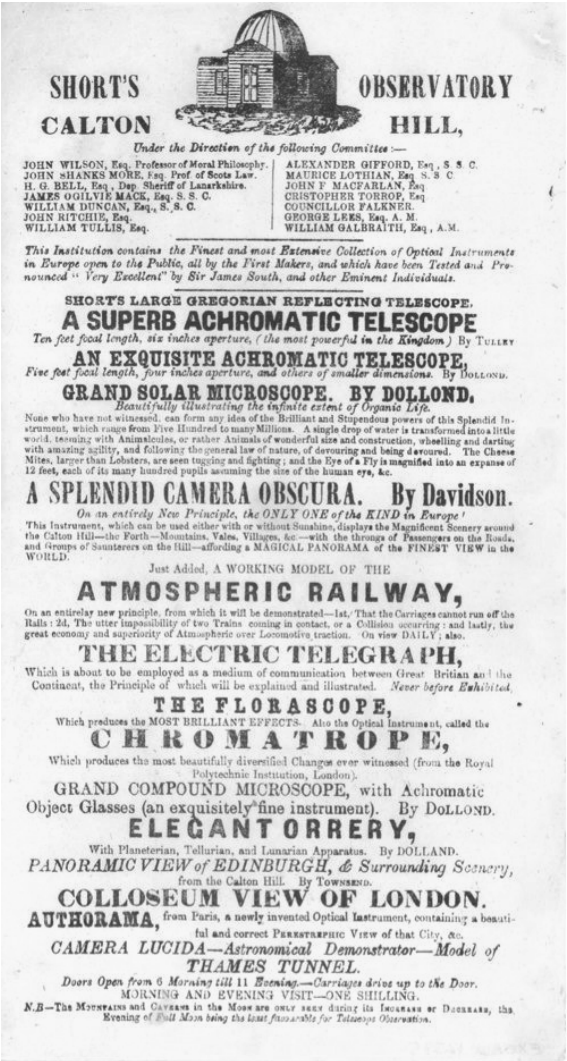
[44] William WALLACE, "Letter to the Lord Provost of Edinburgh." May 15, 1928, ECA Bundle 105 D/8.

> which belonged rightfully to the public, but which a former Town Council, in the exercise of an easy generosity, gave her as a boon.[45]

Like Wallace and the other petitioners who requested that the city's magistrates stop the construction of the "paltry show box" with the "spacious name of an observatory," Solicitor-General Henry Cockburn decried Maria's plans to build a camera obscura on Calton Hill as "a profanation of that sacred ground," fearing it would "henceforth become the receptacle of Panoramas, Caravans of wild beasts, and all manner of public show boxes."[46] In his journal (published in 1874) Cockburn, would write of the situation, "I instantly assailed the Council, and excited the press, and agitated in all quarters, and the result has been that the grant is rescinded!" adding later, "They have since rescinded this rescission, and the abominable edifice is rising."[47] Town Council approved Short's revised plans in September 1834, ironically on the very day they welcomed Thomas Henderson, the new Astronomer Royal to his poorly equipped post.[48]

None of the complainants mentioned that the grounds of the Royal Observatory already housed a camera obscura on Calton Hill. For the Astronomical Institution had included a popular observatory in its own mandate and the camera obscura outfitted in the gothic tower (Thomas and Jacobina's old home!) had long served as its "chief object of attraction to visitors."[49] Maria Short's venture thus competed with and detracted from the institution that had been decades in the making. Along with her camera obscura and uncle's telescope (which had the advantage of showing an upright image of city views in daytime),[50] Maria exhibited solar microscopes that projected magnifications of the minute into the monstrous, a chromatope that as a new kind of magic lantern projected a series of dissolving views, an electric telegraph that could connect Britain to the continent, as well as numerous other technological devices that few might otherwise experience (see Figure 2). Perhaps preferring the simpler attractions of a third camera obscura on Calton Hill, installed in Nelson's Monument in 1849, and its proprietor, their tenant, the courteous Mr. Kerr, Town Council took steps to

[45] *The Scotsman*, July 23, 1834, p. 3.
[46] *Ibid.*
[47] Henry COCKBURN, *Journal of Henry Cockburn: Being a Continuation of the Memorials of His Time, 1831–1855*. Volume I. Edinburgh: Edmonston and Douglas 1874, p. 61–62.
[48] ECA, "Town Council Minutes." Volume 217, 23 September 1834, p. 169–174.
[49] BREWSTER, "Observatory," p. 571.
[50] WALLACE, "Maria Obscura," p. 105.



SHORT'S OBSERVATORY
CALTON HILL,

Under the Direction of the following Committee:—

JOHN WILSON, Esq. Professor of Moral Philosophy.
JOHN SHANKS MORE, Esq. Prof. of Scots Law.
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This Institution contains the Finest and most Extensive Collection of Optical Instruments in Europe open to the Public, all by the First Makers, and which have been Tested and Pronounced "Very Excellent" by Sir James South, and other Eminent Individuals.

SHORT'S LARGE GREGORIAN REFLECTING TELESCOPE.

A SUPERB ACHROMATIC TELESCOPE

Ten feet focal length, six inches aperture, (the most powerful in the Kingdom.) By TULLEY

AN EXQUISITE ACHROMATIC TELESCOPE,

Five feet focal length, four inches aperture, and others of smaller dimensions. By DOLLOND.

GRAND SOLAR MICROSCOPE. BY DOLLOND,

Beautifully illustrating the infinite extent of Organic Life.

None who have not witnessed, can form any idea of the Brilliant and Stupendous powers of this Splendid Instrument, which ranges from Five Hundred to many Millions. A single drop of water is transformed into a little world, teeming with Animalcules, or rather Animals of wonderful size and construction, wheelling and darting with amazing agility, and following the general law of nature, of devouring and being devoured. The Cheese Mites, larger than Lobsters, are seen tugging and fighting; and the Eye of a Fly is magnified into an expanse of 12 feet, each of its many hundred pupils assuming the size of the human eye, &c.

A SPLENDID CAMERA OBSCURA. By Davidson.

On an entirely New Principle, the ONLY ONE of the KIND in Europe!

This Instrument, which can be used either with or without Sunshine, displays the Magnificent Scenery around the Calton Hill—the Forth—Mountains, Vales, Villages, &c.—with the throngs of Passengers on the Roads, and Groups of Sunterers on the Hill—affording a MAGICAL PANORAMA of the FINEST VIEW in the WORLD.

Just Added, A WORKING MODEL OF THE

ATMOSPHERIC RAILWAY,

On an entirelay new principle, from which it will be demonstrated—1st, That the Carriages cannot run off the Rails: 2d, The utter impossibility of two Trains coming in contact, or a Collision occurring: and lastly, the great economy and superiority of Atmospheric over Locomotive traction. On view DAILY; also.

THE ELECTRIC TELEGRAPH,

Which is about to be employed as a medium of communication between Great Britian and the Continent, the Principle of which will be explained and illustrated. *Never before Exhibited.*

THE FLORASCOPE,

Which produces the MOST BRILLIANT EFFECTS. Also the Optical Instrument, called the

CHROMATROPE,

Which produces the most beautifully diversified Changes ever witnessed (from the Royal Polytechnic Institution, London).

GRAND COMPOUND MICROSCOPE, with Achromatic Object Glasses (an exquisitely fine instrument). By DOLLOND.

ELEGANT ORRERY,

With Planeterian, Tellurian, and Lunarian Apparatus. By DOLLAND.

PANORAMIC VIEW of EDINBURGH, & Surrounding Scenery,
from the Calton Hill. By TOWNSEND.

COLLOSEUM VIEW OF LONDON.

AUTHORAMA, from Paris, a newly invented Optical Instrument, containing a beautiful and correct PERSPECTIVE VIEW of that City, &c.

CAMERA LUCIDA—Astronomical Demonstrator—Model of THAMES TUNNEL.

Doors Open from 6 Morning till 11 Evening.—Carriages drive up to the Door.
MORNING AND EVENING VISIT—ONE SHILLING.

N.B.—The MOUNTAINS and CAVERNS in the MOON are ONLY SEEN during its INCREASE or DECREASE, the Evening of *Full Moon being the least favourable for Telescopic Observation.*

Figure 2. Handbill from Short's Observatory on Calton Hill, c1835–1850.

close Short's Observatory in 1850, having for years been "worried to death by this woman."[51] They raised Maria's rent, refused her offers to both buy out Kerr and rebuild her wooden building in stone, and then elected to withdraw her lease because by passing out handbills to attract visitors, she had "disobeyed the regulations of the Council."[52] Maria, now Mrs. Henderson (having married in 1843), appealed multiple times and counted both city councillors and citizens among her supporters. Protesting the motion of removal, council member David Ridpath argued for Maria's business as "a source of innocent and instructive amusement, which is also resorted to annually by thousands of strangers...the want which cannot be supplied otherwise, " and a petition with 4000 signatures demanded it be preserved for the "benefit of the public".[53] The subject of removal had councillors refusing to approve of the minutes of several Town Council meetings from June to October 1850, and following the execution of an order made in the absence of some of the Council members, on September 27, 1850, "the Observatory was invaded at an early hour, the Instruments were thrown out upon the hill, and the building demolished."[54] In his "Reasons of Dissent and Protest," councillor Robert Ritchie called the incident "harsh and precipitate," while newspapers reported Ridpath's complaint that it had been an act intended to "destroy science."[55]

Though ignobly ousted from her first site and obliged to rebuild in a location of lesser prominence, Maria Short had already achieved what seems impossible. She appeared out of nowhere, and enduring active opposition from the political and intellectual elite, in practically no time built a business on little more than an old name and a old telescope – neither of which may have been rightfully hers. That she used her alleged family ties to Edinburgh science, turned its instruments into popular spectacles, and polarized City leaders suggests that in her time and place, science had cachet, but its meanings and spaces were more fluid than fixed. The next level of analysis may further account for the unfortunate history of observatory-building in Edinburgh and demonstrate that Maria's mix of nepotism, spectacle, private sponsorship, and popularization capitalized on methods already employed

[51] *The Scotsman,* July 4, 1849; June 12, 1850.
[52] *The Scotsman,* January 23, 1850; June 19, 1850.
[53] ECA "Town Council Minutes." Volume 254, 18 June 1950, p105; 10 July 180, p154.
[54] ECA "Town Council Minutes." Volume 254, 22 October 1850, p443.
[55] *Ibid*.; "Short's Observatory," *The Scotsman* 2 October 1850; "Town Council Proceedings," *The Caledonian Mercury,* 3 October, 1850.

within the local institutional albeit transforming spaces of science before and during her time.

Part II: Local Vistas of Science in the City

The University of Edinburgh

Historian Roy Porter characterizes the eighteenth century as an era of "assimilation [and] consolidation," quoting Margaret Jacob's assertion that it was then that, "scientific knowledge became an integral part of Western culture."[56] In earlier times, the lack of stable places for science obliged practitioners to seek their own cover, finding protection in various religious organizations, courts or schools since universities were meant to train clergy, educate gentlemen and prepare individuals for civil service. However, conditions were changing in the eighteenth century with the increasing establishment of scientific academies and state-funded posts, and the growing presence and authority of science in the public sphere (through societies, lectures, salons, and museums). Yet Porter's assertion that, "Science never presented a united front,"[57] cautions against assumptions that developments were uniform or universal. The development of science spread unevenly throughout both social and geographic spaces, producing gaps that allowed for marginal actors like Maria Short.

In Edinburgh, the structure and operation of its university shaped the local and patriarchal character of science by encouraging certain practices and specializations. The core group of the city's scientific community comprised its university professors – typically native Scots and all men, hired by Town Council, at least middle class, and often related to another member of faculty.[58] Taking medicine, mathematics, astronomy, philosophy and natural sciences into account, the second half of the eighteenth century saw at most forty science chairs at any one time. The annual salaries for these tenured positions ranged from zero for chemistry to £128 for botany, which professors supplemented with income derived directly from class fees or by changing disciplines for more money – in an arrangement that encouraged

[56] Roy PORTER. "Introduction." In: PORTER, R. (ed.), *The Cambridge History of Science: Eighteenth–century Science*. Cambridge: Cambridge University Press 2003, p. 3 (1–19).
[57] *Ibid*., p. 13.
[58] William CLARK, "The Pursuit of Prosopography of Science." In. PORTER, R. (ed.), *The Cambridge History of Science: Eighteenth-century Science*. Cambridge: Cambridge University Press 2003, p. 222 (211–237).

teaching and discouraged specialization. Describing the University of Edinburgh, William Clark writes

> And one of the famous universities of the age amounted to a rather small community, bound by ties of blood not only spilt in faculty meetings. Scottish universities remained complex and inter-related moral communities, not unlike craftguilds. Here as in traditional societies, the private life remained fused with the public or professional life.[59]

Jack Morrell, who has written extensively about the University of Edinburgh, calls its old system "pre-bureaucratic." [60]

The school was controlled by its municipal patrons, through the thirty-three members of Town Council, from its founding in 1583 until Scottish university reforms in 1833. Along with its civic responsibilities, Town Council supervised the maintenance and administration of the university including hiring and paying base salaries to most of the professoriate. While open to negligence, corruption and nepotism, Morell observes that during the eighteenth century, Town Council acquitted itself rather well, transforming the school from a small college of arts and divinity into a university of medicine and science, and increasing enrollment at a time when many British and European schools saw fewer students. It achieved eighteenth-century renewal by remodeling the school after the Universities of Leyden and Utrecht. Replacing the medieval system of regency, which comprised limited teaching terms for recent graduates, it sought talent for tenured chairs responsible for specific subjects and expanded medical teaching by adding faculty positions and introducing clinical instruction, building and renovating local infirmaries. "The financial interests of the city were directly connected with the ability of professors to attract students to its university."[61] This coupled with the relatively small size of its faculty fostered a local discourse of celebrity-scholars and scientific heroes. Maria Short would later draw on this culture to promote her cause to Town Council and prospective supporters by calling herself, "Daughter and Niece of men celebrated for their Genius ..." [62]

[59] *Ibid.,* p. 226.
[60] Jack MORELL, "Science and Scottish University Reform: Edinburgh in 1826." *The British Journal for the History of Science,* vol. 6, 1972, no. 1 (39–56).
[61] *Ibid.,* p. 43.
[62] Maria SHORT, "Letter to Town Council, 22 March 1928." ECA, Bundle 105 D/8.

By claiming blood ties to James Short, Maria also connected herself to one of the university's most significant hires: Colin Maclaurin, the renowned Professor of Mathematics who had been James's mentor and who initiated the first observatory scheme. The other momentous hire was Alexander Monro *primus,* the first of three Alexander Monros that would occupy the chair of anatomy and whose 1720 appointment was championed by his father, John Monro (former Deacon of Surgeons, and *ex officio* Town Council member) at the expense of two existing lecturers. Both Monro and Maclaurin would be crucial to determining the shape of science in Edinburgh. Monro *primus's* ability to attract students from outside the city would facilitate the building of its "famous school of anatomy" and reputation for medicine.[63] Maclaurin, on the other hand, was elected as an outstanding researcher championed by Isaac Newton having become a fellow of the Royal Society in London at the age of 21. Lifetime tenures for Monro, Maclaurin and their colleagues were meant to promote *Lehrfreiheit* (academic freedom), so their reputations as scholars and educators would benefit both the university and the city. Maclaurin, however, had a terrible teaching record: at Aberdeen's Marischal College, he had collected his salary while ignoring school duties because he was too busy tutoring the son of Lord Polwarth, and then he neglected to resign until a year after being hired in Edinburgh.[64] Still, D. J. Bryden reports that Maclaurin attended to his Edinburgh post, attracting about "a hundred pupils every year...[and] enthusiastic for the higher branches of mathematics, teaching a syllabus that also embraced the useful applications of the discipline."[65] Maclaurin's previous record and improved attitude towards university work likely correlated with Town Council's unique payment structure. As an alternative to high fixed salaries such as those enjoyed by faculty at Oxford and Cambridge, Edinburgh's low base salaries supplemented by class fees were meant to promote pedagogy and discourage sinecure.

Along with the reputation of its faculty, Morell cites flexibility and relative openness as being among the attractions held by the University of Edinburgh. Though Sophia Jex-Blake, in petitioning for the right of women to obtain medical degrees from Edinburgh, argued that within its original Charters "no words are used which in any way exclude women," like other

[63] Jack MORELL, *Science, Culture, and Politics in Britain, 1750–1870.* Aldershot – Brookfield: Variorum 1997, p. 6–7.
[64] *Ibid.,* p. 85–86.
[65] BRYDEN, "The Edinburgh Observatory," p. 448.

universities it was effectively closed to women.[66] However, the school was more open than many of its contemporaries – enrollment required no religious affiliations, entrance examinations or prerequisites, and tuition and subsistence costs were relatively low.[67] This benefitted the city by attracting students from elsewhere, while supplying a relatively inexpensive education to its own citizens. Low class fees meant poorer (lower middle class) students could attend school at least part-time, but connecting fees directly to teaching wages motivated professors to seek large class sizes since each student would represent a relatively small income. All students had the option of taking any classes they chose, in any order or in any quantity and professors focused on individual courses rather than complete programs of study, making graduation a low priority.[68] University teaching in Edinburgh consisted primarily of lecture courses and demonstrations of experiments, specimens and scientific apparatuses when appropriate. Practical work outside of lecture halls may have included field trips and excursions to the Natural History Museum or the Botanic Gardens, but laboratory teaching was practically nil before 1840, possibly because it could not accommodate large numbers. More ambitious students took local private classes (which could admit women) or continued their studies elsewhere, while others might become part of a larger local audience for science initiated by a professoriate eager for their fees.

Adopting diverse entrepreneurial approaches to student recruitment, three Edinburgh professors – Robert Jameson, John Leslie and Thomas Charles Hope – blurred showmanship with scientific pedagogy.[69] All active during the 1820s (around the time when Maria Short arrived in Edinburgh), each significantly augmented their incomes by finding ways to attract large

[66] Sophia JEX-BLAKE, "Appendix: A Brief Summary of the Action of Declarator brought by Ten Matriculated Lady Students against the Senatus of Edinburgh University 1872–1873." In: *Medical Women: A Thesis and A History*. New York: Source Book Press 1970, p. 10. On women and medical training in 19th century Britain, see Véronique MOLINARI, "'Schools of their Own': The Ladies Medical College and the London School of Medicine for Women." In: D. ANDREOLLE – V. MOLINARI (eds.), *Women and Science, 17th Century to Present*. Newcastle upon Tyne: Cambridge Scholars 2011, pp. 99–124. On midwifery training at Scottish Universities before 1830, see Eileen Janes YEO, "Medicine, Science and the Body." In: L. ABRAMS – E. J. YEO (eds.), *Gender in Scottish History Since 1700*. Edinburgh: Edinburgh University Press 2006, pp. 141–142 (140–169). On the general exclusion of women from institutions, see SCHIEBINGER, *The Mind has No Sex*, p. 10–36.

[67] On the openness of the University of Edinburgh, see MORELL, "Science in Manchester."

[68] MORELL, "Science in Manchester," p. 45.

[69] MORELL, "Science and Scottish University Reform," p. 48–55.

numbers to their classrooms, thereby building a local audience for popular science by associating science with spectacle. Regius Professor of Natural History Jameson, "a feeble lecturer who lacked charisma," increased his class from 50 to 200 by 1826 by attracting students and numerous townspeople through offering a comprehensive list of lecture topics for the already popular subject, showing numerous specimens, hosting field trips, making himself available outside class hours, and as Regius Keeper of the Natural History Museum, offering free admission to all of his students. [70] When John Leslie, shifted chairs in 1819 from Mathematics to Natural Philosophy, his base salary dropped from £148 to £52 making him more aware than ever of his dependence on student fees. When visiting France in 1814, Leslie learned that French savants earned £5000-£6000 per year, and so his request was relatively modest when he suggested to Scottish University Commissioners that annual professorial incomes be increased to £300.[71] Unable to make his subject compulsory for medical students (which would have doubled his enrollment), Leslie's class size remained steady at 150 students from 1819 to 1826, although he offered a broad range of topics, with about 1000 lecture-experiments. Still the lack of prerequisites and the consequently low mathematics ability of many students frustrated Leslie, obliging him to adapt his pedagogical approach. Leslie attempted to fix the challenges inherent to uneven aptitudes and expectations, by proposing two classes: "the specialized and mathematical; and the elementary, qualitative and popular."[72] Though his bid to offer an advanced class ultimately failed, his elementary class begun in the 1826-1827 academic year was exceedingly popular. Still Leslie never achieved class sizes like those of chemistry professor Thomas Charles Hope. Though he was given no base salary, Hope taught a popular, practical and compulsory subject and built on those advantages by eschewing research altogether. Regularly lecturing to over 500 students at once with large, custom-built demonstration apparatuses, Morell claims, "One person in 300 in Edinburgh attended his lectures." [73] In 1826, when Hope admitted women to his class, Henry Cockburn (who would later try to stop the establishment of Short's Observatory on Calton Hill) snidely reported that some students even brought dates.[74] Four years later, David Brewster (who had deplored the equipment of the Royal Observatory) criticized the state

[70] *Ibid.*, p. 49.
[71] *Ibid.*, p. 51.
[72] *Ibid.*, p. 52.
[73] *Ibid.*, p. 54.
[74] *Ibid.*, p. 55.

of Scottish science by parodying the mercenary showmanship of university classes:

> No sooner is a professor installed behind the counter of his lecture-room than it becomes his single object to enrich himself with the fees of his ready-money customers. His handbills announce the quality of his wares; – the cups and balls and the fire-works of science are summoned into requisition, and by the legerdemain and alchemy of his art he transmutes his baser metals into gold.[75]

With income and class expenses mostly dependent on class fees, the faculty were essentially "freelance independent teachers" in a system that rewarded class size over student excellence, where "every *man* and his fee were welcome."[76] While low salaries prompted instructors to earn extra money through private instruction (which would have been available in some instances to women), the focus on class size could provide additional educational opportunities (as in the case of Hope) making the Scottish university system more open than after its 1833 reform.[77] Although there is no evidence of Maria Short having any scientific instruction, the structure of the University of Edinburgh affected her and her observatory-building predecessors in at least three ways. First, the low base salary and competition for students may have prompted Maclaurin's successor Matthew Stewart to deplete the observatory fund that might have paid for the completion and equipping of Thomas's observatory, which would have considerably changed Maria's circumstances. Second, reliant on class enrolment and patrons for income and research funds, university professors themselves articulated science with popularity. Instead of embezzlement, most professors wanting to improve their finances would apply tactics such as chair-hopping for better base pay or more popular subjects, and sought alternative means of support such as private tutoring, public lecturing or elite patronage – all activities that depended on gaining favour outside the exclusive and masculine domain of academia. University policy therefore multiplied the sites of science across the city and opened them to the participation of women and other amateurs through the extracurricular activities of its faculty, while inside some classrooms it took spectacular effect. Third, lack of funding for

[75] David BREWSTER, "[Review of] Reflexions on the Decline of Science in England and on Some of its Causes by Charles Babbage (Reprinted from *The Quartery Review*, Volume.43). London, 1830." In: *Debates on the Decline of Science*. New York: Arno Press 1975, p. 326 (305–342).
[76] MORELL, "Science and Scottish University Reform," p. 46.
[77] YEO, "Medicine, Science and the Body," p. 157.

equipment and facilities encouraged affiliations between researchers and private individuals and institutions, and that fostered University and Town Council involvement and interference with the projects of Maria Short and her predecessors.

Societies and Patrons

Steven Shapin argues that audiences were essential to the support of non-medical sciences in the eighteenth and early nineteenth centuries. Whereas medicine had achieved the critical mass to form a professional community by the 1730s, other sciences lacked substantial numbers of experts to constitute a professional peer group.[78] This was largely due to Town Council's focus on medical studies as a strategy to enhance university enrolment and bring student money to the city, and its policies of hiring only one professor per scientific topic and paying little for research and equipment. Thus when Alexander Monro *primus* became ill in 1737 and could no longer lead the likewise ailing Medical Society, Colin Maclaurin transformed it from a society of medical specialists into the Philosophical Society of Edinburgh (or the Society for Improving Arts and Sciences and particularly Natural Knowledge), including in its forty-five person membership, fifteen "Gentlemen who do not make Philosophy or Physick their particular Profession."[79] Maclaurin and his colleagues well understood the advantages of elite patronage; societies could create reciprocal relationships by giving nonscientific but moneyed members status-enhancing cultural capital through association. For these relationships to succeed, scientists needed to adopt the following strategies: 1) appeal to the interests of the most powerful members of their audience; 2) turn science into a pleasurable social activity; 3) draw connections between science and general culture; and 4) communicate information using familiar pedagogical styles, namely humanistic and philosophical discourse.[80]

While numerous scientific societies developed in different places across Britain, each had audiences with uniquely local characters. For example, from 1799 to 1803 the Manchester Literary and Philosophical Society (founded in 1781) had twenty-six members with half being merchants and manufacturers, and only one listed as a gentleman.[81] The Manchester elite preferred experi-

[78] Steven SHAPIN, "The Audience for Science in Eighteenth-Century Edinburgh." *History of Science,* vol. 12, 1974, p. 98 (95–121).
[79] *Ibid.,* p.99.
[80] *Ibid.,* p.166.
[81] CLARK, "The Pursuit of Prosopography of Science," p. 227.

mental chemistry and physics to botany or natural history, since the former were more relevant to local industry.[82] However, Shapin explains:

> The Edinburgh commercial classes were as yet insignificant and politically impotent; local medical men were numerous, but relatively poor. There was no real alternative to seeking cultural patronage and approval among the gentry and aristocrats.[83]

Landed gentry and their relations, the great lawyers, formed the chief supporters of non-medical science in Edinburgh and their "overarching concern – the 'improvement' of the Scottish nation" was both cultural (to be more like the English aristocracy) and agricultural (since land reform had turned feudal clan chiefs into landowners).[84] Wanting to increase profits from farming and mineral rights, which could also help improve their social standing, Edinburgh elites counted agriculture, horticulture, geology and meteorology among their primary scientific interests. Other sciences would have needed to justify their local utility to obtain substantial patronage. In a 1741 bid to raise funds for an observatory, Colin Maclaurin explained that astronomy could help navigation and trade, and be useful for "ascertaining the geography of this Country even of the distant parts," while seventy years later Sir George Mackenzie attempting the same, called astronomy "the most noble, as well as the most useful of the sciences."[85] Shapin notes the "desperate time" experienced by Mackenzie's Astronomical Institution to finance the city observatory in 1818.[86] Except for the Earl of Morton (who initiated contributions to Maclaurin's observatory fund and championed James Short), it seems that few among the Edinburgh elite cared much for planets, moons and stars. Yet in their efforts to raise funds for an astronomical observatory, professors and enthusiasts promoted astronomy to the nonscientific, and introduced the notion of a popular observatory, perhaps inadvertently preparing ground for Maria Short.

Professionalization and Reform

Although the Royal Observatory had its own camera obscura and popular observatory, its relationship to Short's Observatory was not simply one of

[82] SHAPIN, "The Audience for Science," p. 109.
[83] *Ibid.,* p. 110.
[84] *Ibid.,* p. 101.
[85] BRYDEN, "The Edinburgh Observatory," p. 451, 445.
[86] SHAPIN, "The Audience for Science," p. 113.

competition. Considering Maria's project an affront, the Astronomical Institution worried that its proximity might compromise their elite status and prestigious location on Calton Hill – the "Acropolis" to the "modern Athens" that was nineteenth-century Edinburgh.[87] Those wanting to elevate science might deplore any reminder of the classroom showmanship and patronage, they sought to suppress. In Maria Short's time, science was changing. Its spectacular and popular nature emerged from the salary structure of the university, but contemporary movements towards professionalization would see that shift, along with its traditional reliance on patronage. Yet the movement was not only based on the desire for stable funding. By the early decades of the nineteenth century, problems wrought by the entanglement of the scientific with the aristocratic emerged amidst other disruptions within science and politics. The Royal Society of Edinburgh (founded in 1783) had evolved out of Maclaurin's Philosophical Society and from its dubious beginnings, the RSE was entangled and indebted to Tory politics to the dismay of young middle class Whigs, who resented its "illiberal exclusiveness."[88] Henry Brougham, a member of the influential "*Edinburgh Review* circle" lamented,

> The *Royal Societies* are sunk in a sort of inertia, or at least are so much ruled by *party*, and what is more by political party, and still worse by *aristocratical* politics, – that their labours are useless to science.[89]

In London, a large and wealthy population with diverse interests had led to multiple specialized scientific societies that threatened its Royal Society, which had been increasingly denigrated by some of its scientific members for admitting too many amateurs distinguished only by title and affluence. Dissatisfaction with the RS climaxed with Cambridge mathematics professor Charles Babbage's 1830 *Reflections on the Decline of Science in England and Some of its Causes*. Babbage criticized dilettantism while recommending state encouragement and the professionalization of science, which he argued was already in place in Prussia and France.[90] In England, Babbage wrote, "It

[87] John BRITTON, *Modern Athens, Displayed in a Series of Views; or, Edinburgh in the Nineteenth Century*. Bronx: B. Blom, 1969 [1831].
[88] Steven SHAPIN, "Property, Patronage, and the Politics of Science: The Founding of the Royal Society of Edinburgh." *The British Journal for the History of Science,* vol. 7, 1974, no. 1, p. 38 (1–41).
[89] *Ibid.,* p. 39 (1–41).
[90] Charles BABBAGE, *Reflections on the Decline of Science in England*. Farnborough: Gregg 1969, p. 31–32.

appears that scarcely any man can be expected to pursue abstract science unless he possess a private fortune, and unless he can give up all intention of improving it." Babbage's call to arms was swiftly adopted by Edinburgh physicist and editor David Brewster, who was struggling financially and unhappy with the Royal Society of Edinburgh where he worked as its Secretary for several years.[91] Responding to Babbage's polemic, Brewster lamented the lack of financial support for Scottish scientific societies or its members, and argued that Edinburgh professors required better salaries to pursue research and thus advance themselves, the university and the country.[92] Along with William Vernon Harcourt, Babbage, and numerous other sympathizers, Brewster founded the British Association for the Advancement of Science (BAAS) in 1831. Brewster's original hope for the organization was that it would agitate for the state sponsorship of science, whereas the BAAS by 1834 was "relatively indifferent to the question of direct national support for men of science."[93] Instead the BAAS concerned itself with the promotion of science through public engagement and traveling events.

There were other movements afoot in Edinburgh's spaces of science in the early decades of the nineteenth century with both school and social reform. In July 1826, Home Secretary Robert Peel established the Scottish Universities Commission to investigate the five universities. At the time, revitalized and new institutions such as the medical schools of Glasgow, Cambridge, Dublin and London University offered serious competition to the University of Edinburgh for students and new faculty, while Town Council battled with the University Senate for control of school administration. Town Council remained in charge of two-thirds of the chairs and each new appointment was scrutinized for evidence of partisan corruption, nepotism and ignorance.[94] At the same time, the Edinburgh Whigs founded alternative institutions including the School of Arts in 1821 by Leonard Horner, which became the model for Henry Brougham's Mechanics Institutes. In 1832, the Edinburgh Philosophical Association extended scientific instruction from the elite and artisanal to the petty bourgeoisie, offering inexpensive lectures after business hours to clerks and shopkeepers by capitalizing on the local surplus of expertise. Shapin writes that this new mercantile participation in science was beyond the control of Tories, Whigs, or the phrenologists who tried to

[91] MORELL, *Science, Culture, and Politics in Britain*, p. 1–10.
[92] BREWSTER, "[Review of] Reflexions on the Decline," p. 325–326.
[93] MORELL, *Science, Culture, and Politics in Britain*, p. 10.
[94] MORELL, "Science and Scottish University Reform," p. 39–45.

use the EPA to further their own interests in the diffusion of science.[95] While the intellectual elites of this period envisioned science as a career, others used science to legitimate or undermine existing orders. However, the incommensurability of national goals and local needs halted alliances between scientifically minded reformers and the lower classes.

Short's Observatory emerged in this period, amidst the promotion of science to broader audiences and its exploitation by various factions with competing aims. The responses to Maria Short and her project reveals the shifting and uncertain character of local science. The Short name evoked the academic heroes of the previous century, while her spectacles could draw on the prestige of science and tempt those wanting better views of the stars. University payment structures had long made popularization integral to scientific life in Edinburgh, while astronomy had failed to attract sufficient local financial support to properly equip an observatory. Moreover, the promotion of science by those who would see it professionalized and those who would see it reformed, had helped extend the audience for science beyond institutional walls. While Short's Observatory may have benefitted from these local practices of science, it hardly means that a woman like Maria Short could expect an easy time.

Part III: The Broad Point of View

Had Maria Short been her father's son, she might have received an inheritance without question, she might have attended university, she might have become a professor, and she might have joined a scientific society. However, all these routes were closed because she was a woman, and because she was a woman in nineteenth-century Britain, she would find participating in public and therefore scientific life an increasingly disparaged task. Two related and parallel trends emerged in Maria's time: 1) a discourse of separate spheres that would gender space into public (male) and private (female); and 2) the professionalization of science that would elevate its status by moving its practices away from the domestic spaces where women's contributions could more easily take place. It is possible that the 1850 eviction of Short's Observatory from Calton Hill after fifteen years of operation signifies that, by the mid-nineteenth century, these ideologies had taken full hold. Recall

[95] Steven SHAPIN, "'Nibbling at the teats of science': Edinburgh and the Diffusion of Science in the 1830s." In: INKSTER, I – MORRELL, J. (eds.), *Metropolis and Province: Science in British Culture 1780–1850*. London: Hutchinson Education 1983, pp. 151–178.

that it was the distribution of handbills (publicity) that proved to be Maria's final, unforgivable offense.

Understanding the role that gender played in the separation of spaces around Short's Observatory requires considerably more research. Much of the history of science in Edinburgh dates back to the 1970s and before the 1990s, both historians of science and feminist scholars tended to ignore the histories of women and science.[96] Thus historiographical, as well as historical, marginalization of women makes the study of their experiences challenging albeit essential and it requires the untangling of discourse (such as the absence and domesticity of women) from lived experience. The example of Maria Short suggests that the separation of women from scientific and public space was more prescriptive than descriptive, and the involvement of numerous women in the promotion of science as writers, audience members and social facilitators problematize divisions between public and private.[97] Are society, entertainment, and informal education – activities pursued and directed by both women and men – private, domestic, or amateur?

Scientific research and production by women was not uncommon before ideologies of separate space and professionalism. Without the necessity of university education or other credentials required to work in public domains, women could practice science at home, though later as increasingly "invisible assistants" to male relatives.[98] Noblewomen could gain limited access to scientific knowledge by offering public recognition and patronage in exchange for private instruction by scientific men of lesser rank, channelling knowledge into writing or using their connections to run salons and act as social go-betweens. Following craft traditions, which valued practical skill including calculation, illustration and observation over "book learning," women of humbler birth participated in household workshops as "daughters and apprentices, wives assisting their husbands, independent artisans, or widows who inherited the family business."[99]

[96] Marina BENJAMIN, "Introduction." In: BENJAMIN, M (eds.), *Science and Sensibility: Gender and Scientific Enquiry, 1780–1945*. Oxford–Cambridge: B. Blackwell 1991, p. 4 (1–23).
[97] On women and science writing, see Barbara T. GATES – Ann B. SHTEIR (eds.), *Natural Eloquence: Women Reinscribe Science*. Madison: University of Wisconsin Press 1997, pp. 3–24. On women in science societies, see Rebekah HIGGIT – Charles W. J. WITHERS, "Science and Sociability: Women as Audience at the British Association for the Advancement of Science, 1831–1901." *Isis,* vol. 99, 2008, no. 1, pp. 1–27.
[98] SCHIEBINGER, *The Mind Has No Sex*, p. 245.
[99] *Ibid.,* p. 67.

Two home-based fields that saw the participation of women well into the nineteenth century relate directly to observatory use. First, a number of women were active in astronomy, which (like entomology) followed "craft traditions" since its practitioners lived in or near their spaces of study. Between 1650 and 1710, 14% of German astronomers were women, while outside Germany, Margaret Flamsteed (1670–1739) and Elizabeth Helvius (1643–1697), worked alongside their spouses and managed their posthumous publications.[100] British astronomy also saw women actively doing research in Maria Short's time. Comet-finder Caroline Herschel (1750–1848), who had been groomed by her brother Astronomer Royal William Herschel first as an opera singer and then as an assistant-astronomer, became the first woman to publish in the Royal Society's *Philosophical Transactions* (although she could not be a society member).[101] Fellow honorary (but not official) member of the Royal Astronomical Society, Scottish writer Mary Somerville (1780–1872), the "Queen of Science" took advantage of early widowhood and a supportive second spouse to pursue mathematics and astronomy.[102] While perhaps not as submissive or self-effacing as Herschel, Somerville took care to publicly conform to feminine ideals "so as not to appear transgressive."[103] As a socialite in Edinburgh, her charm and talent drew the attention and encouragement of its local intellectuals including future mathematics professor William Wallace.[104] The reputation of Maria Short, however was much less genteel. Upon making the decision to remove Short's Observatory from Calton Hill, the Lord Provost of Edinburgh complained that, "he had had more annoyance with this woman, during the past eighteen months, than with all other business of the Council."[105]

The scientific instrument trade was the other craft tradition connected to Short's work. Alison Morrison-Low researched the participation of women from the late eighteenth to nineteenth centuries by studying street directories and census occupation listings – uncovering numerous

[100] Women in astronomy in Germany, as elsewhere, worked beside male relatives and not in official positions. For example, when Maria Winkelmann applied to replace her husband as assistant astronomer in 1710 at the Academy of Berlin, her petition was denied despite having partnered in his research. See SCHIEBINGER, *The Mind Has No Sex,* p. 79–98. See also BRÜCK, *Stars and Satellites*, p. 1–7.
[101] SCHIEBINGER, *The Mind Has No Sex,* p. 262–263; BRÜCK, *Stars and Satellites*, p. 25–44.
[102] BRÜCK, *Stars and Satellites*, p. 67–79.
[103] YEO, "Medicine, Science and the Body," p. 158.
[104] MADDRELL, *Complex Locations,* p. 40.
[105] "Town Council Proceedings," *The Scotsman,* June 19, 1850, p. 3.

British women instrument-makers including opticians and telescope-makers in London and Edinburgh. Morrison-Low estimates that the numerically small and geographically limited instrument trade had a workforce of thousands with female participants numbering in the hundreds.[106] Many identified by her research were likely widows although the nature of their work (as business managers or artisans) cannot be determined, nor the duration of their ownership (some may have been in the process of closing or preparing to transfer the business to male heirs). Also absent from her study were women employed by shops run by men. Still her study indicates a trade characterized by small family businesses that would have included widows, wives and daughters. Maria Short was not even the first woman to operate a camera obscura on Calton Hill. The Astronomical Institution paid Agnes MacArthur from June 1816 onwards as "Keeper of the Camera," and after their "Keeper of the Observatory" (her father) Peter MacArthur passed away, Agnes herself wrote to the Institution secretary recommending her fiancé.[107]

Since Maria was orphaned by age 8 and little is known of her life before 1827, there is no way of knowing where or whether she learned about astronomy or the instrument trade. A letter attesting to her identity indicate that she and her sister Margaret studied arithmetic and writing, and that Maria spent some time abroad.[108] All else is speculation. As the posthumous daughter of Thomas Short, her mother Jacobina, an older sibling or the family friends that took in the Short sisters may have given her additional instruction. She may have even reunited with the Douglases, Thomas's grandchildren from his first marriage. Otherwise, Maria could have educated herself with popular astronomical books and charts, and if lacking experience, hired knowledgeable employees to operate her instruments.[109] The appearance of competency likely outweighed her need for actual technical ability.

[106] A.D. MORRISON-LOW, "Women in the Nineteenth-Century Scientific Instrument Trade." In: BENJAMIN, M (eds.), *Science and Sensibility: Gender and Scientific Enquiry, 1780–1945*. Oxford–Cambridge: B. Blackwell 1991, pp. 89–117.

[107] On Agnes MacArthur's wages, see Astronomical Institution, "Treasurer's Account Book, 1812–1834," p. 19. Regarding her letter to James Nairn (the Institution secretary), see "Minute Book." Volume 1 (1811–1831), 26 April 1830, p. 285–286. On the removal of the Institution's camera obscura, see "Minute Book." Volume 2 (1831–1847), 11 November 1839, p. 150. Copies of all three books are stored on microfilm at the National Archives of Scotland, NAS RH4/153.

[108] Chris CAMPBELL, "Letter of Attestation," May 23, 1828. Edinburgh City Archives, Bundle 105 D/8; Thomas FLEMING, "Subscription letter."

[109] WALLACE, "Maria Obscura," p. 105.

Given that women had worked to promote science (as popular writers and social directors), astronomers, observatory keepers and instrument-makers, the operation of a popular observatory by an optician's daughter and niece of a renowned telescope-maker was perhaps not all that absurd to many of her compatriots.

Conclusion

The Edinburgh of Maria Short and her popular observatories witnessed political, social, and economic upheaval. In the period roughly between 1790 and 1830, Britain experienced "widespread economic change" in its industrial regions resulting in a "social revolution" and the emergence of "significant social groups and institutions." [110] Amidst the turbulence, it seems plausible that the savvy could find space for remarkable action. When Maria Short arrived in Edinburgh in the late 1820s, the city was still without a working observatory, due as much to local indifference as to misfortune. The traditional and entangled arbiters of science in Edinburgh – men of the university, Town Council and the Royal Society – were besieged by internal conflicts and reformist tendencies, while others sought to diffuse science towards new non-elite networks. Audiences for science had been primed in multiple quarters (sometimes for decades), with showmanship practiced by university professors seeking greater class enrolment for greater renumeration, researchers courting society patrons, would-be professionals seeking public support, and reformers reaching out to lower classes. As science writers and social mavens, women had already been engaged in the popularization of science, and Short emerged out of craft-oriented, home-based fields with traditions of female participation – astronomy and instrument-making. Yet it is remarkable that an unknown woman built two popular observatories beginning with little more than an aging instrument and the name of a long dead uncle. Better educated, more prominent and wealthier men had failed for years to adequately equip just one site to explore the stars above Edinburgh. While city fathers, elite amateurs and men of science wrangled over questions of status and accessibility, Maria Short exhibited technologies that revealed the movements of celestial, urban and miniature bodies to an avid

[110] Ian INKSTER. "Introduction: Aspects of the History of Science and Science Culture in Britain, 1780–1850 and Beyond." In: INKSTER, I – MORRELL, J. (eds.), *Metropolis and Province: Science in British Culture 1780–1850*. London: Hutchinson Education 1983, p. 40 (11–54).

public. Mapping the historic and social background of her activities with an analogous set of magnifications suggests that her unexpected establishment of the sensational Short Observatories is a significant and rather spectacular case of instrumentalizing the right space at the right time.