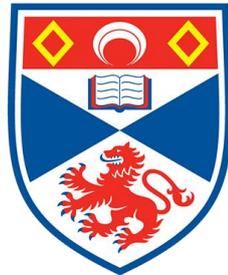


Public botanic gardens and the early institutionalisation
of science – Edinburgh, Florence, and Pisa in the
second half of the eighteenth century.

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University of
St Andrews

This thesis is submitted in partial fulfilment for the degree of

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**Public botanic gardens and the early
institutionalisation of science**

Edinburgh, Florence, and Pisa in the second half of
the eighteenth century

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¹ I wish I had also had the opportunity to thank the lovely museum guard who started a conversation with me, a random visitor, and gave me Dr Barbagli's name, recommending that I contact him. I never knew her name, but her kindness was and is to this day very appreciated.

² As well as Angelo, who was not in the archives but always made me feel right at home.

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ABSTRACT

This thesis is a comparative study of four botanic gardens in Scotland and Tuscany in the second half of the eighteenth century. Taking an approach based on case studies, it argues that botanic gardens were early examples of specialisation, professionalisation, and institutionalisation of science. The existing historiography on the topic has tended to focus on large and famous institutions which enjoyed excellent social and economic resources. By examining gardens at the margins of the largest Enlightenment science centres, the thesis shows that there were European trends in the evolution of botanical and scientific institutions at the time. Despite many differences in their political, economic, and climatic situations, the comparison of the botanic gardens of Edinburgh, Florence, and Pisa reveals striking similarities in their development as institutions in the second half of the century. The thesis explores three main themes: the management of space, the status of staff, and the place of the gardens in a wider public infrastructure. It shows that, though their responses to each theme sometimes differed, the gardens grappled with the same questions and followed similar trends. The space of the gardens was fashioned by and dedicated to scientific activities in a way that gave an increasingly precise definition to the concept of science, one that included research and excluded other forms of knowledge practices. The status of the people in charge of the gardens came to be more clearly defined and made them rare figures of professionals of science in the eighteenth century. Finally, an increase in funding and control by public authorities gave the gardens a mission to serve the public good through the practice of science. By examining these trends in all three cities, the thesis shows how specialisation, professionalisation and institutionalisation of science developed in botanic gardens of the eighteenth century.

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ABBREVIATIONS

ADG – Accademia dei Georgofili

ASP – Archivio di Stato di Pisa

BCNF – Biblioteca Centrale Nazionale di Firenze

BUB – Biblioteca Universitaria di Botanica, Università degli Studi di Firenze

MG – Museo Galileo

NLS – National Library of Scotland

NRS – National Records of Scotland

RBGE – Royal Botanic Garden of Edinburgh

INTRODUCTION

In 1822, Augustin Pyramus de Candolles wrote in the article “Jardins botaniques” of the *Dictionnaire des sciences naturelles* that “no botanist can see [the botanic garden of Pisa] without feeling this sort of respect inspired by places where man started to elevate himself towards ideas of public utility”.³ In de Candolles’ vision, the contribution to “public utility” was part of what differentiated a botanic garden from a regular leisure garden. His article very clearly defended this point of view by focusing on what he thought were the best ways for botanic gardens to prove useful. This notion of “public utility” and its association with botanic gardens was never questioned or defined by de Candolles in his article. He also stressed that it developed mostly in “public botanic gardens”, a category that he only defined by stating that its opposite were “private” gardens, owned by specific people.

This thesis explores the eighteenth-century developments that made it possible for de Candolles to consider these categories and the mission of public utility so self-explanatory in 1822. In fact, botanic gardens did not spring fully armed with public status and functions out of the heads of rulers and botanists when they first appeared in Pisa, Padua, and Florence between 1544 and 1545.⁴ The second half of the eighteenth century saw an important step in their development that led to their conceptualisation as a defined type of public institutions. This evolution had many implications, which this thesis explores through a comparative study of the botanic gardens of Edinburgh, Florence, and Pisa from the 1760s to the end of the century.

Definition of botanic gardens

Botanic gardens were enclosed spaces housing living collections of plants to be used to teach students about them. Originally, the collections were focused almost exclusively on medicinal plants and the teaching emphasized their use in pharmacy. Richard Drayton and John Prest have both shown that botanic gardens’ collections became more varied throughout the sixteenth and

³ Frédéric Cuvier, *Dictionnaire Des Sciences Naturelles, Dans Lequel on Traite Méthodiquement Des Différens Êtres de La Nature, Considérés Soit En Eux-Mêmes, d’après l’état Actuel de Nos Connoissances, Soit Relativement à l’utilité Qu’en Peuvent Retirer La Médecine, l’agriculture, Le Commerce et Les Arts*, vol. 24 (Strasbourg ; Paris: F. G. Levrault; Le Normant, 1822), 167. Throughout this thesis, all translations from French and Italian are my own. See appendices for original text.

⁴ Yves-Marie Allain, *Une histoire des jardins botaniques: entre science et art paysager* (Versailles: Quae, 2012).

seventeenth centuries.⁵ The diversification of collections reinforced the growing interest in the study of plants beyond their pharmaceutical use and contributed to the emergence of botany, the study of plants for themselves, as a specialised and separated interest. This thesis will therefore define a botanic garden as a space housing a collection of plants primarily meant to facilitate the study and transmission of plant knowledge.

But a botanic garden was more than just a space and a collection, it was also the people tending to that space, maintaining and developing that collection and working there every day.⁶ These people were dedicated to the same objectives of transmission and creation of plant knowledge. Including the people in the definition of the botanic means considering it not only as a collection, but as an institution. Some of these institutions were private, created and administered under the authority of an individual or a family, on their own resources and terrain, and for their own benefit. Others were public establishments that were funded and controlled by public authorities such as monarchs or local councils.

When botanic gardens appeared, they represented some of the earliest institutions dedicated to natural knowledge in Europe. They accompanied the first wave of institutionalisation of science, which saw the creation of many associations of people meeting to discuss natural knowledge such as learned societies and academies. Examples of the societies included the *Accademia Secretorum Naturae* in Naples in 1560, the *Accademia dei Lincei* in Rome in 1603, the *Accademia del Cimento* in Florence in 1657, the Royal Society in 1660, and many others across Europe. What made de Candolle's botanic gardens different from these early scientific institutions? Though botanic gardens were often created by a team of people coming together, and therefore constituted institutions from the very start, they went through a process of reinforced institutionalisation throughout the early modern period. In looking at this evolution, this thesis will also ask what an institution of science is and what institutionalisation consists of.

In this thesis, I argue that the second half of the eighteenth century represented an important step in this long institutionalisation process because the gardens did not only become more clearly organized and defined, they were also established as official and public institutions. This process made them into more structured organisations established to be permanent and fixed

⁵ Richard Harry Drayton, *Nature's government: science, imperial Britain, and the 'improvement' of the World* (New Haven: Yale University Press, 2000); John Prest, *The Garden of Eden : The Botanic Garden and the Re-Creation of Paradise* (New Haven London: Yale University Press, 1981).

⁶ A perspective adopted, explicitly or tacitly in most work on botanic gardens, but perhaps most famously in Emma C. Spary, *Le jardin d'utopie: l'histoire naturelle en France de l'Ancien Régime à la Révolution*, trans. Claude Dabbak (Paris: Publications scientifiques du Muséum national d'Histoire naturelle, 2005).

in space. They were not only defined by the activities happening within their physical space, but also through the ways that they were perceived by other actors such as the state or society at large. This thesis will explore the evolution of those public institutions in the second half of the eighteenth century. It seeks to understand what role the people and spaces of institutions such as botanic gardens were assigned in science and society. The changes in organization and the definition of structures and objectives show a will from the management and the public authorities supervising the gardens to turn the gardens into permanent and professional establishments, designed to serve specific goals. Though some gardens may have already been organized as institutions before the mid-eighteenth century, an important aspect of the institutionalisation process I uncover in this thesis is that it was not limited to one individual garden, but rather happened to many different ones at the same time and in similar ways. This homogenisation was part of the institutionalisation process, as it standardized the definition of a botanic garden as an institution.

The comparative framework

This thesis examines this process of institutionalisation through the comparative study of five specific publicly funded botanic gardens in Edinburgh, Florence, and Pisa. The five establishments selected represent a variety of botanic gardens: university gardens, museum gardens, learned societies' gardens, some for teaching, some for experiments, some combining all of the above. Though they were reasonably well-known and well-funded, the botanic gardens of Edinburgh, Florence, and Pisa were not the most famous and prestigious of botanic gardens in the eighteenth century. The gardens of Leiden, Paris, Uppsala, or Kew had international fame and became primary centres of plant knowledge in eighteenth-century Europe and as such, have been more present in the historiography.⁷ Compared to them, Edinburgh, Florence, and Pisa were only secondary, by which I mean their budgets and access to resources did not allow them to become leaders in their field. I chose to label them as “secondary”, rather than adopting a “centre-periphery” approach deliberately to try and keep the nomenclature as neutral as possible. Not only was each botanic garden itself at the centre of its own network, the big, famous gardens were not necessarily connected or directly influencing the secondary gardens that I am discussing here, which makes the centre-periphery approach inappropriate for this study. These secondary gardens were more representative of the majority of European botanic gardens than Paris, Leiden, Uppsala,

⁷ Spary; William Thomas Stearn and Cornelis Gijsbert Gerrit Jan van Steenis, *The influence of Leyden on botany in the seventeenth and eighteenth centuries: lecture delivered at Leyden University, November 11th, 1960* (Assen: Van Gorcum, 1961); Ray Desmond, *Kew: the history of the Royal Botanic Gardens* (London: Harvill Press with the Royal Botanic Gardens, Kew, 1995).

or Kew, in terms of resources, audiences, and attractiveness, which is why they deserve a more in-depth study. The group of Tuscan and Scottish gardens studied here represents a more general experience.

Secondary botanic gardens have so far been relatively little studied in the historiography of eighteenth-century botany. They especially have rarely been studied as a group.⁸ In this thesis, I use the comparative framework to explore European trends in the evolution of gardens in the second half of the eighteenth century. The choice of Scotland and Tuscany is reminiscent of John Robertson's work on the Scottish and Neapolitan Enlightenments because of a similar approach in showing a European-wide phenomenon.⁹ Italy and Britain were two very different contexts in the second half of the eighteenth century, though they were both in Western Europe; and their sharing trends was the consequences of those trends happening Europe-wide, rather than of them influencing each other.

Tuscany in the mid-eighteenth century was officially an independent Grand-Duchy. However, the death of Giangastone, the last Medici Grand-Duke in 1737, had resulted in the house of Lorraine taking over and the marriage of Francis of Lorraine with Maria-Theresa of Habsburg meant that the Grand-Duchy had become a satellite State of the Austrian empire. The Lorraine dynasty was therefore in power for the period of the Italian *Illuminismo* (Enlightenment).¹⁰ Francis ruled from Vienna until his death in 1765. His second son, Peter-Leopold, then took over Tuscany and actually set his Court up in Florence and Pisa. Nicknamed the "Great Reformer", Peter-Leopold was a key figure in Tuscan history.¹¹ During his twenty years reign, he reformed the national and local administration, the justice system, education institutions, and implemented many social changes, such as abolishing the remainders of serfdom. The eighteenth century is often considered a period of decline for Tuscany, especially in Anglophone historiography, but the study

⁸ An example that will be mentioned later in this introduction is Nuala Christina Johnson, *Nature Displaced, Nature Displayed: Order and Beauty in Botanical Gardens* (London, New York: I.B. Tauris, 2011); another group study was made by Therese O'Malley, "'Your Garden Must Be a Museum to You': Early American Botanic Gardens", *Huntington Library Quarterly* 59, no. 2/3 (January 1996): 207–31.

⁹ John Robertson, *The Case for the Enlightenment: Scotland and Naples, 1680-1760* (Cambridge: Cambridge University Press, 2005).

¹⁰ Dino Carpanetto, *L'Italia Del Settecento: Illuminismo e Movimento Riformatore*, Documenti Della Storia 29 (Torino: Loescher, 1980); Furio Diaz, Luigi Mascilli Migliorini, and Carlo Mangio, *Il Granducato di Toscana: i Lorena dalla Reggenza agli anni rivoluzionari* (Torino: UTET, 1997).

¹¹ Adam Wandruszka, *Pietro Leopoldo: un grande riformatore* (Firenze: Vallecchi, 1968); Luciana Bellatalla, *Pietro Leopoldo di Toscana granduca-educatore: teoria e pratica di un despota illuminato* (Lucca: Maria Pacini Fazzi, 1984); Valentino Baldacci et al., *Le riforme di Pietro Leopoldo e la nascita della Toscana moderna* (Florence: Mandragora, 2000).

of the Lorraine's reigns challenges this narrative.¹² Peter-Leopold, who is the main figure of Grandduccal authority in this thesis, was a very hands-on monarch and a keen amateur of science who took interest in the development of botanic gardens in his territories. His son Ferdinand took over in 1790 when Peter-Leopold returned to Vienna to succeed to his brother Joseph II on the Austrian and imperial thrones. Ferdinand backtracked on several of his father's more radical policies, but not in matters concerning botanic gardens. The Lorraines' rule was interrupted in 1799 with the invasion of the French army during the revolutionary wars.

During the second half of the eighteenth century, and most importantly during the reign of Peter-Leopold, Tuscany was prosperous, but less prominent on the European scene as it had been in previous centuries.¹³ Its rich history still made the Tuscan cities famous and attractive to foreigners.

Meanwhile, in Britain, George III took over from his grandfather George II in 1760. As Kings of Great Britain, the two Georges ruled over Scotland, which had been merged with England and Wales in the Kingdom of Great Britain with the act of Union of 1707. Edinburgh had lost its status as a capital and Scotland its status as a country, but strong regional particularism and cultural influence remained. Despite a strong English influence, Edinburgh and the Lowlands saw the development of important cultural movements like the Scottish Enlightenment.¹⁴ Though the British Crown reinforced its hold on Scottish institutions throughout the century, local authorities and elites still had a steady influence in Scotland and led many nationally focused initiatives to improve the Highlands.¹⁵ At the same time, Scotland benefitted from the resources and connections that came with being part of Britain such as the access to a colonial empire, strong trade connections, and the resources, monetary and otherwise, that came with these.¹⁶ This also meant that Scotland was affected by international events such as the American War of

¹² This assumption resulted in very scarce historiography on Tuscany in the eighteenth century in English, but this trend has only recently been broken by Corey Tazzara, Paula Findlen, and Jacob Soll, eds., *Florence after the Medici: Tuscan Enlightenment, 1737- 1790* (New York: Routledge, 2020).

¹³ Luigi Dal Pane, *La Finanza Toscana Dagli Inizi Del Secolo XVIII Alla Caduta Del Granducato* (Milan: Banca Commerciale Italiana, 1965).

¹⁴ Alexander Broadie, *The Scottish Enlightenment: the historical age of the historical nation* (Edinburgh, Royaume-Uni: Birlinn, 2001); David Daiches, Peter Jones, and Jean Jones, eds., *A Hotbed of Genius: the Scottish enlightenment, 1730-1790* (Edinburgh: Edinburgh University Press, 1986); for a very general approach see Alexander Broadie, ed., *The Cambridge companion to the Scottish Enlightenment* (Cambridge: Cambridge University Press, 2003).

¹⁵ Brian Dolan, *Exploring European Frontiers: British Travellers in the Age of Enlightenment* (Basingstoke: Macmillan Press; St. Martin's Press, 2000).

¹⁶ John M. MacKenzie and Thomas M. Devine, eds., *Scotland and the British Empire* (Oxford: Oxford University Press, 2011); Lucile H. Brockway, *Science and colonial expansion: the role of the British Royal Botanic Gardens* (New Haven, Conn., Etats-Unis, Royaume-Uni, 2002).

Independence (1775-1783) which led to a decrease in American students in Edinburgh. On a personal level George III was curious about science and especially agriculture, but he did not implement any large-scale policy for scientific institutions.¹⁷

This general summary of the historical context of both countries already shows that, compared to each other, Tuscany and Scotland were in very different positions and hands in the second half of the eighteenth century. They also had few connections to one another. The Lorraine Grand-Duke was not seeking to emulate the British King, nor the opposite, and though the Tuscan elites and scholars were sometimes admiring of or even in touch with their peers in the British Isles, it was rarely with the Scottish ones. The garden of Edinburgh certainly had no contact with its Tuscan equivalents. As a consequence, similarities in their development could not come from one directly influencing the other, instead it had to come from influences they had in common and that were widespread in Western Europe. The gardens selected for this sample were themselves quite different from one another, as the next section will show (see also key points and dates in the timeline in the appendices).

The case studies

Pisa

The botanic garden of Pisa had first been created in 1544 on the impulse of the then Grand Duke, Cosimo I de Medici. The garden was designed by Luca Ghini, a well-known and well-respected naturalist specialised in medicinal plants from the University of Bologna, who Cosimo recruited to teach the study of simples in the University of Pisa.¹⁸ The garden was officially attached to the latter in 1545. From then on, the university oversaw the management of the garden which was used to teach its students. The collection was moved several times and before being permanently set up in its current site, close to the via Santa Maria, in 1591. Over the years, extra facilities were added to the garden, including a *Galleria* with collections of naturalia, which still existed in the late eighteenth century, though it was most often referred to as a museum. The second half of the eighteenth century saw the acquisition of nearby space to expand the garden, which will be discussed in this thesis. Overall, with its status of oldest botanic garden in Europe and its links to the University, Pisa had one of the most traditional botanic gardens of this sample.

¹⁷ About George III's scientific education see Alan Q. Morton and Jane A. Wess, *Public & Private Science : The King George III Collection* (Oxford; New York: Oxford University Press, Science Museum, 1993); Larry Stewart, "'The King George III Collection" at the Science Museum', *Technology and Culture* 35, no. 4 (1994): 857–63.

¹⁸ Franco Aurelio Meschini, 'Ghini, Luca', in *Dizionario Biografico Degli Italiani* (Online: Treccani.it, 2000); Gaetano Savi, *Notizie per servire alla storia del giardino e museo della Imperiale e Reale Università di Pisa* (Pisa: Tipografia Nistri, 1828), 5.

During the eighteenth century, it was administered by the dynasty of Tili men: Michelangelo, Attilio, and Lorenzo, before Giorgio Santi took over on orders from the Grand-Duke in 1782.

Edinburgh

Edinburgh's garden in the second half of the eighteenth century was not so different from Pisa, though its story was more convoluted. The first botanic garden of Edinburgh had been founded in 1670 by Andrew Balfour and Robert Sibbald, both medical doctors.¹⁹ They had initially opened a private garden, then bought a plot near Holyrood with funding from "several of the Physicians in town" who gave a yearly contribution "for the charge of the culture and importation of foreign plants".²⁰ In 1675, the same doctors created the "Physick Garden" next to the Trinity hospital as an extension of the Holyrood one. By then, the Town Council had taken an interest in the project and deemed it useful to the city, so it was decided that the Council would contribute to the salary of the gardener in charge of both locations, James Sutherland.²¹ The king, Charles II at the time, also started to contribute £50 a year to Sutherland's pay in 1693.²² After Sutherland retired, the care of the Trinity garden and the Holyrood garden were given to different people and remained separated for almost forty years. The Trinity garden was controlled by the City Council and attached to the University of Edinburgh which started to use it for its pharmacy classes. Holyrood stayed under the influence of the Crown and was somewhat neglected. The two gardens were reunited under the management of Charles Alston in 1738 but officially remained two separate institutions.²³ Alston's student and successor, John Hope, managed to secure funding from both the Town and Crown to actually merge the two institutions into a bigger one, moving all the collections to the Leith Walk garden on the road of the same name. The work on the Leith Walk garden started in 1763, soon after Hope had been recruited by the University. The botanic garden of Edinburgh stayed in the Leith Walk location until the 1820s. Both John Hope and his successor, Daniel Rutherford, worked in Leith Walk. Hope was the one who put the most work into the creation of the garden and is therefore more often referred to in this thesis, as he was a key figure in shaping the garden as an institution.

The botanic gardens of Pisa and Edinburgh were both linked to their respective universities which makes their status as places of study quite obvious. The botanic gardens of

¹⁹ Harold R. Fletcher and William H. Brown, *The Royal Botanic Garden Edinburgh, 1670-1970* (Edinburgh: Her Majesty's Stationery Office, 1970), 3–10.

²⁰ Robert Sibbald, *The Autobiography of Sir Robert Sibbald* (Edinburgh, 1833).

²¹ RBGE, Collection SUT – Sutherland, James (Regius Keeper – 1699-1714), « Excerpts from Town Council Records anent Mr. James Sutherland, Professor of Botany in Edinburgh College 1676-1706 ».

²² *The Register of the Privy Seal*, V, p.126.

²³ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, 35–45.

Florence were different, because the Tuscan capital did not have a University to speak of in the eighteenth century. However, this did not mean that it did not have collections of plants dedicated to the study of botany. This thesis will examine three such collections: the botanic garden of the *Società Botanica*, the experimental garden of the *Accademia dei Georgofili*, and the garden of the museum of natural history of *la Specola*.

The two Gardens of San Marco in Florence

The original *Giardino dei Semplici* of Florence was created in 1545 as a twin of Pisa's garden.²⁴ Cosimo I had commissioned Luca Ghini again to create a second garden in his capital. This garden was situated in the Northern part of the city, near the church of San Marco – where the botanic garden still stands today. San Marco enjoyed the same sort of status and funding that Pisa did. In the absence of a university and considering that the hospital Santa Maria Nuova had its own private garden for medicinal plants, San Marco's garden was found purposeless quite quickly. By the seventeenth century it was mostly a local supplier of fruits and vegetable for the Grand-Duke's table and a space of entertainment for the Court.²⁵ In 1718, the management of the garden was given to the *Società Botanica Fiorentina* by Cosimo III.²⁶ This learned society had been created by Pier Antonio Micheli in 1716. Its members were interested in the study of plants, particularly Tuscan ones. They tried to give the garden a more scholarly orientation and to study botany independently from medicine by cultivating exotic and non-medicinal plants. Micheli died in 1737, leaving a collection of 2000 species in the garden. The *Società* continued to manage the garden, appointing various people to manage it and to teach botany, but their administration was chaotic and inefficient.

Partly because of this poor management, the *Società's* garden was replaced in 1783 by the experimental garden of the *Accademia dei Georgofili* on the orders of Peter-Leopold.²⁷ The decision of the Grand-Duke to give the garden of San Marco to the *Georgofili* also had to do with the academy's more practical approach to the study of plants. The *Accademia dei Georgofili* had been founded in 1753 by Ubaldo Montelatici. As their name suggested, they were interested in agricultural and economic issues. When they were given the use of the garden of San Marco in

²⁴ Sara Ferri and Francesca Vannozzi, *I Giardini Dei Semplici e Gli Orti Botanici Della Toscana* (Perugia: Quattroemme, 1993), 49–67.

²⁵ Anatole Tchikine, 'Echoes of Empire: Redefining the Botanical Garden in Eighteenth-Century Tuscany', in *The Botany of Empire in the Long Eighteenth Century*, ed. Yota Batsaki, Sarah Burke Cahalan, and Anatole Tchikine (Washington D.C.: Dumbarton Oaks Research Library and Collections, 2016), 93–130.

²⁶ Tchikine.

²⁷ Tchikine; Pietro Luigi Pisani and Paolo Nanni, 'Gli Orti Agrari Di Firenze', *Rivista Di Storia Dell'Agricoltura Semestrale Dell'Accademia Dei Georgofili*, no. 1 (June 1996): 69–107; Ferri and Vannozzi, *Giardini Dei Semplici*.

1783, they transformed it into a collection of useful plants: crops, dyeing plants, plants used to make thread or ropes, plants used to cure cattle, etc... and used the space to experiment on new crops, investigate the productivity of cultivation methods, and teach on those matters. This makes the *Georgofili*'s garden stand out amongst the gardens on which this study is focused. Unlike the others, it was almost never referred to as a “botanic” garden, yet it fits the definition of one. It was an extremely specialised botanic garden. The space it used also reinforced its status as a botanic garden. Because the space in San Marco was limited, the *orto sperimentale* was really only a garden: Unlike other spaces of agricultural experimentation in the eighteenth century, it was not a farm, or an estate.²⁸ The thesis will show that it was organised and functioned in a very similar way to the other case studies, which is why my definition of botanic gardens purposefully includes it in this study.

The museum of la Specola in Florence

The last Florentine garden to be examined in this thesis is the garden of *la Specola*. Peter-Leopold founded the *Imperiale e reale museo di fisica e storia naturale* (Imperial and royal museum of physic and natural history) in 1775.²⁹ This museum showcased specimens and scientific instruments from all the scientific disciplines of the time. It was housed in the palazzo Torrigiani, in the *Oltrarno*, just behind the Grand-Ducal palazzo Pitti and adjacent to the magnificent Boboli gardens. The palazzo Torrigiani was modified to include an observatory as part of the museum, which gave it its nickname of *la Specola*. *La Specola* became one of the first European museums to open to the public. Its primary goal was to allow a large public, including all classes of society, to instruct themselves on the sciences. The part of the museum dedicated to the vegetable kingdom consisted of a herbarium, a collection of wax models, and, of course, a botanic garden. Like the two iterations of the garden of San Marco, the garden of *la Specola* was not attached to a university. It also did not host any classes, but its objective was to serve the transmission of plant knowledge to a wider audience, which means it also fits the definition used to select this sample.

Historiography

National historiographies

The individual study of these gardens borrows and adds to many current strands of historiography concerning Scotland and Tuscany. There has long been an interest in Scottish

²⁸ A fact lamented by Arthur Young, *Travels in France & Italy during the Years 1787, 1788 and 1789* (London: J.M. Dent & sons, 1915), 277.

²⁹ Simone Contardi, *La Casa Di Salomone a Firenze : L'imperiale e Reale Museo Di Fisica e Storia Naturale, 1775-1801* (Florence: L. S. Olschki, 2002).

science in the eighteenth century, often focused on its role in the Scottish Enlightenment.³⁰ In this context, the botanic garden is often cited as an example of local scientific development, but rarely studied in detail. For example, it is often credited for helping the development of the University of Edinburgh, but studies of the University rarely ask what the development of the University did for the garden.³¹ My exploration of the garden's public mission also ties in with studies of domestic economy and the use of science to "improve" Scotland, and in particular the Highlands which follow the same pattern of mentioning the garden.³² This thesis will show how the garden illustrates the improving mentality of the Scottish Enlightenment, but also that Scottish science of the time had strong ties to England, ties that the Royal authorities were keen to reinforce.

The attention put on the Tuscan gardens on the other hand contributes to remedy to the sadly extremely limited Anglophone historiography on eighteenth-century Tuscan history.³³ This topic is obviously more often considered in Italian historiography and this thesis is also a continuation of the work done by Italian historians, in particular on the history of science.³⁴ Renato

³⁰ Roger L. Emerson, 'Science and the Origins and Concerns of the Scottish Enlightenment', *History of Science* 26, no. 4 (1 December 1988): 333–66; Roger L. Emerson, 'Sir Robert Sibbald, Kt, The Royal Society of Scotland and the Origins of the Scottish Enlightenment', *Annals of Science* 45, no. 1 (1988): 41–72; Peter Jones, *Philosophy and Science in the Scottish Enlightenment* (Edinburgh: Donald, 1988); Charles W. J. Withers and Paul B. Wood, eds., *Science and medicine in the Scottish enlightenment* (Glasgow: Tuckwell, 2002); Paul Wood, 'Science in the Scottish Enlightenment', in *The Cambridge Companion to the Scottish Enlightenment*, ed. Alexander Broadie and Craig Smith, Second edition (Cambridge ; New York: Cambridge University Press, 2019), 90–112.

³¹ J. B. Morrell, 'The University of Edinburgh in the Late Eighteenth Century: Its Scientific Eminence and Academic Structure', *Isis* 62, no. 2 (1 July 1971): 158–71; Nicholas Phillipson, 'The Making of an Enlightened University', in *The University of Edinburgh : An Illustrated History*, ed. Robert D. Anderson (Edinburgh: Edinburgh University Press, 2003); Alexander Grant, *The Story of the University of Edinburgh during Its First Three Hundred Years* (Longmans, green, 1884); Robert D. Anderson, *The University of Edinburgh : An Illustrated History* (Edinburgh: Edinburgh University Press, 2003).

³² Fredrik Albritton Jonsson, *Enlightenment's frontier: the Scottish Highlands and the origins of environmentalism* (New Haven: Yale University Press, 2013); Fredrik Albritton Jonsson, 'Scottish Tobacco and Rhubarb: The Natural Order of Civil Cameralism in the Scottish Enlightenment', *Eighteenth-Century Studies* 49, no. 2 (29 January 2016): 129–47.

³³ Until 2020 Eric W. Cochrane, *Tradition and Enlightenment in the Tuscan Academies, 1690-1800* (Rome: Storia, 1961) was still the most recent publication on this topic; this gap was very well identified in the recent Tazzara, Findlen, and Soll, *Florence after the Medici*.

³⁴ Giulio Barsanti, Vieri Becagli, and Renato Pasta, *La Politica Della Scienza : Toscana e Stati Italiani Nel Tardo Settecento, Atti Del Convegno Di Firenze, 27-29 Gennaio 1994* (Firenze: Leo S. Olschki, 1996); Marta Stefani, 'Linneo e Firenze. Saverio Manetti e l'ingresso del linneismo alla Societa Botanica Fiorentina', in *Toscana e Europa, Nuova scienza e filosofia tra '600 e '700*, ed. Ferdinando Abbri and Massimo Bucciantini (Milan: FrancoAngeli, 2006), 273–92; Diana Toccafondi and Carlo Vivoli, 'Cartografia e Istituzioni Nella Toscana Del Seicento: Gli Ingegneri al Servizio Dei Capitani Di Parte e Dello Scrittoio Delle Possessioni', in *Cartografia e Istituzioni in Età Moderna - Atti Del Convegno Genova, Imperia, Albenga, Savona, La Spezia 3-8 Novembre 1986* (Genova, 1987), 168–202; Mariano Bianca, ed., *La Scienza a Firenze, Itinerari scientifici a Firenze e provincia* (Florence: Alinea editrice, 1989); see also works focused more widely on Italy like Vincenzo Ferrone, *Scienza Natura Religione : Mondo Newtoniano e Cultura Italiana Nel Primo Settecento* (Napoli: Jovene Editore, 1982); Marco Beretta, *Storia Materiale Della Scienza : Dal Libro Ai Laboratori* (Milan: B. Mondadori, 2002); Antonio

Pasta in particular has worked admirably on the intersection of science and politics in the reign of Peter-Leopold, a point that is further illustrated by my case studies.³⁵ Despite his and others' efforts, the historiography of Tuscan science is still dominated by seventeenth century and Galilean studies. This thesis is also a contribution in the promotion of eighteenth-century history of Tuscan science, and an effort to convince people that the second floor of the Museo Galileo of Florence (Leopoldian science) might be less ostentatious but is really the more interesting one.³⁶ The thesis addresses not only the gap in the English speaking historiography, but also uses the examples of the botanic gardens to further the reflections of Pasta and others on the scientific politics of Peter-Leopold by showing how botanic gardens fit into it as a group.

Botanic gardens and science

Beyond its contribution to the historiography of individual institutions and countries, the main addition to the field of this thesis is the comparison and group analysis it offers. Former studies of botanic gardens have too often focused only on individual case studies, particularly of some of the most famous gardens of the early modern period.³⁷ As interesting as these studies are, they can rarely make points on the general history of botanic gardens, as they are too focused on one example, and often showcasing the extraordinary figures of scholars working there such as Carl Linnaeus in Lisbet Koerner's work, or André Thouin in Emma Spary's. I take the approach of doing the history of the ordinary and investigating the concept of a botanic garden through the analysis of a group of gardens.

This has been an uncommon approach within the historiography of botanic gardens, though it has very successfully been adopted by Nuala C. Johnson in her work *Nature Displaced, Nature Displayed. Order and Beauty in Botanical Gardens*.³⁸ Johnson's work focuses on the space of the botanic gardens of Cambridge, Dublin, and Belfast in the nineteenth century and showed the complex and intricate mix of factors that influenced the design and arrangement of the gardens. Her analysis has inspired some aspects of this thesis, particularly Part I, but her investigation

Borrelli, 'Scienza e Accademie Negli Stati Italiani Del Settecento', *Studi Storici* 38, no. 2 (1997): 571–77; Paola Govoni, *Un Pubblico per La Scienza : La Divulgazione Scientifica Nell'Italia in Formazione* (Rome: Carocci, 2002).

³⁵ See in particular Renato Pasta, *Scienza, Politica e Rivoluzione : L'opera Di Giovanni Fabbroni (1752-1822), Intellettuale e Funzionario al Servizio Dei Lorena* (Firenze: L.S. Olschki, 1989).

³⁶ Simone Contardi, 'Gli Oggetti Della Scienza Lorenese: Le Collezioni Scientifiche Del Regio Museo Di Fisica e Storia Naturale Di Firenze', *Quaderni Storici* 44, no. 130 (1) (2009): 153–78.

³⁷ Some examples Spary, *Le jardin d'utopie*; Fabio Garbari, Lucia Tongiorgi Tomasi, and Alessandro Tosi, *Giardino Dei Semplici : L'Orto Botanico Di Pisa Dal XVI al XX Secolo* (Ospedaletto: Pacini, 1991); Stearn and Steenis, *The influence of Leyden on botany*; Lisbet Koerner, *Linnaeus: nature and nation* (Cambridge: Harvard University Press, 1999); Fletcher and Brown, *Royal Botanic Garden Edinburgh*; Desmond, *Kew*; Alessandro Minelli, *The Botanical Garden of Padua, 1545-1995* (Venice: Marsilio, 1995).

³⁸ Johnson, *Nature Displaced, Nature Displayed*.

focused more on the spatial than the institutional aspect of the gardens, and in fact her sample was made of gardens with very different institutional status, some private, some public. Though the angle is different, the methodology of comparing the gardens, pointing out their differences but finding that common roots actually mean that variations in solutions still point out towards a similarity in objectives, is much the same as the approach I will be taking.

This study also distinguishes itself from Johnson's work in its focus on institutional matters as well as spatial organization. The history of institutions and institutionalisation of science in the eighteenth century is most often associated and studied through the example of learned societies and royal academies.³⁹ Even a recent chapter like Mikuláš Teich's on the institutionalisation of science in the scientific revolution focuses primarily of the Royal Society and the French *Académie des Sciences*, considered to be the absolute models of science institutions at the time. Amongst these studies, many, like John R. R. Christie or John Gascoigne also offer a prosopographic angle and/or consider these institutions by looking at the people that they hosted and how scientific communities built up. All these studies offer fascinating insights into scientific collaboration and networks, but the extreme focus on societies and individuals has led the historiography to ignore different types of institutions, such as botanic gardens and observatories. Beyond the simple gap, the study of societies and even academies puts a lot of emphasis on amateur culture in the eighteenth century and the important role it played in the history of science at the time because the recruits of these institutions were more often than not amateur scientists. This has contributed to the narrative that the professionalisation of science was a nineteenth-century phenomenon, a narrative that I challenge in Part II of this thesis by reflecting on the status of botanic garden directors.⁴⁰ By looking at the gardens as institutions, I also consider their role in society and

³⁹ Cochrane, *Tradition and Enlightenment*; Simone Testa, *Italian Academies and Their Networks, 1525-1700: From Local to Global* (New York: Palgrave Macmillan, 2015); Matteo Ermini, *La Cultura Toscana Nel Primo Settecento e l'Origine Della Società Colombaria Fiorentina* (Firenze: L. S. Olschki, 2003); John R. R. Christie, "The Origins and Development of the Scottish Scientific Community, 1680-1760," *History of Science; an Annual Review of Literature, Research and Teaching* 12, no. 2 (June 1974): 122–41; John Gascoigne, "The Eighteenth-Century Scientific Community: A Prosopographical Study," *Social Studies of Science* 25, no. 3 (1995): 575–81; Roger Hahn, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666-1803* (Berkeley: University of California Press, 1971); James E. McClellan, *Science Reorganized: Scientific Societies in the Eighteenth Century* (New York: Columbia University Press, 1985); Mikuláš Teich, "Institutionalisation of Science," in *The Scientific Revolution Revisited*, (Open Book Publishers, 2015), 55–74.

⁴⁰ Cyrus C. M. Mody, 'The Professional Scientist', in *A Companion to the History of Science* (Hoboken: Wiley, 2016), 164–77; Steven Shapin, 'The Image of the Man of Science', in *The Cambridge History of Science* (Cambridge: Cambridge University Press, 2003); Steven Shapin, 'The Man of Science', in *The Cambridge History of Science*, ed. Lorraine Daston, Katharine Park, and Steven Shapin, vol. 3: Early modern science (Cambridge; New York: Cambridge University Press, 2006), 179–88; Julien Prud'homme, 'Professionnalisation de La Science', in *Sciences, Technologies et Sociétés de A à Z*, ed. Frédéric Bouchard and Pierre Doray (Montréal: Presses de l'Université de Montréal, 2017), 180–83; Roger Hahn, 'Scientific Careers in Eighteenth-Century France', in *The Emergence of Science in Western Europe* (London: MacMillan, 1975), 127–38.

examine public support for science. As I stated before, these relations have been examined in Tuscan history, but are much rarer in British studies.⁴¹ They have also never been considered in a comparative framework between the two, which brings forward much more similarities than traditional opposition between the continental state support and the British amateur culture model found, for example in Colin Russell's work.⁴² Overall, with this thesis, I aim to nuance traditional narratives on the institutionalisation and professionalisation of science by looking at the precise example of botany.

Sources and methodology

The thesis was based on research carried in the archives of the botanic garden institutions themselves. Some complementary work was done in some other archives (private Targioni-Tozzetti fund, general records of the University of Pisa) but the main part of the work has had to focus on the documents directly produced in the gardens. The unequal conservation of documents from one institution to the next also means that I did not always have access to equivalent sources between gardens and have had to use a very diverse range of types of documents to build this study. For example, the main source of information about the botanic garden of Pisa in the second half of the eighteenth century is the financial records kept by the director, and there is therefore sometimes little to work from. On the end of the spectrum, documents concerning the garden of *la Specola* are integrated into the much wider collections of the museum of natural history and the sheer volume of material made it impossible – or at the very least unrealistic – to track down many specific details. For all the gardens, the information is reconstituted from a mix of different documents, from expenses to plans, correspondence to instructions to the gardeners, official speeches to throwaway notes.

Structure

The thesis has been divided in three main parts exploring the institutionalisation of botanic gardens from different angles: the space, the people working in that space, and the public status of the institution.

⁴¹ Pasta, *Scienza, Politica e Rivoluzione*; Pasta; Lavinia Maddaluno, 'Practices of Science and Political Economy between the State of Milan and the Italian Republic, 1760s-1805.' (Doctoral Thesis, Cambridge, University of Cambridge, 2017); 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* 7, no. 1 (1 March 1974): 1–41; John Gascoigne, 'The Royal Society and the Emergence of Science as an Instrument of State Policy', *The British Journal for the History of Science* 32, no. 2 (1999): 171–84.

⁴² Colin A. Russell, *Science and Social Change: 1700-1900* (London: Macmillan, 1983).

In Part I, the chapters will explore what the function of the space was, starting with examining what the materiality of the gardens can teach us about their use. Chapter 2 focuses on gardens as classrooms and how they were used to transmit knowledge. Chapter 3 puts a new emphasis on the role that gardens played in creating the said knowledge and the research that took place in them. Chapter 4 then asks who had access to those spaces of knowledge and what the restrictions on the audiences meant for the definition of botanic gardens as spaces of science.

Part II is focused on the people working in the gardens, most importantly the directors and managers. Chapter 5 looks at what these jobs entails and how they came to be more clearly defined. Chapter 6 shows that there were increasingly demanding and defined criteria to recruit directors. Finally, chapter 7 examines their pay, status, and careers, to argue that they were early examples of the figure of the ‘professional scientist’.

Part III changes scale to consider the status of botanic gardens and their place in society. Chapter 8 investigates the links between public authorities and the gardens to show that the gardens were in fact State institutions. Chapter 9 concludes the thesis by showing that that State support for gardens gave them a civic mission to serve the “public good”.

Overall, this thesis will show that botanic gardens evolved in the second half of the eighteenth century to become public institutions of science and that the process of standardization they went through meant that this became part of the definition of any public botanic garden. This example, I argue, does not only add to the history of botany specifically, but also challenges our understanding of the institutionalisation of science in general.

PART I – SPACES

Introduction

A garden is a defined section of space with set limits, often materialised by walls or fences. This designated space is then defined as a “garden” by its content: plants, often in an open-air environment. To be a “botanic” garden, this same space must be dedicated to the study of plants in the most general terms: what they are, what they look like, what they do, how they function, how to use them. The materiality of the gardens and the dedication of their space to study makes them prime examples of “lieux de savoir”.¹

In *Qu'est-ce qu'un lieu de savoir?*, the introduction to the great collective work of the volumes that follow it, Christian Jacob explains that his is not a work of epistemology. Instead, by looking at the “lieux” of knowledge, he wants to focus on the practical aspects and the material objects facilitating, hosting, or resulting from knowledge practices and pursuits. His approach is directly linked to the practical and spatial turns that have taken place more widely in the historiography.² By looking at the material things involved in knowledge practices, Jacob, and the many contributors to the – so-far – two volumes of his series, hope to better understand the idea of knowledge, beyond national scales, disciplinary boundaries, and strict periodization.³

Although not as ambitious a project in scale, this first part of the thesis aims to reproduce some of this methodology and apply it to the botanic gardens of Edinburgh, Florence, and Pisa. The gardens will be considered as material spaces to understand what their role was in knowledge practices.

Like Jacob, I do not limit the definition of “space” (or in his case “lieu”) to the notion of an area. Instead, any material object that supports and results from knowledge practices in this area is itself a “space” in which knowledge practices are expressed.⁴ This approach falls within a

¹ This notion, which can be translated as ‘space of knowledge’, was first defined in French in Christian Jacob, *Qu'est-ce qu'un lieu de savoir ?* (Marseille: OpenEdition Press, 2014); it is further explored in the following series Christian Jacob, ed., *Lieux de Savoir* (Paris: Albin Michel, 2007); for a similar approach, see also Pascal Schillings and Alexander van Wickeren, ‘Towards a Material and Spatial History of Knowledge Production. An Introduction’, *Historical Social Research* 40, no. 1 (151) (2015): 203–18.

² Christian Jacob, ‘Practical turn’, in *Qu'est-ce qu'un lieu de savoir ?* (Marseille: OpenEdition Press, 2014); Christian Jacob, ‘Spatial turn’, in *Qu'est-ce qu'un lieu de savoir ?*, Encyclopédie numérique (Marseille: OpenEdition Press, 2014).

³ Christian Jacob, ed., *Lieux de Savoir. 1 Espaces et Communautés* (Paris: Albin Michel, 2007); Christian Jacob, ed., *Lieux de Savoir. 2 Les Mains de l'intellect* (Paris: Albin Michel, 2011).

⁴ Jacob, ‘Practical turn’.

long tradition of the history of material culture relating to science.⁵ Unlike many works on this topic, this thesis is, in some way, a material culture history without material. Most of the physical objects of the gardens studied here have long disappeared through gardens' moves, expansion, redesign or simple plants' life-cycle. To study the materiality of the gardens, I will use plans, maps, and contemporary testimonies about the gardens, since there are almost no material objects left.

The approach defended by Jacob is also linked to that of works in the expanding field of spatial history.⁶ Working on spatial history means grappling with many nuances in the definitions of the word "space", especially in opposition, or complementarity with the term "place". Those two words are used in spatial history as translations of the French concepts of "espace" and "lieu". Michel de Certeau distinguished between the *lieu*/place being stable and fixed and the *espace*/space being a "practical place", a place to which people and practices gave meaning.⁷ Following theorists, such as Henri Lefebvre, inverted the definition of the two terms.⁸ It is in the latter's tradition that Leif Jerram wrote his article "Space: a useless category for historical analysis?" which encouraged historians to use this category.⁹ In this article, he describes the study of space as the study of a physical configuration of points across distance. This physical configuration can affect human behaviour and therefore influence historical analysis. This Part of the thesis will consider the gardens mostly as physical spaces modelled by humans to affect other humans, which is why "space" is the main term I use in the chapters. However, I will also look at some elements that Lefebvre and Jerram associate with the study of "place", for example, the definition of a place by different social groups, especially in the last chapter. I also use this part to examine how the people designing the gardens gave meaning to space by shaping it one way or another. Therefore, my use of the term "space" is a theoretical shortcut, which often points to the intersection of material and conceptual space.

⁵ A good introduction to the topic can be found in Beretta, *Storia Materiale*; for more specific works, with examples on the eighteenth century, see for example Ursula Klein and Emma C. Spary, *Materials and Expertise in Early Modern Europe : Between Market and Laboratory* (Chicago ; London: University of Chicago Press, 2009); Daniela Bleichmar and Peter C. Mancall, eds., *Collecting across Cultures: Material Exchanges in the Early Modern Atlantic World* (Philadelphia: University of Pennsylvania Press, 2011); Marie-Noëlle Bourguet, Christian Licoppe, and Heinz Otto Sibum, *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century* (London ; New York: Routledge, 2014).

⁶ See for example the work done in the University of St Andrews: 'Institute for Transnational & Spatial History', 27 December 2013, <https://standrewstransnational.wp.st-andrews.ac.uk/home/>.

⁷ Michel de Certeau, *L'invention du quotidien, Arts de faire* (Paris, France: Gallimard, 1990), chap. IX-« Récits d'espace ».

⁸ Henri Lefebvre, *Critique de la vie quotidienne* (Paris: L'Arche, 1968); Henri Lefebvre and Rémi Hess, *La production de l'espace* (Paris, France: Anthropos, 2000).

⁹ Leif Jerram, 'Space: A Useless Category for Historical Analysis?', *History and Theory* 52, no. 3 (2013): 400–419.

Ironically, the limited space of the PhD thesis itself will force me to restrict my consideration in terms of scale. Part I will only focus on the internal space of gardens and not their situation in the urban or national space for example, which would merit its own study, following examples such as the work of David Harvey on the urban geography of revolutions.¹⁰ Part I will look at the internal space of the garden, how it was conceptualised and used as a place, what type of circulation existed inside of it, as well as at the door.

These themes will be explored first through an analysis of what the material and spatial organization of the gardens can tell us about the knowledge practices they were created to support. I will use this information to then consider the practical role of gardens in teaching, both formal and informal in chapter 2. Chapter 3, on research in the gardens, will examine how scientific developments influenced the materiality of the gardens. Finally, the last chapter will focus on who had access to those material resources and what they did with it. Overall, the chapters will show that the eighteenth century saw a crystallisation of the gardens' identity as "spaces of science".

¹⁰ David Harvey, *Rebel cities: from the right to the city to the urban revolution* (London: Verso Books, 2012).

Chapter 1: Materiality and organization of space

In his *Botanic Philosophy* published in Uppsala in 1750, Carl Linnaeus defined the botanic garden by saying that “a great number of Plants are cultivated [in there]”.¹ This very simple statement already points towards two of the most important or obvious characteristics of botanic gardens as spaces of knowledge: they are collecting spaces and they collect plants, which are living things. Botanic gardens as places represented a form of official knowledge. Even if it was not yet always called “science”, the knowledge of botanic gardens and their staff was recognised as a form of codified and formal knowledge, one that – as we will see in chapter 2 – was taught in universities and learned societies. It was a very different knowledge than the practical craft knowledge that could be exchanged in an artisan workshop, for example. But even amongst other spaces of formal or official knowledge, the nature of the collections that botanic gardens hosted set them apart. Unlike libraries, gardens were storing collections that required daily attention to make sure they survived. Unlike observatories, gardens were directly responsible for keeping the object of their study in a state that would be conducive to their studying. Unlike many eighteenth-century classrooms, the gardens relied on more than speech or the written word to pass on the knowledge deposited in them. Unlike the collection of the mineralogist, the garden could not be rearranged easily and often.

This chapter will look at how this specificity of the gardens’ materiality defined them as spaces of science and at what the material reality of the gardens can tell us about their scientific role. Works by Nuala C. Johnson, Esther Helena Arens or John Dixon Hunt have already established that the design of botanic gardens was directly influenced by the contemporary ideas of “order” – in particular classification – and the objectives of each garden.² Johnson in particular writes about how the local and institutional contexts of the three gardens she examines – Cambridge, Glasnevin in Dublin, and Belfast – greatly impacted their material conception. In this chapter, I will follow Arens and Johnson in arguing that the notion of order and what it meant for different science practitioners was reflected in the spatial organization of the gardens I study. I will not only look at the arrangement of plants following classification, but also at the division of the space in the garden to show that the organization of the space itself can and must serve as a source for the history of these botanic gardens.

¹ Quoted in French by Allain, *Une histoire des jardins botaniques*.

² Johnson, *Nature Displaced, Nature Displayed*; Esther Helena Arens, ‘Flowerbeds and Hothouses: Botany, Gardens, and the Circulation of Knowledge in Things’, *Historical Social Research* 40, no. 1 (2015): 265–83; John Dixon Hunt, *A World of Gardens* (Reaktion Books, 2014).

Like the gardens studied by Johnson, each of the gardens of Pisa, San Marco, Edinburgh, and *la Specola* was different than the others in the eighteenth century. A quick look at their plans and illustrations in the appendices will suffice to show that they all had different shapes, different internal organisation, and different looks. This, as Johnson argues, is due to local circumstances and institutional objectives that this chapter will indeed consider. Johnson puts a lot of emphasis on the differences between her gardens, however, I will emphasise the ways in which the Scottish and Tuscan botanic gardens resembled each other.³ The chapter argues that the principles guiding their organization in space were similar, and that looking at their design in light of those principles can give us much information about the culture of science in the eighteenth century. By doing this, I do not want to argue against Johnson but rather consider the matter from a different angle, one showing Europe-wide scientific trends.

The chapter will first look at how the specialisation of science influenced the design of the gardens in the second half of the eighteenth century. It will then show how when it came to arranging the plants, one has to think of taxonomy, practicality and aesthetics as intertwined.

The specialisation of plant knowledge

Although scientific “disciplines” as we know them today are often credited as a nineteenth-century development, the process of specialisation of knowledge had started much earlier.⁴ Specialisation in science entailed a focus on increasingly precise parts of one domain of knowledge. These precise parts would also be increasingly considered different and separate from one another, creating sub-domains, or indeed specialisations.

In the early eighteenth century, botany, or plant knowledge, was attached to the wider domain of medical knowledge. This was why the botanic gardens of Pisa and Edinburgh were attached to the medical faculty of their respective universities.⁵ In Edinburgh, the faculty was

³ Johnson’s methodology is different also because the gardens that she studies were each in very different and well-defined institutional contexts. In the nineteenth century, when she looks at them, a university garden is clearly and strongly different from a public research garden, and both are again different from a private society garden. The gardens studied here are not only all publicly funded, they also existed in a blurrier institutional context in which the learned society’s garden had the same objectives as the museum’s one.

⁴ For an example of the study of disciplines development in the nineteenth century see Bennett Zon and Bernard V Lightman, *Victorian Culture and the Origin of Disciplines* (London ; New York: Routledge, 2020).

⁵ For general histories of the gardens and the universities see Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*; Romano Paolo Coppini and Alessandro Tosi, *La ‘Sapienza’ Di Pisa* (Pisa: Plus, 2004); Fletcher and Brown, *Royal Botanic Garden Edinburgh*; Henry J. Noltie, *John Hope, 1725-1786 : Alan G. Morton’s Memoir of a Scottish Botanist*, New and rev. ed.. (Edinburgh: Royal Botanic Garden Edinburgh, 2011);

officially named Medicine. In Pisa, medical teaching was part of the “Arts” faculty, as opposed to the Theology, and Law faculty, but the students attending the classes in the botanic garden were supposed to be working toward a medical qualification nonetheless.⁶

The ties to medicine can be seen in the language used to talk about the gardens. Though its name was not fixed, the garden of Pisa was most often called the “*Orto dei Semplici*”, “Garden of Simples”. This referred to its original medical functions since “simples” were originally medicinal plants. In Edinburgh University, the name of the subject taught in the botanic garden for the first half of the century was “Botany and *materia medica*”. *Materia medica*, the Latin term for pharmacy, was also an explicit reference to the medical teaching that the garden was supposed to facilitate. The fact that the subject had a double name, stressed by the use of “and”, shows that the specific knowledge of medicinal plants and the knowledge of plants in general were starting to be considered as different. This is a first illustration of the process of specialisation.

During the eighteenth century, the specialisation of plant knowledge led to the recognition of botany as a discipline separate from medicine. In the second half of the century, more precise objects of focus appeared within plant knowledge, most importantly economy. This subdivision of the general plant knowledge domain had some strong influence on the design of the gardens, the division of knowledge leading to the fragmentation of space.

Pisa: fewer simples than expected

The only surviving plan for the botanic garden of Pisa in the eighteenth century is the one drawn in 1723 for the catalogue of the collection published by Michelangelo Tilli (Appendices, Figure 5). The plan does not reflect exactly what the garden looked like by the end of the century, but it does give an idea of how it was organized. One can see very geometric designs and clear subdivisions of the space. The plan also shows several buildings, which are other sub-spaces in the garden. Confronting the plan with archival sources and testimonies shows how the space of the garden evolved from a space dedicated to *materia medica* to one reflecting eighteenth-century specialised knowledge areas, changing the meaning of the garden as a “place”.

Alexander Bower, *The History of the University of Edinburgh*, vol. II (Edinburgh, London: Alex. Smellie, 1817); Bower; Robert D. Anderson, *The University of Edinburgh*.

⁶ For more details on the teaching in the garden see chapter 2 of this thesis.

In his *Reise durch Toskana*, Georg Christoph Martini described the garden of Pisa and showed that it was not entirely dedicated to medicinal plants.⁷ The description details several plants and trees, mentioning curious trivia about each: the pepper tree, small and with interesting fruits, the *arbour Phidiae*, which had the reputation of killing anyone who would sleep under it, the Indian chestnut, with thick bark and chestnuts different from the local ones, the *Aloe di Goa*, so big it took half the greenhouse it was in, the coffee tree, producing some fruits, and others. Those plants were not used for medicinal purposes, and Martini never mentioned any medical use in the details he gave about them. Even to outsiders, the medicinal qualities of plants were not the focus of the garden. By the middle of the century – Martini wrote between 1724 and 1745 – the garden was already moving away from its strictly medical role. This was in big part due to the new specialisation of botany, the study of plants in themselves, and not only in a medicinal goal. This was what led to the valorisation of collections of exotics and interesting species like the ones mentioned by Martini.

Specialisation of knowledge can also be seen in the legend of the plan. The plan shows that the buildings were associated with knowledge that was not directly *materia medica*: as well as accommodation for the professor of botany, they counted a museum and a chemical laboratory. Both of those were considered to be part of the garden, since they appear on the plan. This suggests that their content was associated with plant knowledge, but their distinct names marked the difference between them and the rest of the garden.

The history of the chemical laboratory illustrates the specialisation of both botany and chemistry, as well as the move away from the focus on medical matters. The laboratory had been part of the garden for a long time. It was first built in the seventeenth century as the “*fonderia*”.⁸ At the time, the garden and the *fonderia* worked as a unit, because plants and chemical process were the two facets of pharmacy, the subject taught in the *Orto*. The *fonderia* was then in charge of the production of medications for the town’s hospitals and the poor, using plants from the garden. The *fonderia* disappeared at the beginning of the eighteenth century, because, as botany, pharmacy and medicine each became more specialised, the professors did not teach all of them together. Instead, they were separate and there was a chair of chemistry, not using the laboratory in the garden.

⁷ Lucca, Archivio di Stato, ms 106, Geog Christoph Martin, *Reise durch Toskana*, III, 1725-1745, cc70-71.

⁸ Ferri and Vannozzi, *Giardini Dei Semplici*, 38.

The laboratory was renovated to make it suitable for the practice of modern chemistry after Giorgio Santi, a talented chemist, came to be director of the garden in 1782.⁹ Although the laboratory was described as “little” by Alessandro Da Morrona, it was still the sign of a renewal of the practice of chemistry in the garden.¹⁰ This practice, though, was not directly linked to the collections in the garden as it had been with the *fonderia*. When Santi was recruited, he was given the chair of “of Botany, and of Natural History”, and promised that he could merge it with that of chemistry when the latter became vacant. This was not due to an intellectual ambition of bringing the two disciplines together again, but to Santi’s personal talent and interest in chemistry, and the University’s interest in not paying him more than one salary.¹¹ The new laboratory also had no ambition to work with hospitals or to focus on medicinal plants. The laboratory and the garden were now two separate entities, two specialised sub-places in the common space of the botanic garden.

Santi’s title as Professor “of Botany, and of Natural History” suggests that the other building, the museum, was still considered an integral part of the garden. The links between the two spaces were stronger. For example, casual visitors did not have access to the laboratory, but they could visit the museum and garden together as a unit, as Martini’s text shows. Santi’s predecessor, Angelo Tilli, was simply referred to as “Professor of Botany” so the name shows a new valorisation or recognition of Natural History as a separate knowledge from botany.¹² Actually, the museum was not clearly identified as a separate entity on the plan of 1723, but gets mentioned in 1782, when Peter-Leopold gives to Lorenzo Tilli the charge of “demonstrator of the Botanic Garden, *and* of the Museum of Natural History”.¹³ It seems that by the end of the century, the Museum was starting to be considered a separate space, dedicated to a separate type of knowledge.

The garden of Pisa went from a garden of simples to a multi-faceted space where all-encompassing medical knowledge had lost its foothold to the profit of new specialisations. Those new specialisations were not only theoretical frameworks but were materialised in the use of the space. The same process of specialisation is even more easily spotted in Edinburgh, though it started slightly later.

⁹ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 220.

¹⁰ Alessandro Da Morrona, *Pisa illustrata nelle arti del disegno*, vol. III (Livorno: Presso Giovanni Marenigh, 1812), 368–71.

¹¹ Pisa, ASP, 13bis/G8, f104.

¹² This is consistent in the archival material, for one precise quote, see for example ASP, 13bis/G3, f198.

¹³ ASP, 13bis/G8, f104.

Edinburgh: the disappearance of materia medica

The plan of Edinburgh shows a very stark contrast between subsections of the garden in 1763. The largest part, called *sylva botanica* was arranged like a landscape garden – a fact that will be discussed in more detail later – and the smaller part in the North, called *schola botanica*, was neatly and geometrically laid out. The comparison between some of the alternative proposals from 1760 (App.Fig.3-4) and the final plan (App.Fig.1) show that the design could have been very different. The separation of the garden into those different spaces was indeed a deliberate choice of the director, John Hope.

What is less obvious on the plan is that the *schola botanica* itself was subdivided and only a part of it was officially dedicated to medicinal plants. In Hugo Arnot's 1788 guide to Edinburgh, the writer's account of the garden mentions that "On each side of [the *schola botanica*] are placed the officinal plants, shrubs, and trees".¹⁴ This detail, when put together with the plan, show that the space devoted to medicinal species in the new botanic garden was quite limited. In his notes of 1782, John Hope wanted "the border for Officinals¹⁵ along the Beach hedge to be made broader by one foot", which did not even represent a quarter of the whole garden's space!¹⁶ Officinals were literally put aside as the collection evolved way past medically useful species. Since this was the restricted space dedicated to *materia medica*, it means that by the early 1780s, the rest of the garden was designated for another specialisation, botany, with collections of various non-medicinal plants.

These choices in the organization of space were also reflected in the university curriculum. In the first half of the century, reforms in the University of Edinburgh contributed to make medicine its main course. In the second half, new chairs were created, showing the emergence of new subjects.¹⁷ Amongst those new subjects was botany, for which a chair was created in 1768 by the King because "it would be for the advancement of Learning [...] that the two Professions of Botany and Materia Medica be separated and each taught by its respective Professors".¹⁸ After 1769, John Hope was only professor of botany, whilst Francis Home was recruited as professor of *Materia Medica*.

¹⁴ Hugo Arnot, *The History of Edinburgh: From the Earliest Accounts to the Present Time* (Edinburgh: William Creech and Messrs. Robinson & Co., 1788), 418.

¹⁵ Officinals are medicinal plants.

¹⁶ RBGE, HOP, GD253/144/13/3.

¹⁷ Morrell, 'The University of Edinburgh in the Late Eighteenth Century'; Phillipson, 'The Making of an Enlightened University'.

¹⁸ Register of the Privy Seal, 30 septembre 1768, Vol. X, p10, quoted in RBGE, HOP, « HOPE, John (various) IBB's scrap book, memoir, misc, etc... ».

The division of the two subjects happened several years after Hope had been granted the support for his new garden. But from the plan chosen in 1760 (App.Fig.1), it seems obvious that he had already planned to devote only a limited amount of space to the *materia medica stricto sensu*. The organization of space reflected the evolution of the discipline even before the formal university curriculum did. The new garden was no longer an accessory for the school of medicine, but the main centre of teaching for a new science. The creation of the new garden also saw a shift in the naming conventions. After 1763, it seems to only be referred to as the “botanic” garden, instead of “physick garden”.

The practical uses of the garden show an even stronger disconnect with medicine. The garden hosted collections of medicinal plants but was never used to teach *materia medica* on site after 1768. The medicinal plants were not removed from the garden, but Francis Home only taught from the University buildings. As a place, the garden became associated mainly, if not only with the new science of botany. Medicinal plants were only represented in the garden as a category of plants like any other.

Birth of a specialisation: economy in space

The effect that specialisation of knowledge had on the space of botanic gardens was also seen when economy developed as a discipline in the second half of the eighteenth century. In Pisa this was illustrated by the expansion of the garden itself when, in 1785, Santi acquired a piece of land from a nearby convent to establish an agricultural garden. In a letter of 1803, Giovanni Fabbroni writes¹⁹:

[...] In the space of this ground, acquired like said, and merged with the Botanic Garden, an Economic Garden was established for the commodity of the Young Scholars by the Director of the same.

In this context, the word “economic” refers to matters of agriculture and practical use of plants.²⁰ This subject could bear several names “economy”, “agronomy”, “political economy” or simply “agriculture”²¹. It can be summarised in contemporary wording as the science of agriculture. The new section of the garden was dedicated to crops and other plants that could potentially be

¹⁹ ASP, 13bis/G14, ff745-746.

²⁰ Emma C. Spary, “‘Peaches Which the Patriarchs Lacked’: Natural History, Natural Resources, and the Natural Economy in France’, *History of Political Economy* 35, no. 5 (17 February 2004): 14–41.

²¹ Although those terms were sometimes interchangeable at a time where their definition was still fluid, it is important to note that some of them could cover much wider domain than agriculture.

cultivated on a large scale in Tuscany and be useful for agriculture or industry. As in Edinburgh, the creation of a new separate sub-space was symptomatic of the emergence of a new discipline. In Edinburgh, this specialisation was included in the original design, because the director had the chance to establish an all-new garden, but even in a garden already established and fixed as Pisa, the organization of space could still evolve to reflect developments in the contemporary knowledge.

This also happened in Florence, in a more radical manner. The garden of San Marco was the oldest of all the gardens studied here in terms of occupied space. It had – and still has – never moved since its creation in the sixteenth century.²² In the undated plan under the *Società Botanica*(App.Fig.9), there was also some space dedicated to medicinal plants, in the same way as in Edinburgh, showing again the distinction between *materia medica* and botany. When the *Società*'s management was deemed not satisfactory anymore and the garden was given to the *Accademia dei Georgofili* in 1783, there was no subdivision of space, instead, the whole garden was rearranged and redesigned(App.Fig6). The plan under the *Georgofili* is a radically different interpretation of the same delimited space.

The difference in the design of the garden shows that different specialisations called for different spatial organizations. Beyond the general division of space, the more detailed organization of the collection depended on the type of knowledge that the garden was meant to illustrate; the material lay-out of the space was a vector of information. The *Georgofili* were a group dedicated to the study of economy as defined above and this specialised form of plant knowledge was explicitly separated from *materia medica* and 'botany' more generally.

The influence of contemporary scientific classification

The previous part of this chapter has shown that specialisations in plant-science would influence the partition and interpretation of space in the gardens. On a bigger scale, the specific arrangement of the beds was determined by scientific theories of the time. This is particularly easy to see when looking at the problem of classification and its influence on garden design.²³ In Florence, Giovanni Targioni-Tozzetti, head of the San Marco botanic garden before 1746, said that the plants should be arranged "the way one liked it best, that is, either alphabetically or in

²² Paolo Luzzi and Fernando Fabbri, 'I Tre Orti Botanici Di Firenze, Paolo Luzzi & Fernando Fabbri', in *I Giardini Dei Semplici e Gli Orti Botanici Della Toscana*, by Sara Ferri and Francesca Vannozi (Perugia: Quattroemme, 1993).

²³ Arens, 'Flowerbeds and Hothouses'.

accordance to the method of Tournefort or Linnaeus”.²⁴ Although Targioni-Tozzetti did not favour a particular system, this quote shows that there was supposed to be a logic to the positioning of the plants in the beds and the garden, and that this logic often depended on classification systems. Here, “the way one liked it best” seems not to be an aesthetic or practical choice, but a scholarly and intellectual one. This idea was only partially true in practice but took centre stage in the discussions on garden arrangements.

The classification or taxonomy of plants was one of the most important and most debated issues of eighteenth-century botany.²⁵ The most popular system in the early eighteenth century had been Tournefort’s. By the second half of the century, the most popular classification system in Europe was Linnaeus’ sexual system, first published in his *Systema Naturae* in 1735.²⁶ Despite its popularity, the sexual system still had some competition, for example from the contemporary natural system developed by Bernard de Jussieu in Paris.

The main difference between classification systems was the criteria they based the distribution of plants on. Tournefort’s was based on flowers and fruits as well as distinctions between herbs, bushes and trees. The success of Linnaeus stemmed from the fact it only used one criterion: the number of sexual organs on the plant, which made it easy to use. Linnaeus also revolutionised taxonomy by creating the binominal denominations of all species, which simplified communication between scholars. Systems like this were called “artificial systems” because they only used a reduced set of arbitrary criteria. The utopia of botanists like Linnaeus or Jussieu was to create a “natural system” by comparing all the plants in the world to determine what the actual relevant criteria to sort them were. This was, of course, always a work in progress since Europeans continuously discovered species unknown to them.

The opinion that botanic garden staff and directors defended in the classification debates mattered both for the discourse used to analyse and explain the garden and for their design. Botanic gardens could be used as tools to explain or practice classification. Plants that were

²⁴ Quoted and translated by Tchikine, ‘Echoes of Empire’, 106.

²⁵ See, for example Giulio Barsanti, *La scala, la mappa, l’albero: immagini e classificazioni della natura fra Sei e Ottocento* (Firenze: Sansoni, 1992); Peter Francis Stevens, *The development of biological systematics: Antoine-Laurent de Jussieu, nature, and the natural system* (New York: Columbia University Press, 1994); Paul Lawrence Farber, *Finding Order in Nature: The Naturalist Tradition from Linnaeus to E.O. Wilson* (Baltimore: Johns Hopkins University Press, 2000).

²⁶ Frans Antonie Stafleu, *Linnaeus and the linnaeans: The spreading of their ideas in systematic botany, 1735-1789* (Utrecht, Pays-Bas: Oosthoek, 1971); Marco Beretta and Alessandro Tosi, *Linnaeus in Italy: The Spread of a Revolution in Science* (Sagamore Beach: Science History Publications, 2007); Sten Lindroth, ‘Linnaeus in His European Context’, in *Linnaeus: Progress and Prospects in Linnaean Research*, ed. Gunnar Broberg (Stockholm: Almqvist and Wiksell, 1980); Koerner, *Linnaeus*.

brought into the classroom had to be considered on their own, or in small groups, for lack of space. In a garden, it was possible to place them in a spatial representation of a classification system. This was a way of making explicit the connections between different species. In this way, the garden could become a sort of textbook, illustrating scientific theories. This mattered because the gardens were used for teaching. The choice of the classification system used in a botanic garden was crucial both to its spatial organisation and to the curriculum that would be taught in it. The second half of the eighteenth century saw most botanic gardens switch to the Linnaean system, albeit at an uneven rate.²⁷ Whilst many in the North of Europe, and Britain in particular, quickly became enthusiastic Linnaeans, Italians took more time to be convinced.

The Società Botanica's classification debate

In 1758, Targioni-Tozzetti wrote in a report that the garden of San Marco, then not using a classification system in its spatial arrangement, was in a terrible state of disorder.²⁸ Saverio Manetti, prefect since 1746, was therefore asked to supervise the reorganization of the garden, following a plan that was to be decided collectively between members.²⁹ The plan of San Marco under the *Società Botanica* was, like Pisa, very geometrical (App.Fig.9). To implement a new taxonomical arrangement in the garden, only the order of plants inside of the sections had to change, the general shape of the garden could, and seemingly did, stay the same. The debates on what the changes should be were quite long, partly because of Manetti's reticence to the Linnaean system.

There were several proposals considered for the new plan. Many members of the *Società* were supporters of Linnaeus whilst traditionalists were still rooting for Tournefort.³⁰ One suggestion was to have both systems illustrated simultaneously in two separate parts of the garden. Manetti opposed this proposal, invoking issues with the plan and the Linnaean system which can be summarised in three themes: first, the Linnaean system was necessarily incomplete – the theoretical system as well as the garden's illustration of it because they would be missing some links based on their collection; secondly, the same system was not aesthetically pleasing because

²⁷ Stafleu, *Linnaeus and the linnaeans*; Beretta and Tosi, *Linnaeus in Italy*.

²⁸ BNCF, Targ Tozz 205, f70.

²⁹ Tchikine, 'Echoes of Empire'; Stefani, 'Linneo e Firenze'.

³⁰ Marta Stefani, 'Linneo e Firenze. Saverio Manetti e l'ingresso del linneismo alla Società Botanica Fiorentina', in *Toscana e Europa, Nuova scienza e filosofia tra '600 e '700*, ed. Ferdinando Abbri and Massimo Bucciattini (Milan: FrancoAngeli, 2006), 273–92.

trees, herbs and bushes would be all mixed together; lastly, two systems at once would make it hard to write a catalogue and even harder for people to read the garden.³¹

Ultimately, the *Società* chose to impose the double classification upon Manetti. Parts of the garden and the greenhouse were rearranged following the Linnaean system and others used Tournefort, representing the two “main systems of plants”.³² Despite this final choice, Manetti’s arguments against this plan shed some light on the purpose of the debate. All three of those categories show concerns over the link between theoretical knowledge and materiality of the garden. The first is a reminder that changing the layout once it had been concretised – in case new plants were brought for example – was not an easy task when dealing with a living collection rooted in the ground. The second brings in the aesthetic aspect which, as I will discuss in detail later in this chapter, shows concerns over the materialisation of the theory. Most importantly, the third demonstrates that the garden was meant to be “read” like a book. The material space of the garden was designed to convey information to the people in it. Whilst the divisions and sub-divisions of space linked to specialisation were more practical, the organization of plants inside the general spaces was informative. Knowledge – in this case knowledge of taxonomy – was expressed through garden design.

This idea of conveying scientific information in the arrangement of the plants was also linked to the teaching function of the botanic gardens.³³ The gardens had to match the information that they were supposed to convey. The *Società* decided that their garden was to demonstrate the two most popular taxonomical systems of their time, other institutions made different choices.

The Accademia dei Georgofili and useful taxonomy

The garden of San Marco was completely remodelled when its management passed from the *Società* to the *Georgofili*. The design after 1783 was based on a grid, the space being divided in regular rectangle-like sections (App.Fig.7). These shapes made it easier to cultivate crops with eighteenth-century agricultural tools than the sharp triangles featured in the *Società*’s plan. Beyond the shape of the plot, what radically changed in San Marco was the interpretation of space. This is obvious when seeing the classification system used to map the garden. The taxonomy used in the *Orto Sperimentale* was based on functions, as the following table, reproducing the legend of the plan, shows.

³¹ Stefani, 289.

³² Quoted by Stefani, 291.

³³ For more on the teaching in the gardens see chapter 2 of this thesis.

I Piante Frumentacee, cioè tutte le Specie, e varietà dei Grani e Frumenti
II Piante Ordeacee, cioè Orzi Segale, ed altre piante panizzabili
III Piante Sorgali, cioè Saggine, Granturchi, Migli &c ed altre piante panizzabili estive
IIII Piante Bacceline o Legumi, cioè Fave, Fagioli, Piselli &c
V Piante da Cucina, cioè Cavoli, Insalate, Sparagi &c
VI Piante Olearie, cioè una serie di Olivi posti separatamente in una parte dell'Orto, e in questo spartimento vi sono quelle Piante, che danno Olio co'loro semi, cioè Ricino, Ravizzone, Sesamo &c.
VII Piante que danno Filo e qui si comprendono anco le varie specie di Gelsi, coi quali si nutriscono i Bachi da Seta, situati in altra parte dell'Orto, e in questo Spartimento si coltivano le Piante filamentose cioè Canape, Lini, Cotone &c.
VIII Piante Tintorie, cioè Guado, Luteola, Robbia, &c.
IX Piante Tecniche, inservienti ad alcune arti, cioè Soda, Scardiccione &c.
X Piante da Foraggio per nutrimento del Bestiame, cioè Erba Medica, Lupinella Trifogli &c colle quali si formano i prati artificiali.
XI
XII Piante Boschive, cioè Castagni, quercie, Cerri &c. e quelle necessarie a vari lavori ed usi.
XIII Piantonaio Semenzaio e Nestaio di Frutti, e di altre simili piante
XIV Piante da Giardino, cioè Limoni, Aranci &c., e quelle Piante di cui foglie e fiori s'impiegano per le Distillazioni, col altri usi economici, come melisse, Rose &c.
XV
XVI Piante Officianali, colle quali i Contadini possono curare alcune proprie malattie, e quelle del Bestiame, come sono le Piante emollienti, le restringenti, le refrigeranti &c.

Figure 1 Sections of the Georgofili's garden's plan

The document includes no mention of Linnaeus, Tournefort, or indeed any other taxonomist. Regardless of their species, two specimens that produce oil would be put together. This alternative type of classification shows that economy and/or agriculture was a different discipline than botany, not using the same names or groups. The focus was not on the plants themselves and how they functioned. Instead it was on what they could be used for. Unlike the gardens of Edinburgh and Pisa, the *Georgofili* did not teach about plants, but about functions. Only “useful” plants were part of the collection.

This type of useful taxonomy was not as codified by internationally defined systems like the systems of Linnaeus or Tournefort, but it was not an idea unique to the *Georgofili*. During his mission exploring the Maremma for the Grand-Duke in 1767, the mathematician Leonardo Ximenes suggested a taxonomy of trees based on their uses – boat building, furniture, fire wood,

etc.³⁴ The vegetables concerned and the criteria to sort them were different between Ximenes and the *Georgofili*, but the idea of a useful taxonomy remained. Different taxonomies could convey different information. A visitor would gain different insights from reading the garden of the *Georgofili* rather than that of the *Società*, but in both the choice to organize the plants based on a system came from the same necessity of conveying information through space. With this in mind, I will now consider what the other gardens had to say about plant life.

Pisan varieties of learning

Pisa is a tricky garden to examine under this lens, since the only surviving plan, dating from 1723, was made long before the period studied here. I must assume that, by the 1760s, the plan had not changed too much in its organization in order to analyse it. This may well be wrong, and the analysis might only apply to the early eighteenth century, but the scarcity of sources leaves little choice. The 1723 design of the botanic garden of Pisa was not based on a unique coherent system. Until 1782, the main taxonomy used for labelling and catalogues was Tournefort's, but that system was not used for spatial organisation.³⁵

The plan of 1723 shows that plants were not divided according to consistent criteria. In some sections, the plants were grouped based on similarities in shape of flowers (“Umbelliferes” or “plantae acanaceae”), habitat (“palustres”), properties of fruits (“venenatae”), or other characteristics (“odoratae”). Certain groups – like the first ones listed here – were Tournefortian in that they were based on shape of flowers, one of the two main criteria used by Tournefort in his classification. Categories like “venomous plants” or “odorous” plants were more practically orientated. The spatial organisation of the collection did not teach one system but conveyed a lot of varied information about the plants.

The catalogue and signage in the garden still gave the Tournefortian names for every plant. The garden presented a set of alternative criteria. The garden was just one of the media through which plant knowledge could be conveyed. When combined with others, such as the catalogue, or teaching by lecturers, it participated in creating a more complex vision of this knowledge.

After Giorgio Santi became director of the botanic garden in 1782, he changed the system used in the garden to the Linnaean one. This was perceived as a move toward modernity since the

³⁴ Lavinia Maddaluno, ‘Forests, Woods, Roads : Agricultural Landscapes as Instruments for the Material Administration of an Eighteenth-Century Tuscan Periphery’, in *Florence After the Medici* (New York: Routledge, 2020), 199–223.

³⁵ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 213–26.

Tournefortian system was becoming less popular. The Linnaean system facilitated communication with and visits by foreign scholars since it had become the *lingua franca* of botanists. Since no plan of the garden at this period exists, it is unclear how much was changed, but it seems to have been a lot of work. The decision to change the system was taken in 1783, but due to the necessary preparation and the cost of the work, the building and planting work only started in 1787.³⁶

The classification system used by a botanic garden was not only an intellectual exercise. It had a concrete influence on the materiality of the garden, effectively turning the space into a textbook. It required a lot of manual work to physically rearrange the collections in the garden. Changing theoretical approach, even without radically changing the discipline, could have many very practical and material consequences. This included moving potted plants, replanting some of the beds and changing the labels everywhere to update them to new denominations. The new edition of this textbook was a very costly enterprise.

Edinburgh: landscape and nature

In Edinburgh, the classification used for the literature surrounding the garden was that of Linnaeus. In contrast to the Pisan and Florentine gardens, Edinburgh's garden started with a clean slate in 1763 and did not go through complex restructuring to fit the new system. Hope was one of the earliest and most active supporters of the Linnaean system in Britain, the first, with Thomas Martyn, professor in Cambridge, to teach the Linnaean system in Britain starting in 1762.³⁷

Unlike the discourse surrounding it, the material space of the garden did not only use the Linnaean system. As described earlier, the final design of the garden was quite original, combining the severity and regularity of a traditional medical garden in the *schola botanica* with a more open area inspired by the landscape garden movement in the *sylva botanica*. In his description of the *schola botanica*, Hugo Arnot wrote:

In the east division of the garden, there is a large area, called the School of Botany, where the plants are systematically arranged. On each side of this area are placed the officinal plants, shrubs, and trees, according to their sizes. This division contains about 2 000 species of plants.³⁸

³⁶ Garbari, Tongiorgi Tomasi, and Tosi, 220.

³⁷ Stafleu, *Linnaeus and the linnaeans*, 199–200.

³⁸ Arnot, *The History of Edinburgh*, 418.

The plants in that section of the garden were laid out in rows, following the classification of Linnaeus. The *schola botanica*, as its name suggested, was used for teaching demonstrations only and it was simply an illustration of the classification system.

Hope later regretted this arrangement. In notes about the *schola botanica* he made in 1782, he regretted that there were too many plants in it, and that they were not varied enough and suggested they should be rearranged in a “pell-mell” order instead of the Linnaean classes.³⁹ It is unclear why this seemed better to him. It might have been for aesthetic reasons, or more probably for practicality. It would have made it possible to include new plants in the rows without redesigning the entire lot every time. Whatever Hope’s reasons, his notes at the very least illustrate the importance of the choice of plan for the garden. Any choice was, if not impossible to reverse, at least very hard to amend. Consequences of the choice of the physical organisation also weighed on the teaching: the plants in the *schola botanica* were the main ones figuring in the class. Changing the program of the class would also have material consequences on the garden.

Because of a lack of direct sources and a less common approach to botanic garden design, it is more difficult to analyse what type of knowledge the main part of the garden was trying to convey. My analysis can only be an educated hypothesis, but the contrast between Edinburgh and other gardens of the time makes it impossible not to ask what the *sylva botanica* was trying to convey.

It is even more interesting to consider this issue knowing that Hope had the choice to go for a more classic garden design. The plan by Sir James Nasmyth(App.Fig.4), for example, was a proposition for a very geometrical and regular organisation. Andrew Crosbie’s project(App.Fig.3) seemed to separate trees from lower plants, with the latter arranged in very regular rows, in the shape of an amphitheatre, around a pond. It was a purely practical answer to the project of showing plants to students. Its strict regularity would probably have made it practical for demonstration purposes and made it the perfect example of a botanic garden designed as a textbook.

The choice of a landscape garden was a curious one. Edinburgh seems to have been the first botanic garden to use a landscape garden design in Europe. The Tuscan gardens, all very regular and geometrical designs, were much more representative of European botanic gardens in general. As shown previously, a geometrical and regular plan helped to convey information in teaching and was a practical set up for gardeners. Many botanic gardens continued to use geometrical designs throughout the eighteenth century, even as the landscape garden became popular on the continent for pleasure gardens.

³⁹ RBGE, HOP, GD253/144/13/3.

The landscape garden appeared in England in the 1720's, inspired by gothic imagery.⁴⁰ It sought to imitate natural landscapes in their most dramatic aspects. The gardens imitated wilderness – or the idea of it – but were carefully designed by architects. Alexander Pope, a pioneer of the movement, had a “wild garden” designed for his villa of Twickenham in the 1720s.⁴¹ Pope compared the architects and gardeners in charge of this type of gardens to landscape painters, carefully crafting an image from nature. The artificiality of the garden allowed staging vistas and highlighting elements the architect considered important like ponds, buildings, or plants. The landscape garden became popular in Scotland in the 1760s.⁴² The pioneers of the movement in Edinburgh were James Robertson and Robert Robinson, two architects trained in England. Robert Robinson⁴³ seems to have been the one responsible for the design of Leith Walk botanic garden. He is the author of several of the projects for it and in particular of the ones most similar to the design that was finally adopted (App.Fig2). Robinson had worked on landscape gardens before and had even supervised the execution of designs by Lancelot “Capability” Brown, one of the most famous landscape gardens artists.⁴⁴ By hiring Robinson, John Hope was making a deliberate choice to use the landscape style for his garden and put Leith Walk not only a pioneer of the type of design for botanic gardens, but for Scottish gardens in general too.

The result was that the *sylva* was not designed with any straight or perpendicular axis. Instead, it was centred on an oval pond and all the paths and alleys were irregular, asymmetrical and convoluted (App.Fig1). It was also the only part of the garden that contains trees, which are planted all around. This may be one of the reasons it got the name of “forest”.

There are no records explaining why exactly John Hope made such an original choice for his new garden. The only botanic garden of the time which could have inspired this choice was Kew gardens in London.⁴⁵ The case of Kew was very different though, because the “exotick garden” or botanical section was only a small part of the property. The rest of it, the part that was using landscape design, was a leisure park for the royal palace it was attached to. Whilst it is possible

⁴⁰ Michel Baridon, *Le jardin paysager anglais au dix-huitième siècle* (Dijon: Editions Universitaires de Dijon, 2000).

⁴¹ Robert Purks Maccubbin and Peter Martin, eds., *British and American gardens in the eighteenth century: eighteen illustrated essays on garden history* (Williamsburg: The Colonial Williamsburg Foundation, 1986).

⁴² Arthur A. Tait, *The landscape garden in Scotland, 1735-1835* (Edinburgh: Edinburgh University Press, 1980).

⁴³ Also sometimes called Robertson, for very confusing reasons.

⁴⁴ ‘Robert Robinson’, in *Dictionary of Scottish Architects*, accessed 14 December 2018, http://www.scottisharchitects.org.uk/architect_full.php?id=408138.

⁴⁵ Desmond, *Kew*.

that the botanic garden of Edinburgh was meant to be read as a leisure space⁴⁶, I would like to consider what type of scientific information this could have conveyed as well.

First, the decoupage of the space, as unconventional as it was in its shapes, still worked to separate groups of plants. In the notes on the document entitled “intended plan” of 1782, Malcolm M’Coig, then Head-Gardener, gave an outline of the repartition in the garden:

- A. Places for dwarf shrubs, valuable, bienial and ornamental plants
- B. Places for tall and dwarf trees and shrubs and some beautiful umbelliferae
- C. Grass which make a part of the General Sylva in the swamp ground
- D. Rocks for rupestres plants
- E. For rare Aepiutichis
- F. A wall with a border for plants on each side
- G. For pits [?] the valuable Exotics in summer

The taxonomy used here is not Linnaean. It resembles more the one used in Pisa, combining many different criteria. In this regard, it is not so dissimilar to the organizing methods of traditional gardens, only presented in a different shape. It also considers aesthetic qualities – “ornamental plants”, “beautiful umbelliferae” – of the specimens, showing once again that the organization of the space was not only decided on dispassionate scientific criteria.

The movement of the landscape garden came from a new taste for natural environment, the recognition that nature did not necessarily have to be moulded by man to be beautiful – this immediately leading to man moulding nature to look as if it was beautiful without intervention. The landscape gardens invited people to “[leap] the fence and [see] that all nature was a garden” as Horace Walpole said.⁴⁷

Parallel to this new fashion, scholars had been going through what Richard Drayton called “the second loss of Eden”.⁴⁸ This was the realization, as more and more new vegetable species kept arriving in Europe, that no enclosed garden would ever be able to contain all the plant species

⁴⁶ For more details on this, see chapter 4 of this thesis.

⁴⁷ Morris R. Brownell, “‘Bursting Prospect’: British Garden History Now”, in *British and American gardens in the eighteenth century: eighteen illustrated essays on garden history*, ed. Robert P. Maccubbin and Peter Martin (Williamsburg: The Colonial Williamsburg Foundation, 1986).

⁴⁸ Drayton, *Nature’s government*, 19.

in the world. It was in fact impossible to recreate Eden in an *hortus conclusus*, the full system of classification, be it artificial or natural, could never be entirely illustrated in one garden.

Combining these two trends, it could be that the garden of Edinburgh was also to be read as an admission that the perfect neatly ordered *hortus conclusus* would never exist, and that imitating nature itself was a more valuable way to present plant knowledge. Like the private landscape gardens, it could be an invitation to think of nature as a complex environment, not entirely dictated by men's law of geometry and order, not unlike a forest. Like a forest too, plants in nature were not always separated into species but exists in ecosystems where they sometimes depend on one another. This latest principle was, voluntarily or not, illustrated by the planting of the trees all around, and only around, of the garden, so that they would protect the rest of the collection from the wind.

The garden of Edinburgh is an oddity in this sample and was in Europe when it was created in 1763. But looking at how deliberately each of the botanic gardens in this sample were laid out and what scientific information they conveyed, it is impossible to think that the choices made in Edinburgh were not also made to pass on some form of knowledge to the visitors. Of course, on top of this, and any other scientific classification criteria, botanic garden designs also considered more practical and aesthetic aspects. Considering how important the debates were on the organization of the space based on scientific criteria, one can wonder if those were hindrance to the scientific project or contributed to it.

Practicalities

John Dixon Hunt, in his analysis of the layout of botanic gardens, writes that they were designed “symbolically and practically”.⁴⁹ The role of the symbolic was the one I just examined, but it is important to consider what role practicality could play in the arrangement of the gardens. Hunt mentions practicality for access to the specimens by both the visitors and the staff taking care of the plants. Some of the choices made in the plans of the gardens were based on practical problems of maintaining the collections, since living plants were more complicated to care for than herbaria or books. Grouping of plants based on their life cycle or their preferred habitats made the work of gardeners easier by allowing them to water the plants together or making sure that species that preferred the sun could all be in the sunniest spot. I have mentioned already a few cases in which practicality played a role in the layout of the garden: the rectangular like shape of

⁴⁹ Hunt, *A World of Gardens*, 130–45.

the sections in the *Orto Sperimentale* in San Marco, the group of “rupestre plants” in Edinburgh, the “palustres” in Pisa. The most open considerations of practical aspects though, appear in proposals not carried out.

In Edinburgh, for example, the plan proposed by Nasmyth(App.Fig4) organised plants based on their life cycle (biennial, annual) and types (hardy, grass). These categories did not match Linnaeus’ classification system but were similar to the ones Linnaeus himself advised to use in the design of a botanic garden.⁵⁰ This organisation was designed for teaching purposes and for gardening practicality. For the teaching, it could help plan the demonstration lessons throughout the year based on what species would be flowering for example. On the practical side, grouping the plants with similar life cycles made it easier for the staff to take care of them. Less detailed but similar in intent, Crosbie’s plan(App.Fig.3) was not representative of any type of classification either, but its organization was based on a seasonal separation between winter, summer and autumn.

During the debates of the *Società Botanica* on the reorganization of their garden, Manetti’s plan was to group the plants based on “the situation or cultivation that they require, in the way that there would be in I° the annuals, in II° the perennials, in III° the wetland plants etc”. Like the propositions for Edinburgh, this organisation was based on what made cultivating the species easiest. It was already partially in place in the garden at the time of the debate. Manetti had arranged some of the plants by original habitat: “alpinus, palustris, maritimus, celsus, humilis, nemorosus, squallens, urens, glacialis”.

In regards to the use of the collection for teaching, Manetti justified this practical choice by writing that “the plants should not be used to learn the system, but instead the system should be used to learn the plants; and the entire system should be examined and questioned in books and on the desk, and not in the garden”⁵¹. In his idea the link between the garden and the classes was limited to the function of the garden as the supply of live examples. The garden would have necessarily needed verbal/textual interpretation to be used for teaching, except if it was used as a field for exercises, since students could practice identification of species in it. Manetti’s was a vision of a botanic garden arranged primarily for the convenience of the staff and not for teaching purposes.

⁵⁰ Carl von Linné, *Philosophie botanique de Charles Linné*, trans. François-Alexandre Quesné (Rouen: Leboucher, 1788).

⁵¹ Quoted by Stefani, ‘Linneo e Firenze’, 289.

Of course, such a plan could have still conveyed information. As the analysis of this chapter showed, his layout would simply have conveyed different information, about the natural habitat of the plants, for example. Prioritising practicality did not strip the garden of its demonstration potential. Nasmyth's plan for Edinburgh was another example of this: it gave information on the seasonality of plants, which illustrated the life cycle of plants. Different mediums were superimposed to produce different analysis of plants. Even in the most purely practical repartition imaginable, the organization of space would at the very least convey knowledge on the practicalities of gardening. Even when the people in charge of the design themselves claimed to not want to use the garden as demonstration of botanical knowledge like Manetti, the organization can still tell us about the state of plant knowledge at the time. There was no such thing as a neutral, or silent botanic garden. The layout was always a vector of knowledge.

The projects prioritising practicality tell us that botanic garden design was not a completely abstract task. It was rooted in the inescapable realities of plant life. This had to be considered in any design, and the fact that practicality was not prioritised in most cases since the projects based on practical criteria were not adopted or were changed in the course of the period, shows just how valuable scientific relevance was to the people in charge.

The Aesthetic

The discussion of the organization of gardens following scientific principle has established that this was one of the primary criteria considered by the people responsible for botanic gardens. However, no discussion of garden can avoid talking about the aesthetic and artistic ideals involved in their design.⁵² I have mentioned that fashion and taste played a role in the creation of the gardens. Indeed, their influence was probably the strongest factor in their looking so different. Before 1783, San Marco and Edinburgh both used the Linnaean classification system and yet looked nothing alike. This is partially due to the influence of local taste and tradition.⁵³ All three Tuscan gardens described so far had very different shapes and design, but shared similarities in style, probably inspired by traditional Italian gardens.⁵⁴ Though the number of statues had to be

⁵² Some examples of literature on this topic include Yves-Marie Allain and Janine Christiany, *L'art des jardins en Europe: de l'évolution des idées et des savoir-faire* (Paris: Citadelles & Mazenod, 2006); Michel Baridon, *Les jardins: paysagistes, jardiniers, poètes*, Bouquins (Paris: R. Laffont, 1998); 'Reading and Writing with Nature: A Materialist Approach to French Formal Gardens', in *Consumption and the World of Goods*, by John Brewer, Roy Porter, and Chandra Mukerji (London ; New York: Routledge, 2013), 439–61.

⁵³ Johnson, *Nature Displaced, Nature Displayed*.

⁵⁴ Alexander Samson, "'Locus Amoenus': Gardens and Horticulture in the Renaissance", *Renaissance Studies* 25, no. 1 (2011): 1–23; Giovanna Ragionieri, *Il Giardino Storico Italiano : Problemi Di Indagine, Fonti*

limited in a botanic garden, the geometrical designs of the Italian garden had the advantage of providing lots of separate beds. Though the traditional Italian garden style had originated in the Renaissance, the geometrical patterns were still in fashion and still used in the gardens in the late eighteenth century. The gardens could keep their designs for a long time because of inertia, lack of funding, tradition, and/or the difficulty of rearranging the layout. Pisa took pride in having one of the oldest botanic gardens and keeping a design similar to of the sixteenth century was also a way to honour the longevity of the institution. Tradition carried weight. Meanwhile, in Scotland, the botanic garden of Leith Walk was created just in time to fit with the fashion of the landscape garden, which had an influence on Hope's project.

Gardens were also spaces of leisure and beauty, even botanic ones. Aesthetics was an important factor outside of local tradition because people liked a beautiful garden, this resulted in the presence of ornaments. In Pisa and San Marco under the *Società Botanica* there were fountains in the gardens. In Edinburgh, Hope built a monument to Linnaeus, which was both a way to honour the great botanist and a pleasant addition to the garden. The consideration of the staff for aesthetic matters was directly voiced when Manetti objected to the Linnaean system on the ground that it would mix trees and shrubs which would not be "aesthetically pleasing". Despite the focus of contemporary discussions on classification matters, the visual aspect of the garden still mattered.

It is unclear if the concern for the aesthetic ever took over scientific considerations in debates or not in most of the gardens, especially because there are not many images of the gardens, apart from their plans, which do not give a precise idea of what the garden looked like for visitors. Based on the plans and visible signs of aesthetic research, the garden that seemed the least concerned with questions of aesthetic was the *Georgofili's*. All the ornaments of the previous design were taken down. This does not suffice to say that the garden was designed without any consideration for its appearance. As Arens points out, there could be ways to combine scientific order and aesthetics.⁵⁵ In Edinburgh, by contrast, it is easy to spot the aesthetic intentions. For example, since the *sylva botanica* was a landscape garden, it was probably organised with vistas. However, the division between the *sylva* and the *schola* meant that John Hope could have his cake and eat it too. The presence of a strict classification illustration in the north of the garden gave him the luxury of prioritising aesthetic choices in the *sylva*. This means that in both cases, the aesthetic, like practicality, seems to have been a secondary consideration, but still more important

Letterarie e Storiche : Atti Del Convegno Di Studi, Siena-San Quirico d'Orcia, 6-8 Ottobre 1978 (Firenze: L.S. Olschki, 1981).

⁵⁵ Arens, 'Flowerbeds and Hothouses'.

than practicality. The gardens could be beautiful as long as they also served their scientific purpose first.

Another way of looking at this is also to consider that the beauty of gardens also had a role to play in their scientific mission. The aesthetic aspect of the garden also played a role in making the garden attractive to various sorts of people, scholars and others.⁵⁶ Making the garden attractive was also a way to ensure it could carry out its mission to transmit scientific knowledge. A book never read would have little chance of educating anyone.

One last case study: la Specola

The garden of *la Specola*, planted in 1779, has not yet been mentioned in this chapter and I would like to use it as one last example of the many issues I have mentioned so far. As further chapters will show, *la Specola* was not a centre for botanical research and the staff of the museum seemed little concerned with changing their layout. It did have a focus on useful and indigenous plants, but it was not specialised in any specific branch of plant science. It had an extremely geometrical design and a few fountains, a straightforward design (App.Fig.8). In fact, the illustration of it puts little emphasis on the garden, with very few plants rising from the beds and little attention to them, suggesting that the aesthetic of the garden was not the first concern.

What the garden of *la Specola* endeavoured to do better than any other was to be legible. It combined all the techniques used in the other gardens, in the most simple and efficient way possible, to convey the maximum of information to the maximum of people as efficiently as possible.

Because of the multitude of subjects represented in the museum, it is obvious that *la Specola* was not part of the movement towards strong specialisation in scientific institutions like the *Georgofili*. In fact, it was going against this movement on purpose. Felice Fontana was a man of the Enlightenment and his museum was to be a form of *Encyclopédie* for science. Each science was given its own section of the museum. Like in the Pisan garden, there was a division and specialisation of space *within* the museum, with the garden, and some rooms inside the building representing botany.

⁵⁶ For more on the visitors, see chapter 4 of this thesis.

If the visitors were to follow the suggestion of the creators, the different sections of the museum were arranged in a very specific order.⁵⁷ This order was a representation of nature and the world and was meant to guide the visitors from the illustration of the microcosm to the macrocosm, whilst stopping by every reigns of nature. From the ground level of the museum where they entered, visitors would go through the departments for chemistry – the microcosm –, mineralogy, botany, zoology, human anatomy, and astronomy – the macrocosm – in the tower of the observatory which was at the top of the museum. Again, the spatial organisation of the collections had something to say about the world and the hierarchy in nature. Access to the botanic garden was on the first floor of the building, since the ground floor was mostly dedicated to chemistry and mineralogy.

The rooms were explicitly organised in a way that could convey information. Simone Contardi wrote that Fontana wanted a “model of knowledge that would be immediately perceptible by the greatest number of people possible. A type of knowledge based on the proof coming from instantaneous vision”.⁵⁸ For the botanic garden, the reasoned and rational organisation meant that the plan adopted was an extremely regular one. The plants were put in rectangular beds all the same size and all parallel to each other, following the Linnaen classification.⁵⁹ This plan followed the Italian tradition of gardens but was even more regular and severe than Pisa and San Marco. The austere aesthetic of the plan is reminiscent of the *schola botanica* in Edinburgh and coherent with the project of the museum.

The example of *la Specola*, not only through the garden, but through the entire museum, demonstrates that the conveying of information through space was absolutely part of the staff's plan. Unfortunately, the lack of written documents means that the exact objectives of the people of Edinburgh, Pisa, and San Marco can only be speculated about. Fontana, on the other hand, wrote extensively about his project for the museum and wanting to tell a story and share knowledge through the spatial arrangement of it. He was a perfect example of how delicate the choices of spatial organization were and of how important the consideration of what information those choices conveyed was to the people making them.

Conclusion

La Specola was an extreme example of what I have discussed in this chapter: the transmission of plant knowledge by spatial and material arrangement of botanical gardens. Though

⁵⁷ Contardi, *La Casa Di Salomone*, 181.

⁵⁸ Contardi, 187.

⁵⁹ BCNF, Targ Tozz 259, unbound sheet with plan of the garden.

the design of each of the gardens studied here was different, they were all inspired by common preoccupations. These preoccupations came mainly from the fact that botanic gardens conveyed information through the way they were arranged. Any spatial choice would have an influence on the nature or type of this information. As such, the space of botanic gardens was literally shaped by science.

This was true before the eighteenth century, of course, but the designs of the gardens in Tuscany and Scotland show that it became a pressing matter at a time where botany and plant-science in general changed so much. New specialisations required new spaces; new classifications required remodelling. The evolution of the gardens as material spaces presents an interesting mirror of scientific developments such as the increased popularity of Linnaeus' theories: in the 1750s, the *Società Botanica* settled for a double classification system, proving the endurance of the Tournefortian system in Italy, a decade later, John Hope, a Linnaean pioneer, used only the sexual system for Edinburgh, and in the late 1770s, *la Specola* did not even consider any other system. The debates over classification happening in the middle of the century seem to have had a strong influence on the debates on botanic garden design – the debates on this topic in San Marco started as early as the 1740s. They are not only the most cited in the contemporary debates, as shown by the example of the *Società Botanica*, but also in the historiography, which often emphasizes the changes in preferred classification in mentioning garden renovations.

Despite the actors' obsession with taxonomy, it is obvious that practicality and aesthetics were still important considerations and greatly influenced the design choices. The materiality of the garden had to convey information, but it was also its role to make knowledge beautiful and accessible.

Ultimately, the materiality of the gardens was a central aspect of their identity as spaces of science, not only in terms of space, but also of place: the organization of the garden was to be interpreted and therefore the space itself had scientific meaning. Aesthetics and practicality were part of this, enhancing the message and adding layers of interpretation to be uncovered in the various uses of the gardens, the first of which was teaching.

Chapter 2: Gardens as classrooms

[...] the famous Garden of Simples, named for the extremely rare Plants, and infinite qualities of Flowers, and of extremely rare Herbs, which are held there under the direction of a brilliant Lecturer, in order to give the knowledge of [those plants] to the Young Students of the Medical Art, deserves to be seen, for the various qualities of Herbs, and Medicinal Plants, known of the Naturalists; and for the different foreign Plants as well, which we did not have any knowledge of before today, [and were] brought from America and Oriental Indies for the decoration, and variety of this Garden.

This description of the botanic garden of Pisa was given by Pandolfo Titi in his *Guida per il passeggiare* in 1751.¹ Here, Titi very clearly associates the garden with a teaching function: “to give the knowledge of [those plants] to the Young Students of the Medical Art”. Botanic gardens had first been created in Pisa and Padua in the sixteenth century to reinforce universities’ curriculum. In the eighteenth century, their primary function was still to support teaching. This was not only true in gardens attached to universities, like Edinburgh and Pisa, but also in the various gardens of Florence. The gardens were not only spaces of knowledge as repositories, they were spaces of knowledge transmission.

Titi’s description mentions that this knowledge was to be transmitted to medical students. As was said in chapter 1, botanic gardens were still attached to the medical faculties, and/or associated with the wide field of medical knowledge, but not with the precise domain of pharmacy anymore. Titi’s distinction between medicinal plants and others type of plants in the garden does point at the new specialisations of plant knowledge that chapter 1 has analysed. The mention of plants’ properties unknown “before today” shows that growing medical plants was not the only function of the garden, even in its role in the transmission of knowledge to students. We saw the consequences of this in the organization of space, and I will now examine what it meant for teaching.

Titi also identifies the botanic garden of Pisa as a university space used by “Young Students” under the authority of a “brilliant Lecturer”. Yet, the author clearly visited the garden, and encouraged his readers to visit it, which implies an audience outside of medical students – the book mainly advertised itself as a guide on art. Titi explains that he himself learned about plants

¹ Pandolfo Titi, *Guida per il passeggiare*, 1751, quoted in Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 315–16.

during his visit, showing that teaching functions of the *orto* were not limited to an audience of students.

Titi wrote about Pisa, but this presentation, focused on the garden as a teaching place, could be applied to the other gardens of this study, although there were variations. His remarks introduce many of the themes that this chapter will discuss by focusing on how the garden was used for the formal and informal teaching of plant knowledge. The teaching function of botanic gardens is well known, but the historiography on botanic gardens often takes for granted the links between the actual physical garden and teaching, without examining precisely how a garden functioned as an educative space.² An exception within the historiography is Clare Hickman's upcoming publication *The Doctor's Garden*, which explores the sensory training of students in the garden.³ Most studies are also centred on a single garden and do not interrogate the overall mechanics of teaching, only the particulars of the one place. Even Nuala C. Johnson did not look to analyse precisely the relations between spatial organization and teaching, though this was mostly because her sample of gardens did not lend itself to the task.⁴ Building on Hickman's work on the sensory observation of plants in the teaching of botany, I will consider the different roles that the gardens could play in the teaching and how not only the individual plants, but the garden as a whole supported this process.

The chapter will first look at the formal teaching taking place in the garden. I will consider who this formal teaching was for and what methods it used. It will then look at which ones of those methods were entirely dependent on the material space of the garden. From then, it will ask to what extent this material learning could apply to a wider audience in informal teaching.

Formal teaching in the gardens

By formal teaching, I refer to the teaching that took place in the gardens in a setting including a defined group of students and a defined teacher, either an individual or a group. In formal teaching, the teacher is the carrier of knowledge and passes it on to the students. This happened in all the gardens, except *la Specola*, which did not have official classes and will therefore

² Noltie, *John Hope, 1725-1786*; Spary, *Le jardin d'utopie*; Yvonne Letouzey and Jean Dorst, *Le Jardin des plantes à la croisée des chemins: avec André Thouin, 1747-1824* (Paris: Edition du Muséum, 1989); Allain, *Une histoire des jardins botaniques*.

³ Forthcoming Clare Hickman, *The Doctor's Garden: Medicine, Science and Horticulture in Late Georgian Britain (Title to Be Confirmed)* (New Haven: Yale University Press, 2021). Thank you to Dr Hickman who generously shared her manuscript before publication!

⁴ Johnson, *Nature Displaced, Nature Displayed*.

not appear in this section. Those gardens had to be spaces that could host those students, but also actively support and enhance their learning.

The students

The teachers in botanic gardens were the directors. This group is easy to identify, and relatively homogenous as far as social and cultural status went.⁵ The groups of “students” were more varied. The students were in many ways the traditional audience of botanical institutions. This audience was made of students in a wide sense of the term: individuals who came to study; some were taking courses in the closest university, some were already trained scholars who came to expand their knowledge, but they all had to register with a professor to attend formal classes.

The main example of students visiting botanic gardens are, of course, Edinburgh and Pisa. Those two gardens were very closely linked with their respective universities. The students were sent to the garden as a requirement for part of their course. The *Guide for gentlemen studying medicine at the University of Edinburgh* (1792) clearly indicates that the visits to the garden were “necessary for those who mean to become candidates for the degree of doctor of medicine. [...]”.⁶ Another comment on botany being “only in a slight degree connected with medicine” stresses that at least some of the students were there by obligation more than out of pure interest.⁷

Mandatory presence applied to many students. In 1750, the Scottish capital counted around 300 students in the medical cursus only!⁸ As professor of botany, John Hope kept a detailed list of his students every year so we know who visited the garden regularly.⁹ The average number of students in Hope’s class was 71 a year, with variations, especially in the early 1760’s, when the garden moved to Leith Walk. Overall, the numbers grew over time, up to 100 in 1785, showing the popularity of the class.

⁵ For a detailed analysis of the role of directors of gardens and their teaching responsibilities, see Part II of this thesis.

⁶ J. Johnson and John Fleming, *A Guide for Gentlemen Studying Medicine at the University of Edinburgh* (London : Printed for G.G.J. and J. Robinson ..., 1792), 13.

⁷ Johnson, 13.

⁸ Robert D. Anderson, *The University of Edinburgh*, 77.

⁹ RBGE, Collection HOP - Hope, Dr. John (Regius Keeper 1761-86), GD253/144/8-10.

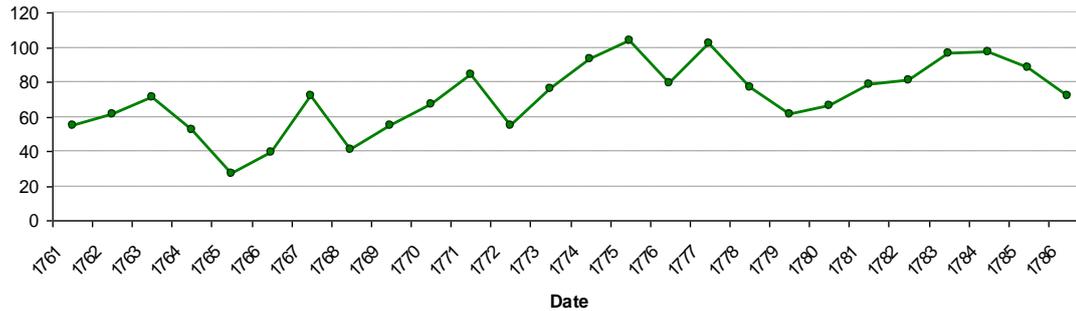


Figure 2 Number of students in John Hope's class

As far as Pisa is concerned, it is difficult to estimate how many students would have frequented the garden because there is no trace of a list in the archives. Tracking the information through testimonies is also tricky. A frequent motif of travellers' testimonies about Pisa was the perceived decline of the city, and the university, in particular in terms of population. This led to comments on the small number of students in publications such as the *Encyclopédie*, or the *Grand Dictionnaire Geographique et Critique* by Bruzen de la Martinière.¹⁰ Other sources, such as the great dictionary of Livorno, were more optimistic and flattering, describing the university as “equally celebrated and flourishing due to the distinguished merit of the professors and the number of students, normally from 500 to 600”¹¹. A closer study by Alessandro Volpi estimates that the university was frequented by around 260 students on average per year in the 1760s and 70s.¹² This was the total number of students in the university. They were spread between Law, Theology and Arts. Science and medicine were only a subsection of the Arts, so the number of students actually visiting the botanic garden might have been very small.

Although they were all registered with the faculties of medicine, the students coming to botany classes in the universities were not necessarily a homogenous group – although they did all share the characteristics of being male, (presumably) of Caucasian descent, and, in Edinburgh, Christians.¹³ Hope recorded many British (mostly English, generally around 10% of students) and foreign students in his classes.¹⁴ (Noltie counted 77 from North America, 35 from the East Indies, 5 Swiss, 3 Russians, 2 Germans, 2 Danes, 2 Swedes, 2 Frenchmen, 2 Dutchmen, 1 Italian, 1

¹⁰ Anna Vittoria Bertuccelli Migliorini, ‘Viaggiatori Stranieri in Sapienza’, in *La ‘Sapienza’ Di Pisa*, by Romano Paolo Coppini and Alessandro Tosi (Pisa, 2004), 61.

¹¹ Bertuccelli Migliorini, 61.

¹² Romano Paolo Coppini and Alessandro Tosi, *Sovrani Nel Giardino d’Europa : Pisa e i Lorena* (Ospedaletto: Pacini, 2008), 152.

¹³ The University of Pisa was open to Jewish students.

¹⁴ Noltie, *John Hope, 1725-1786*, 86.

Spaniard, and 1 Portuguese over Hope's career). Despite the lack of lists, we know that Pisa was attractive to Italians outside of Tuscany as well.

Beyond their geographical origins, an important factor of diversity amongst the student group was their social status. Whilst most students in Edinburgh and Pisa would have been youths studying medicine in the universities, some were established professionals looking to develop their skills in botany. Of these professionals, some used botany as part of their trades (in total on all the years recorded by Hope, 32% of the professional students are doctors, and 25% belong to medically related professions such as surgeons, druggists, or pharmacists) and others were attending classes out of amateur interest and without any particular professional objectives (43% of Hope's professional students).¹⁵ This phenomenon was not unique to Edinburgh and echoes the findings of Michael R. Lynn in his study of popular science in Enlightenment Paris, which showed an interest in science outside of predetermined university courses.¹⁶

In the case of Edinburgh, it is clear that botany students were not a homogenous group. No comparable documents exist for Pisa, so it is impossible to definitely say if such diversity existed there. Based on the numbers of students and the trends in the general population of the university as a whole, it seems unlikely as far as geographical origins are concerned, but not impossible regarding their professional status or reasons to be interested in botany.

Florence had no university, but the botanic garden of San Marco still hosted students. First, the *Società Botanica* described its garden as an element of support for the education of students from Pisa and from the hospital Santa Maria Nuova. It was to serve “the young scholars of medicine [who] leave Pisa for the academic holidays” and “youth from various Nations, who are learning Surgery, and Pharmacy” who were training in the hospital.¹⁷ In this description, the society clearly tried to link its garden to traditional institutions of learning, the university and the training hospital, rather than presenting itself like one. They suggest that their garden would be a complement to other universities gardens since the academic year did not include blooming season, a very real problem for the study of live plants.

¹⁵ Elena Romero-Passerin, 'Un Jardin des Lumières; Le Royal Botanic Garden d'Edimbourg à la fin du XVIIIe siècle' (Master thesis, Paris, Sorbonne Université, 2015), 143–54.

¹⁶ Michael R. Lynn, *Popular Science and Public Opinion in Eighteenth-Century France* (Manchester: Manchester University Press, 2006), 10–11.

¹⁷ BUB, Scaffale Msi, n°97, ff52-57, “Memoria presentata al Principe per Regolamento della Società”, no date.

Even if they did not emphasise it in those excerpts, the *Società* did employ a professor of botany and was therefore a space of formal teaching.¹⁸ During the time period studied here, this professor was Saverio Manetti. There are not many documents left on the classes in the *Società* but since Manetti was paid as a professor of botany, it is very likely that he offered classes.

It is not clear why the *Società* did not describe itself as a teaching institution for botany when they presumably offered classes on the subject. One hypothesis is that they did not see their lessons as formal classes because they were not aimed at a traditional student audience. The classes in San Marco did not deliver a diploma or contribute to a medical degree. Instead classes were probably aimed at members of the society or their equivalent: established men, members of the elites, or well-off classes of Florence. This audience of students must have been similar to that of the professionals attending John Hope's classes in Edinburgh. There was no other public botany class in Edinburgh than Hope's, so all the people interested in the subject had to attend courses in the garden. Edinburgh's garden cumulated the two types of student audiences that may have been split between institutions in Tuscany.

The *Georgofili* also offered classes in San Marco. Because the *Georgofili* focused on agricultural improvement, they had envisioned a very different audience of students than their university and society's counterparts. The archives of the *Accademia* show a great concern for the education of peasants, for example through discussions "on the project of creating in the countryside public schools for Agriculture without help from the State".¹⁹ The academicians would have liked to attract farmers and other agricultural workers to their classes. Peasants were the ones most concerned by agricultural science after all. For any of the techniques developed by the academy to be applied in Tuscan agriculture, the practitioners themselves had to be taught. Earlier in the century, Voltaire had humorously noted that "They wrote useful things on agriculture, everyone read them, except the ploughmen".²⁰ The *Accademia* seems to have been a great illustration of this quote.²¹ There are no official lists of students, but based on the registered members of the *Accademia*, who were the more likely audience for classes in the garden, not many agricultural practitioners found it relevant for them to join. Instead the members of the society, and presumably the majority of the students who attended the classes were, like in the *Società*, established men, members of the elites, or well-off classes of Florence; many probably interested

¹⁸ ADG, Documenti Vari, Busta 131, Ins.5, "Liquidazione della Società Botanica".

¹⁹ ADG, Verbali di Adunanze, 4, 7 June 1797.

²⁰ Quoted by Peter Jones, *Agricultural Enlightenment: Knowledge, Technology, and Nature 1750-1840* (Oxford: Oxford University Press, 2016), 60.

²¹ On the discrepancy between agricultural theory and practice, see Maddaluno, 'Practices of Science and Political Economy'.

in the topic of economy as landowners rather than agricultural practitioners. This means the audience was similar to the one of the previous garden.

All of these gardens were spaces of formal teaching. Though there was some diversity in the group, the types of students who attended their classes were quite similar from one garden to another. They could mostly be divided into university students, professionals, and elite amateurs. In Edinburgh, these different profiles were all mixed in one class. In Tuscany, they could be spread on different gardens: Pisa presumably hosting more students, the *Georgofili* receiving only professionals and elites, and the *Società* aiming for more of a mix. There were no noticeable changes in time through the period, apart from the ones brought by the handover of San Marco to the *Georgofili*. Though they fitted into three different categories, it should be noted that they shared more similarities than differences since there was a lot of overlap between those categories: students more often than not came from professional or elite families, professionals such as military officers or medical doctors could very well be part of the elite, and vice-versa. They could have different levels of motivation or interest in botany, but they shared many characteristics education-wise: literacy, familiarity with science, potentially Latin skills, and a shared objective of learning botany the way the class program described it, since they had registered.

Material facilities

These were the people for whom the curriculum was designed and who the gardens had to cater to. As far as formal teaching went, this meant that the gardens as material spaces had to be designed and used to support formal teaching. This teaching could take several forms in the gardens. The variations in how gardens were used as material facilities did not come from differences between student groups, since they different types of students were usually mixed in one class and shared enough similarities to learn in similar ways. Instead they came from the different methods of instruction that the professors would choose. The extent of the role that the gardens had to play in each method varied. The gardens were used as classrooms for lectures, resources for demonstration and observation, and finally as material for exercise, or practice of the knowledge. Most of the gardens' courses combined several, if not all, of the methods highlighted below, so the role of the gardens was to serve all those different purposes, but at different points in time.

Lectures and demonstrations in class

As part of the reforms that the two successive Lorraine Grand-Dukes had made in the University of Pisa, there was a minimum number of lectures for each subject that had to take place in the building of *la Sapienza*, the central building of the university.²² This measure had originally been taken to prevent lecturers giving class in their own homes and institutionalise university learning by giving it a more official space. It meant that some botany lectures would take place in the *Sapienza*, and other classes would be focused on demonstration and take place in the garden. This shows two different settings and methods for the teaching of botany. The fact that some class still needed to be in the garden stresses its practical importance in the teaching.

It turned out that giving the lectures in the *Sapienza* was not the most practical or efficient method for the professor of botany. In 1783, Giorgio Santi, freshly made professor of botany and chemistry in 1782 got the Grand-Duke to bend the rules for him by stressing that “the most useful lessons of the Professor of Natural History and of Chemistry are the ones during which he must unite to the lectures the Demonstrations, and the Observations” and asked to “be dispensated of doing all the Mandatory lessons in the *Sapienza*, and do only the number that he thinks sufficient for the science that he represents”.²³ This shows that the demonstrations and observations of plants were considered indispensable for the teaching of plant science – here part of natural history, since Santi’s official title was “professor of botany and natural history” – to the point that the regular rules of university organization did not apply to this course.

In Edinburgh, the cottage attached to the garden included a classroom where theoretical lectures could be delivered so John Hope’s work as a professor was conducted entirely in the garden and not in the university buildings. Like in Pisa, the garden had important role to play.²⁴ The student guide described the garden’s purpose as “illustrating the subjects of the lectures”, clearly linking the material collections to the formal transmission of knowledge.²⁵ This is reinforced by the fact that the classes for botany took place specifically in the summer, to allow students to observe the collections of the gardens in bloom.²⁶ In her work on how the senses were used in botanical teaching, Clare Hickman quotes Hope saying that he learned more about plants and *materia medica* through sensory observation than in any book.²⁷ This remark suggests that the

²² Coppini and Tosi, *Sapienza*; Coppini and Tosi, *Sovrani Nel Giardino d’Europa*.

²³ ASP, 13bis/G8, f406.

²⁴ On the botanic cottage see Jane Corrie, ‘Botanic Cottage Project - Stories from the Historical Archives, about Botanic Cottage, the Leith Walk Garden and John Hope’s “Other” Life as a Physician’ (Edinburgh: Friends of Hopetoun Crescent Garden, May 2009).

²⁵ Johnson, *A Guide for Gentlemen Studying Medicine at the University of Edinburgh*, 13.

²⁶ Noltie, *John Hope, 1725-1786*.

²⁷ Hickman, *The Doctor’s Garden*, chaps 1-Educating the senses.

demonstration and live observation of plants was not only necessary, but actually more valued than the lecturing when it came to plant science. The format of the university lecture, here defined as time where the students were only listening to the professor dictating his class and taking notes with no practical support for the content, was not seen as sufficient to convey the knowledge, like in Pisa.

This is not to say that there were no lectures in botany. Sets of notes for the lectures of John Hope in Edinburgh²⁸ as well as for those of Angelo Tilli in Pisa²⁹ exist and prove that there was indeed much lecturing going on. In fact, the program announced by Hope in his introductory class was: “Our course is divided into the three following parts: 1. Vegetation, 2. Classification, 3. A Demonstration of the different Plants in the Garden and Hothouses”.³⁰ There is no mention of how much time was to be dedicated to each part, but at least in importance, the demonstration in the garden does not seem to out-value the lectures on vegetation and classification.

Yet lectures and demonstration were not always separate entities, especially in Edinburgh where the collection was so close to the classroom. Henry Noltie noted that Hope’s different sections of the course bled into each other.³¹ There were some demonstrations taking place in class. By demonstration, I mean the showing of a plant specimen with an explanation by the professor. Part of the role of the gardens, and the advantage of lecturing close to them, was that it gave access to specimens that could be brought into the classroom for demonstrations. When Santi requested to spend less time in the Sapienza, he also mentioned giving class in his home, which was attached to the garden and would have given him the same advantage than Edinburgh’s classroom. These gardens filled a double role of material resources provider and teaching space. They grew and kept plants which were used as demonstration material during classes. This, obviously, had been the very first function of gardens like Pisa and Edinburgh when they had originally been created: to produce physical examples of the cases studied in class. In Edinburgh, parts of the collection were potted plants to allow for their transportation to the classroom. At the most basic level, gardens were made to produce material for teaching.

²⁸ Several sets of notes on Hope’s lectures have survived, documented by Noltie in *John Hope, 1725-1786*. The most thorough notes are the ones taken by James Cunningham on the class of 1781 found in Archives of the University of Aberdeen, MS 564, ff 1-134, “Dr Hopes Lectures on Botany”. The transcription of those notes was very kindly sent to me by Dr H. Noltie to whom I am most grateful.

²⁹ Although other records may exist, I have found notes (in Latin) on Tilli’s classes in the personal archives of Ottaviano Targioni-Tozzetti in BNCF, Targioni-Tozzetti 242.

³⁰ UoA, MS 564, f 2.

³¹ Noltie, *John Hope, 1725-1786*, 58.

The other way to do demonstrations of the plants was for the professor to accompany the students in the garden and look at the plants directly there. This was what was covered in that last part of Hope's class. The group was to move to the garden itself and to the hot houses. This would allow studying plants that were difficult or impossible to transport in the classroom like trees or exotics that needed the climate control of the hot house. The garden was in effect like the textbook accompanying the course.

Demonstrations with the professor were one of the reasons that laying out the garden according to classification systems in the way that was described in chapter 1 was useful. The content of the course was already neatly organised. The choice of the classification system or the criteria used to arrange the garden was important to the teaching because of this reason. A disconnect between the system taught in class and the system used in the garden could create difficulties for the professors, although, like a textbook, it was still possible to use the garden as a support even when not everything matched the course content exactly. This meant that the elaboration of the course and the arrangement of the garden were usually linked. I have already demonstrated that the spatial layout of the gardens conveyed information and looked at the example of university gardens. To not repeat the same examples, I would now like to build on this argument and examine the links between the space and curriculum design using the garden of the *Georgofili*.

What is economy? Teaching in the Georgofili

The director and professor in charge of the *Orto Sperimentale* for the *Accademia* was the Canon Andrea Zucchini. He was recruited in 1784, shortly after the academy was given the management and use of the garden of San Marco. Very few archival records pertaining to the actual day to day administration of the garden survive, so it is difficult to say when the work to transform the garden from the plan used by the *Società Botanica* to the new one started and ended, let alone who participated in the elaboration of the new plan. This means it is impossible to judge the extent to which Zucchini was involved in the design. It is also impossible to say what exactly was in the class he taught in this garden, since – to my knowledge – no set of notes on his classes exists. However, I argue that the analysis of the garden's plan and its legend already says a lot about the content of the course. Confronting this plan with the content of the classes given in the same garden by his successor Ottaviano Targioni-Tozzetti also suggests that the two men had slightly

different approaches and that the teaching in the garden evolved in the end of the eighteenth century.³²

Chapter 1 has shown that plants in the *orto sperimentale* were separated based on their uses. The legend listing the categories of uses discussed in chapter 1 reveals that the usefulness of plants was defined with peasants and farmers in mind. The garden included plants cultivated on a large scale for human or cattle consumption such as cereals, corn, or oil-producing fruits. It also included plants used in industrial settings like dyes or plants used to make fabrics. Those plants were the ones that Tuscan peasants were susceptible to grow in order to sell them and make profit. Other sections were aimed at everyday life like “kitchen plants” (garden vegetables) and medicinal species “with which the Peasants can cure some illnesses in themselves, and in Cattle”. This precision shows that the collection was only focused on knowledge that would serve rural populations best. These were populations who had a limited access to medical care so medicinal plants were essential. This also explains why there were exceptions to the useful taxonomy with some categories based on origins, such as “forest plants”. This group was not based on the functions but on how to best exploit the resources of the rural environment – the forest plants present in that part are mostly edible. This was a textbook to learn about farming focused on the practicality of life in the countryside. The course taught by Zucchini was aimed at an audience of farmers and agricultural practitioners.

This was also reinforced by the choice of a professor who had himself grown up in the countryside and developed “all the practice of agricultural matters, the talent, the genius, and the passion to apply them to subjects of public advantage” according to letters defending his hiring in 1784.³³ This was the reason he was preferred to other candidates “who could have more erudition”.

The content of his successor Ottaviano Targioni-Tozzetti’s lessons was published as the *Lezioni di agricoltura specialmente Toscana*.³⁴ The book was written based on the lessons he gave in San Marco in the year 1801 – and presumably before, which gives us an insight into the content of his teaching. The introduction of the book runs through the program, which contains – amongst other things – a section about “plant in general, their parts, their nutrition, and growth”, a section on food plants like cereals and oil-producing plants, another on plants used for thread, cloth, paper,

³² Fausto Barbagli and Daniele Vergari, eds., *I Targioni Tozzetti Fra '700 e '900 - Catalogo Della Mostra* (Florence: Accademia dei Georgofili, Museo di Storia Naturale & Università degli Studi di Firenze, 2006); Daniele Vergari, ‘Giovanni Targioni Tozzetti Georgofilo e Agronomo. Uno Scienziato al Servizio Della Comunità’, *Atti Della Accademia Dei Georgofili* I, no. 9 (November 2012): 881–94.

³³ ADG, Giustificazione di entrata e uscita, Busta 153, Ins.3, 53.

³⁴ Ottaviano Targioni-Tozzetti, *Lezioni di agricoltura specialmente Toscana del dottore Ottaviano Targioni Tozzetti professore di Botanica, e Agricoltura*, vol. I (Florence: G. Piatti, 1802).

and dyeing, and one on plants useful to treat and feed cattle. These topics align quite closely with the legend of the garden plan, but his comment about medicinal plants shows a new approach to the subject. Targioni-Tozzetti referred the reader to his book *Botanical Institutions* for an in-depth study of medicinal plants, but mentions that the *Lezioni* will cover “Saffron, Tobacco, Rhubarb, Pepper, and a few others, the cultivation of which is interesting as a branch of commerce”.

This program was already radically different from the one for the botanic lessons in Edinburgh quoted earlier. Here there were no introductions to the theory of classification, no focus on sensor recognition of species. Scientific names of plants are few and far between, instead replaced by common names: “cereals”, ‘saffron’, “vegetables”. The class does not invite to a reflection on plants in themselves. Even more clearly than in the other cases, one can see here the clear correlation between the content of the garden and that of the class. The different groups defined in this program are differentiated by their uses, just like they were in the compartments.

The focus on commercially profitable medicinal plants may reveal an evolution in the teaching between Zucchini and Targioni-Tozzetti. Though the plan of the garden read like a textbook on farming life, the *Lezioni* stress knowledge that would result in financial profit, and not necessarily aimed at farmers or peasants themselves. Saffron, rhubarb, tobacco and pepper were imported from Asia and America and learning about their cultivation was both an asset for international trade and for local agricultural development because growing any of them on European soil would have been extremely profitable. Targioni-Tozzetti chooses to emphasise this potential financial profit, rather, for example, than the perceived medical profit of the rhubarb, considered a cure-all.³⁵

Targioni-Tozzetti’s lessons seemed aimed at a different audience, not the farmers, but their landowners. Eighteenth-century Tuscany’s farming was still organized in the tradition of the *mezzadria*, in which the cultivator paid his rent to the landowner by giving them half of what the land produced.³⁶ The landlords were the one most susceptible to make big financial profit from agriculture and were therefore interested in commercially viable species, even if they were not personally useful to them. An audience of landowners was also probably much closer to the reality of people attending the classes in the *Georgofil’s* garden than farmers and peasants, suggesting that the change in the program may have come with the realization that peasants were not attending

³⁵ Clifford M. Foust, *Rhubarb: The Wondrous Drug* (Princeton University Press, 1992); Jonsson, ‘Scottish Tobacco and Rhubarb’.

³⁶ Maddaluno, ‘Forests, Woods, Roads’, 203.

the classes and that the content had to be adapted to its students. The plan of the *Georgofili*'s garden shows how closely intertwined teaching, students and garden space were.

Since there was no visible building on the plan of San Marco, we have to assume that the classes were given outside – a more realistic prospect in Tuscany than in Scotland – and therefore would have included a lot of demonstrating on top of lecturing, like in other gardens. But the new angle adopted by Targioni-Tozzetti at the end of the century shows that the same collection could be used with different approaches. Once arranged, the garden was an illustration, but human discourse could also change the way this illustration was perceived and mentally shape the collection in a different way. In lectures and demonstrations, the mental space was shaped by the professors and their discourse.

Observation and independent learning

In his document approving that botany lessons should take place in the garden of Pisa, the Grand-Duke stressed the importance of both “demonstration” and “observation”. Though he doesn’t give an explicit definition, here I will look at observation as the students examining plants on their own, without the immediate discourse of the lecturer to shape their perception.

This practice was very much considered an integral part of the students’ learning, even in formal teaching. One of its function was to compensate for lack of access to plants during the classes. In Florence, it was what the *Società Botanica* encouraged when they described their garden of San Marco as useful for people studying medicine in Pisa who couldn’t see the plants in full bloom there since the academic year ended before the summer. Hickman mentions how, in Edinburgh, the number of students in Hope’s classes made it difficult to bring all of them in the garden at once for fear of damages.³⁷ In this context, the students were encouraged to go visit the garden on their own outside of class hours. This encouragement was not only conveyed in the lecture discourse, but also in the material layout. I have already spoken in chapter 1 of the division into two main spaces of the garden of Edinburgh: the *sylva botanica* on one side and the *schola botanica* on the other. This division also played a role in the teaching of students, as shown by Head Gardener Malcolm M’Coig’s remarks on the idea of building a wall between the two in 1782:

The wall that is much wanted will be a charming situation for many of the hardiest exoticks besides dividing the Garden into two divisions so that the students may be confined to the Dispensary and the high parts of the Garden in the Morning till the Lecture begins at which time the Doors may be opened

³⁷ Hickman, *The Doctor’s Garden*.

to let them in to the place of Lecturing. After the Lecture is finished the Doors shut and them confined while they remained in the Lower parts.³⁸

This excerpt describes the schedule of the classes. The students were only permitted into one particular zone of the garden depending on the hour of the day. The “high ground” mentioned here included the *schola botanica* and the “lower parts” were presumably the rest of the garden. The higher part was the most organised one, and also the smaller one, so it could make it easier to contain the students before the class. The lower ground contained more and rarer plants that the students could discover on their own after the lecture. This time of observation was planned into the organization of the class. In fact, M’Coig thought it would be a good idea to have it almost physically enforced or at least physically represented. In this the garden was also planned like a course in itself, with a structured path for learning.

Observation was also a time when the physical layout of the garden played an important role. A taxonomy-based design could come in handy to help students identify plants more easily, but a non-system-based plan like the one of the *sylva botanica* came with its own advantages. Independent observation lead to practice and exercise of the skills learned in the class. For example, after Dr Hope spent some time giving students tips on how to use their five senses to identify species as discussed by Hickman, the students could go and do just that with the plants in the *sylva botanica*.

This process was described by Saverio Manetti during the *Società Botanica* debate on classification in San Marco. To defend his argument that the plants should not be arranged following the Linnaean system in space, Manetti argued: “the plants should not be used to learn the system, but instead the system should be used to learn the plants; and the entire system should be examined and questioned in books and on the desk, and not in the garden”.³⁹ In Manetti’s idea, the lecture, or the books, should be separated from the garden, and the garden’s purpose was not to demonstrate but to serve as support for the practicing of the theories learned then.

The garden of Edinburgh managed, in a way, to do both: on one side the physical illustration of the classification system, on the other the forest of interesting plants for students to observe. Of course, there would also be parts of the course when the professor would accompany them in the *sylva* during demonstrations. The official demonstrations came later in the course program though, so the first visits to the garden would not be guided.

³⁸ RBGE, HOP, “HOPE, John (various) IBB’s scrap book, memoir, misc, etc...”, “Remarks on the plan”; RCAHMS, EDD/275/15.

³⁹ Stefani, ‘Linneo e Firenze’, 289.

Teaching in botanic gardens could be done in different ways. Based on the gardens with the best archival evidence, it seems that most gardens used a combination of lectures, demonstration, and observation in their formal teaching. Most of these practices involved a professor helping the students interpret the garden via the medium of discourse either directly, with the professor presenting the plants, or indirectly, with his teaching influencing how the gardens were perceived by students. Formal teaching was an interpretative lens through which one could look at the garden. It was reserved for the defined group of students. However, non-students could also learn from a visit in the gardens through more informal teaching.

Informal teaching

Chapter 1 has shown that space and material organization could convey some information to the visitors of the garden. In the case of students, that information was more often than not interpreted by the discourse of a professor, but the physical garden on its own could also and had the ambition to be a vector of information for people who did not attend classes. Chapter 4 will discuss in more details the level of access and the identities of the non-student visitors. For now, I will limit myself to saying that the gardens were open to visitors many days of the year and that men and women of different backgrounds, from scholars to uneducated, from rich aristocrats to poor members of the lowest classes, could at times visit the gardens. This applied doubly to the garden of *la Specola*, which was in fact a champion of informal teaching. What information they could get out of the gardens depended on what type of medium or discourse they could use to interpret it.

First, for visitors who were keen on getting *ad hoc* demonstrations of the collections, there were possibilities to get help from the staff of the garden. Not the professors, but the gardeners could give tours and explanation to curious visitors. In Edinburgh, the first Head Gardener to work with John Hope, John Williamson, earned an additional income by charging visitors for tours he would give in the garden.⁴⁰ This was not an isolated practice, since it was documented in other institutions of the same type, such as the museum of natural history in the botanic garden of the University of Leiden, where the “anatomy servant” earned more money than the actual university

⁴⁰ John Hope mentions this when discussing the budget for the new garden, saying that the Head Gardener should earn more, to prevent the staff from charging visitors too much and from focusing on this rather than their work. RBGE, HOP, “Original Letters donated via Sibbald Trust”, John Hope to the Chieff Baron, January 1782.

professors doing the same thing.⁴¹ This method of experiencing and learning from the garden was quite close to the traditional formal learning, but did not rely on registration and regular attendance.

For people who went through the garden without any human guide, it is more difficult to gauge what their experience of it could have been. It greatly depended on their individual background. In the case of scholars, or educated people, they could experience the garden through the filter of their pre-existing knowledge in plant-science. For example, James Edward Smith, keen botanist and later head of the Linnaean Society of London, took a tour of the continent in the late 1780s and visited every botanic garden on his way. He wrote about Pisa:

The [botanic garden] seemed well stocked with hardy plants, arranged according to the Linnaean system. *Scirpus Holoschaenus* was here named *Juncus conglomeratus*, as at Montpellier. *Rhapis flabelliformis*, the Chinese palm, already mentioned at Leyden [...] was here in fruit [...] Unluckily taking it for a *Chamaerops*, I neglected to preserve any, and the fruit of the *Rhapis* has not yet been described.⁴²

His testimony shows that he was interested in comparing the classification of species in different places, thus refining his opinion on certain specimens. His note on Chinese palm also shows that visiting gardens in different countries would give him access to fruits that did not grow at home. This use of the garden to access plants he couldn't see otherwise is also confirmed by his comment on the garden of *La Specola* later in the same book: "the plants are fine, though not numerous; but we thought our pain of going thither amply repaid, by seeing an immense tree of *Dracaena Draco*, with the gum called Dragon's blood exuding most copiously".⁴³ He was happy to find a curious species, not easily accessible and to be able to see in the flesh things he had read about before. All those reactions can only be the result of his knowledge of botany and his expectations on what a botanic garden could bring him. Having had lectures previously, or being well-read on the topic of plant science, gave visitors a lens through which to interpret what they saw.

The informed experience of botanic gardens was not only the sole province of scholars or members of the bourgeoisie or the élite. Different levels or types of plant knowledge could bend

⁴¹ Rina Knoeff, 'The Visitor's View, Early Modern Tourism and the Polyvalence of Anatomical Exhibits', in *Centres and Cycles of Accumulation in and Around the Netherlands during the Early Modern Period*, by Lissa Roberts (Zürich, 2011), 155–76.

⁴² James Edward Smith, *A Sketch of a Tour on the Continent, in the Years 1786 and 1787* (London: printed by J. Davis; sold by B. and J. White, 1793), 265.

⁴³ James Edward Smith, 314.

the experience one way or another. In the garden of the *Società Botanica*, the staff complained that some “vulgar Women” were “well often drawn to superstition, a ridiculous belief in some virtues of the plants” and would pick those same plants.⁴⁴ Despite the obvious contempt that the women’s belief in plants’ virtues inspired to the writer, this was the result of a different plant knowledge system. The women did not share the same academic knowledge of the members of the *Società*, but they had a form of alternative knowledge or belief about the uses of the plants. This would allow them to experience the garden through a different lens. It is difficult to say then, what they would learn from the garden, but it shows that there could be different levels of interpretation and understanding of the collection.

There could be strategies to facilitate and homogenise those levels of understanding and experience for the visitors without guide. One of those was signage and was most evidently exemplified in *la Specola*.

La Specola: one space to educate them all

The type of knowledge imparted in *la Specola* was different to the other gardens. This knowledge of plants was less specialised. When creating the museum, Felice Fontana had wanted to make it accessible to anyone.⁴⁵ Fontana and the botany section director, Attilio Zuccagni, had made the choice to not focus on rare and exotic plants because they wanted the visitors to learn about species they were actually susceptible to find. The garden was mostly composed of plants native to Tuscany and meant to teach Tuscans about the resources of their own country. The teaching had to be relevant to the local population. This was inspired by the philosophy of the Enlightenment and on trend with some other institutions: the museum was to focus on useful science. Fontana wanted to make the place and its garden a “theatre of nature but also an inventory of knowledge that should always find its most significant vocation in practice”.⁴⁶ The plants that were chosen to be in the garden had to have specific uses that would make them relevant to the general population. The uses could be related to medicine, industry, or food. As with any practical knowledge, the objective was to share it and to teach people about it. This was similar to the garden of the *Georgofili*, except that the uses did not condition the physical organization of the garden.

What it did condition was the systematic labelling of every specimen in the garden. There was signage in every bed, so that people could learn about each species. Signage existed in other gardens but was often only made of numbers referring the visitors to a catalogue. The signs of *la*

⁴⁴ BUB, Scaffale Msi, n°97, ff103-105, “Incumbenze che si assegnano dalla Società Botanica al Giardiniere del Giardino de Semplici di Firenze”, nd. More on this particular detail in chapter 4.

⁴⁵ See Chapter 4.

⁴⁶ Contardi, *La Casa Di Salomone*, 105.

Specola were more developed. They listed not only the Linnaean name of the plant in Latin, but also its common name, and its possible uses in Italian. This meant that the only pre-required knowledge to learn from the garden was to be able to read. The use of the common names made it accessible to less-educated people. By the time *la Specola* was created in 1775, Linnaeus had long been established as the main reference and his system was also the most practical one to use for the museum's project. The Linnaean names – composed of only two parts, the names of the family, and the name of the species – were much easier to comprehend for a lay audience than long tortuous descriptions of physical attributes.⁴⁷ The simplicity of Linnaeus' system was once again its biggest asset, making it easy for people to understand and apply the system themselves. The signs of *la Specola* recognised in a way the value of common plant knowledge for those who had it, whilst offering the opportunity to learn what was deemed the more “scientific” approach to vegetable study. This was another material aspect of the gardens that could convey information and make the physical garden into a vector of information for its visitors.

People visiting *la Specola* did not need a background in plant knowledge to learn from the collection. They also did not need a guide – in fact Fontana was very clear that there was to be no formal teaching in the museum – or even a catalogue; everything was provided in the material space of the garden.

Conclusion

Botanic gardens' first function had been to support the teaching in the universities they had been attached to. In the eighteenth century, this was still one of their most important functions and had great influence on the garden as material spaces. The gardens served as classrooms in hosting the students, but also as textbook in supporting their learning, be it with demonstration or observation. Because the materiality of the space was such an important part of the transmission of knowledge, it could be a support of learning for students and non-students alike though it was interpreted differently.

This did not change much through the second half of the eighteenth century, though it could be applied in different ways and to new plant-knowledge specialisation such as economy. Each garden was unique, and each lecturer could have a different approach to the subject of plant science, but the gardens used the same strategies to enhance the learning experience of the people who went through them. Those strategies meant regardless of the shape that teaching took –

⁴⁷ In fact, Koerner argues that Linnaeus deliberately chose simple names to facilitate their use in economical prospects. Koerner, *Linnaeus*.

lectures, book reading, observation – it was always strongly associated with the materiality of the garden.

From the 1770s onward, *la Specola* represented the strongest change in the nature of teaching in botanic gardens. It introduced a garden that deliberately banned professorial interpretation from its space, and instead capitalized on the material and spatial nature of the garden itself to teach. This was probably made possible by the concentration of botanic gardens in Tuscany, which meant that each one of them could take slightly different approaches to teaching like university teaching, specialisation in agriculture, or indeed completely informal teaching, whilst Edinburgh had to offer all of the teaching levels in one.

Chapter 3: Gardens as research spaces

Though Pandolfo Titi focused his description of the Pisan garden on its teaching function, his brief mention of “the different foreign Plants as well, which we did not have any knowledge of before today” subtly points towards an important and often underestimated function of botanic gardens: research into plant science. Collecting new, rare, or even ordinary species allowed gardens’ staff to study them and therefore add to the sum of European plant-knowledge. The gardens were not only spaces of knowledge transmission, they were also sites of knowledge production. This chapter will investigate the ways in which this new knowledge was made and argue that the knowledge-making practices taking place in botanic gardens added to their specificity as spaces of science.

In his book *Ways of Knowing*, John V. Pickstone distinguishes between three main “ways of knowing” in the history of science: natural history, analysis, and experimentalism.¹ Of these three, of course, the first way, which encompasses observation and classification practices, is the most easily associated with botanic gardens. After all, the eighteenth century is commonly considered to be the “age of classification”.² As collections, botanic gardens were primarily made for observation and the previous chapter showed that the practice was an integral part of the teaching of plant-knowledge. This chapter will show that the practice was not only used for teaching and that the space was also arranged to optimize observation as a research practice. Observation and classification were undoubtedly central to the knowledge-making practices of the botanic gardens, but, as this chapter will show, they were also combined with other ways of knowing in the gardens.

Since Pickstone himself ruled that “analysis” developed mostly in the nineteenth century, I will not examine this “way of knowing here”. The big question will be on the cohabitation of observation and experimentation.

The nineteenth century imposed a classification of disciplines which gave more prestige to sciences associated with experimental practices such as physics and chemistry than with the natural history based subjects such as botany.³ Because of this and the perceived opposition between the

¹ John V. Pickstone, *Ways of Knowing: A New History of Science, Technology and Medicine* (Manchester: Manchester University Press, 2000).

² An image often based on the work of Michel Foucault, *Les mots et les choses: une archéologie des sciences humaines* (Paris: Gallimard, 1998).

³ David Cahan, *From Natural Philosophy to the Sciences: Writing the History of Nineteenth-Century Science* (Chicago: University of Chicago Press, 2003); Robert Bud, ‘Categorizing Science in Nineteenth and Early Twentieth-Century Britain’, in *Basic and Applied Research*, ed. David Kaldewey and Désirée Schauz, vol. 4 (New York: Berghahn Books, 2018), 35–63.

two types of science, natural history disciplines have sometimes been excluded from the study of the history of experimentation. A book like Gooding, Pinch and Schaffer's *The uses of Experiments* does not draw on natural history in its epistemological analysis.⁴ Going further, Maurice Crosland associates experimental science exclusively with the laboratory, a space designed to provide appropriate facilities for the sustained pursuit of experiments, allowing the experimenter to control as many aspect of the environment as possible. Crosland argues that botanic gardens were not laboratories, because they were sites for “cultivation, observation, and, ultimately, classification”, all three processes that he considers different from the “experimentation” that laboratories were designed for.⁵

Yet, since Pickstone's study, more attention has been drawn to the practice of scientific observation and its importance for the history of science that has shown that observation and experimentation are complementary.⁶ In her introduction to the history of scientific observation in the seventeenth and eighteenth centuries, Lorraine Daston points out that scholars of that period did not perceived the two practices as opposite or even as separate.⁷ Drawing on her work, this chapter will show how the two ways of knowing were used jointly in the specific context of eighteenth-century botanic gardens.

The chapter will also argue that the practice of both observational and experimental science in the gardens likened them to laboratories. With this argument, I directly contradict Crosland, and yet use his own words: “unlike the night sky or rock formations, the laboratory, far from being given, has to be planned, constructed and paid for”.⁸ As chapter 1 has shown, the gardens were sometimes supposed to represent nature, but they were always completely artificial environments. They were planned and organized meticulously based on many criteria. They were spaces designed to help understand and study nature, but very remote from nature themselves. To paraphrase Crosland, unlike wild vegetable ecosystems, the botanic garden had to be planned and constructed.

⁴ David Gooding, Trevor Pinch, and Simon Schaffer, eds., *The Uses of Experiment: Studies in the Natural Sciences* (Cambridge ; New York: Cambridge University Press, 1989).

⁵ Maurice Crosland, 'Early Laboratories c.1600–c.1800 and the Location of Experimental Science', *Annals of Science* 62, no. 2 (1 April 2005): 237.

⁶ See for example Lorraine Daston and Elizabeth Lunbeck, *Histories of Scientific Observation* (Chicago: University of Chicago Press, 2011); Cristina Grasseni, *Skilled Visions: Between Apprenticeship and Standards* (Berghahn Books, 2007); Daniela Bleichmar, 'Visible Empire: Scientific Expeditions and Visual Culture in the Hispanic Enlightenment', *Postcolonial Studies* 12, no. 4 (1 December 2009): 441–66.

⁷ Lorraine Daston, 'The Empire of Observation, 1600-1800', in *Histories of Scientific Observation*, by Elizabeth Lunbeck and Lorraine Daston (Chicago: University of Chicago Press, 2011), 81–114.

⁸ Crosland, 'Early Laboratories c.1600–c.1800 and the Location of Experimental Science', 233.

By considering knowledge-making practices in botanic gardens, this chapter hopes to contribute to recent discussions of scientific practices in early modern gardens.⁹ Most recently, Fabrizio Baldassarri and Oana Matei have chosen to showcase laboratory practices in all kind of gardens, a work that Denis Ribouillault and Ana Duarte Rodrigues obviously hope to continue. By focusing specifically on the botanic garden, I want to show how knowledge-making practices became formal and institutionalised research: the research itself was deliberate, methodically organized, practised by trained staff in an environment designed specifically for this purpose and the process was recorded. Contrary to many discoveries and progress in crafts, the knowledge-making in botanic gardens was less and less “accidental”. This meant that the gardens were defined as research spaces.

The chapter will first examine the knowledge-making practices in the garden and how they were mixed together. It will then focus more specifically on the role that gardens played in experimental practices. Finally, it will consider the resemblance between gardens and laboratories. Since *la Specola* was intentionally not a research garden, it won't figure much in this chapter.

Knowledge-making practices in the garden

Crosland's note that botanic gardens were spaces dedicated to “cultivation, observation, and, ultimately, classification” is correct.¹⁰ The gardens' collections supported these practices. It is, however, misguided to consider that these activities were removed from experimental practices. The practices associated with the “natural history” way of knowing as described by Pickstone – the recording of variety and change in nature – might be the most visible activities, but they were intertwined and sometimes impossible to separate from experimentation.

Collecting and observing new plants

Botanic gardens were spaces of collection. The previous chapter has shown how collecting in gardens served observational practices for teaching purposes. Students were trained to observe plants in a scientific way, focusing on the relevant parts or criteria, identifying characteristic features.¹¹ Research observation in the garden was done in a similar way, but the objects of

⁹ Juliette Ferdinand, *From Art to Science Experiencing Nature in the European Garden : 1500-170* (Treviso: ZeL edizioni, 2016); Hubertus Fischer, Volker R. Remmert, and Joachim Wolschke-Bulmahn, eds., *Gardens, Knowledge and the Sciences in the Early Modern Period* (Basel: Birkhäuser, 2016); Fabrizio Baldassarri and Oana Matei, *Gardens as Laboratories: The History of Botany through the History of Gardens*, 2017.

¹⁰ Crosland, ‘Early Laboratories c.1600–c.1800 and the Location of Experimental Science’, 237.

¹¹ Daniela Bleichmar, ‘Training the Naturalist's Eye in the Eighteenth Century: Perfect Global Vision and Local Blind Spots’, in *Skilled Visions: Between Apprenticeship and Standards*, ed. Cristina Grasseni and Daniela Bleichmar (Berghahn Books, 2007), 166–90.

observation were necessarily different. Instead of focusing on what was already known and had to be taught to the students, knowledge-making implied observing new things.

This could mean observing new and unknown specimens. The gardens' ever-growing collections showed a constant interest in new species and knowledge outside the realm of *materia medica*. Botanic garden collections had been expanding since their creation. In the eighteenth century, the collections started to grow faster thanks to public authorities encouraging or requiring that travellers, merchants, and sailors help the development of naturalia collections at home.¹² In 1696, John Woodward had already appealed to travellers for help in this process, encouraging non-initiated people to collect specimens and information for scholars in Europe.¹³ This type of appeal became more common through the century. In France, instructions were published in the *Journal Economique* by the Inspector general of the Navy and Lieutenant General of naval forces in 1753.¹⁴ In Britain, John Ellis, a correspondent of Hope, also published such a set of instructions.¹⁵ There was a strong interest in bringing new natural specimens to Europe.

The botanic gardens of Edinburgh, Florence, and Pisa benefitted from this phenomenon thanks not only to private contacts but also governmental support. In Edinburgh, Hope was put in contact with Casimir Ortega, the head of the Madrid botanic garden, by Robert Liston, an English diplomat in Spain. Liston served as an intermediary and translator for the two men.¹⁶ Through his contact with Ortega, Hope obtained seeds and plants from the Spanish colonies, especially South America, which would normally have been out of reach for him as a Briton. Hope was also in contact with the directors of British colonial botanical gardens in the Caribbean who sent him material from their region.¹⁷

¹² The process resulting from this phenomenon has been famously studied by Bruno Latour, *La Science En Action* (Paris: Éditions La Découverte, 1989) though it has since been critiqued; for other interesting takes on European collecting see for example Benjamin Schmidt, 'Accumulating the World: Collecting and Commodifying "globalism" in Early Modern Europe', *Centres and Cycles of Accumulation in and around the Netherlands during the Early Modern Period*, 2011, 129–54; Lissa Roberts, *Centres and Cycles of Accumulation in and around the Netherlands during the Early Modern Period* (Zürich: LIT-Verlag, 2011).

¹³ John Woodward and Victor Ambrose Eyles, *John Woodward's Brief instructions for making observations in all parts of the world, 1696* (London: Society for the Bibliography of Natural History, 1973).

¹⁴ Henri-Louis Duhamel Du Monceau, *Avis pour le transport par mer des arbres, des plantes vivaces, des semences, et de diverses autres curiosités d'histoire naturelle* (Paris: Imprimerie Royale, 1753).

¹⁵ John Ellis, *Directions for bringing over seeds and plants, from the East Indies and other distant countries, in a state of vegetation: together with a catalogue of such foreign plants as are worthy of being encouraged in our American colonies, for the purposes of medicine, agriculture, and commerce. To which is added, the figure and botanical description of a new sensitive plant, called Dionoea muscipula: or, Venus's fly-trap* (London: Printed and sold by L. Davis, 1770).

¹⁶ RBGE, HOP, "misc correspondence in box from Sibbald Trust".

¹⁷ See correspondence in previous as well as garden's accounts in RBGE, HOP, E414.

Tuscany had a much weaker presence on the international stage than Britain, but the Grand-Duke Peter-Leopold nevertheless participated in the expansion of the gardens' collections. He arranged on several occasions for exotic seeds to be brought to the garden in Florence.¹⁸ We also know from documents relating to *la Specola* that he reimbursed postal fees for the museum and that special arrangements were in place to facilitate the transport of natural specimens.¹⁹

The effort in bringing this new material in the gardens to be observed and recorded shows the interest in producing new knowledge. It also had an important impact on the space of the gardens, because a growing collection meant a growing need for physical space. Sometimes, this problem could be solved by a change in location. The gardens of Edinburgh and Pisa moved several times in their history. Changing locations was not always possible though. The garden of San Marco never moved, but, as we saw in previous chapters, its design was radically altered several times. Each of those gardens was confronted with the challenge of making space for research and offered different answers.

The previous chapters have already mentioned the expansion of the garden of Pisa in the 1780s made possible by the acquisition of a neighbouring garden used to create an economic garden.²⁰ The space needed to adapt – in this case expand – to support the new research into economical plants taking place in the garden.

When John Hope inherited two different botanic gardens in 1763, he decided to move both collections to a completely new location on Leith Walk. One of the major advantages of this move was that the new plot was much bigger than the previous ones. We know from the writings of its founder, Robert Sibbald, that the very first botanic garden was 40 feet by 40 feet, or 1 600 feet square.²¹ The plot of the next garden was not much bigger either. The Leith Walk garden, by contrast, measured 5 English acres, or 43 560 square feet.²² Hope and the authorities funding him recognized the need for more space to host and expand the collection.

The records on the sale of the plot of land show that Hope also took into consideration the need for further extensions of the garden in the future. Hope had bought the land the garden was built on even before his project was approved. The parcel he bought was actually larger than the garden he got funding for in order to guarantee that the garden could continue to expand for a few years in this location. Later plans of the city do show that the parcel around the botanic

¹⁸ BUB, Scaffale Msi, n°97, f771.

¹⁹ MG, ARMU. Affari 001 - 1771-1794, 123.

²⁰ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 220.

²¹ Sibbald, *The Autobiography of Sir Robert Sibbald*.

²² RCAHMS, EDD/275 ; NAS, GD253/146/6.

garden was a “property of Dr Hope”(App.Fig.5).²³ Hope had bought the land at a time when the city was expanding northward. The new Town was being built and it was clear that the city would keep expanding but Leith Walk was still far enough that the garden would not be surrounded or overtaken by buildings too fast.²⁴

In San Marco, the *Società Botanica* also needed more space for new species, but the garden could not expand. The only way to do this was to get rid of plants already in the collection. Members made efforts to remove the collection of citrus tree – more than 80 species of citrus trees! – inherited from the previous role of the garden as supplier of fruits for the Court in the seventeenth century.²⁵ They argued it “would be better ornament in one of the other Royal Gardens”.²⁶ This collection was not interesting to the *Società Botanica* as they wanted to cultivate “rare plants” instead. New species and new knowledge were given priority in the conflict over space in the garden.

A similar process was at play when the garden passed over to the *Georgofili*. The academy got rid of the exotic plants – and also, finally, of the citrus trees – and replaced them with plants that they were interested in such as cereals. They made space for their own research. Focusing on economic plants also allowed them to free some space because there was only a precise set of species that they were interested in. In both cases, there was a hierarchy of species based on the specific interests of the group.

The expansion of botanic gardens’ collections in the eighteenth century meant that gardens needed to expand their physical space or prioritize certain type of plants over others. The ways the gardens studied here responded to those needs show that the making of new knowledge was an essential part of their activities and that they all found solutions to adapt to it. In the case of Edinburgh, one can also see that it was envisioned that this need would not stop, and that Hope should plan on the long term. Plants were a space-consuming way to store knowledge.

Bringing all those new plants into the botanic gardens made them available for observation by the staff and visitors. The focus on new and exotic plants was in part to help develop theories

²³ NLS, AINSLIE John, « Plan of the Old and New Town of Edinburgh and Leith with the Proposed Docks », 1804.

²⁴ Brian Edwards and Paul Jenkins, eds., *Edinburgh: the making of a capital city* (Edinburgh: Edinburgh University Press, 2005); Michael Fry, *Edinburgh: a history of the city* (London: MacMillan, 2009).

²⁵ Tchikine, ‘Echoes of Empire’, 100–103.

²⁶ BUB, Scaffale Msi, n°97, ff52-57, “Memoria”.

of classification by adding new species into the systems.²⁷ I have already looked at the impact taxonomic theory had on the space of the gardens. Here, I want to add that bringing species from different parts of the world together in one garden allowed the observers to compare species more easily and create classification arrangements that were completely removed from consideration of natural habitat. Flowers from Peru could be placed in the same taxonomic group as those from China both theoretically and physically. Bringing the plants to a botanic garden was like putting them against the “blank background” described by Daniela Bleichmar: it allowed the observer’s gaze to focus exclusively on details and not pay attention to the plant’s ecosystem.²⁸

Botanists could use gardens’ resources to produce in-depth observations of different specimens. In 1761, Dr Carlo Guadagni, member of the *Società Botanica* in Florence, drew pineapple seeds that he observed with the microscope of Mr Cuffa, another member (Fig.3).²⁹ Guadagni and Cuffa knew each other through the society. There is no telling if the observation took place in the actual garden, but the pineapple they used certainly came from there. This is a good example of the type of observation that the collection of botanic gardens would allow. In this case the learned society also ensured that the members had access to specific instruments like the microscope which made it possible to have new observations of previously known species.

²⁷ For some studies on classification, see for example Farber, *Finding Order in Nature*; Koerner, *Linnaeus*.

²⁸ Bleichmar, ‘Visible Empire’.

²⁹ BUB, Scaffale Msi, n°97, f340.

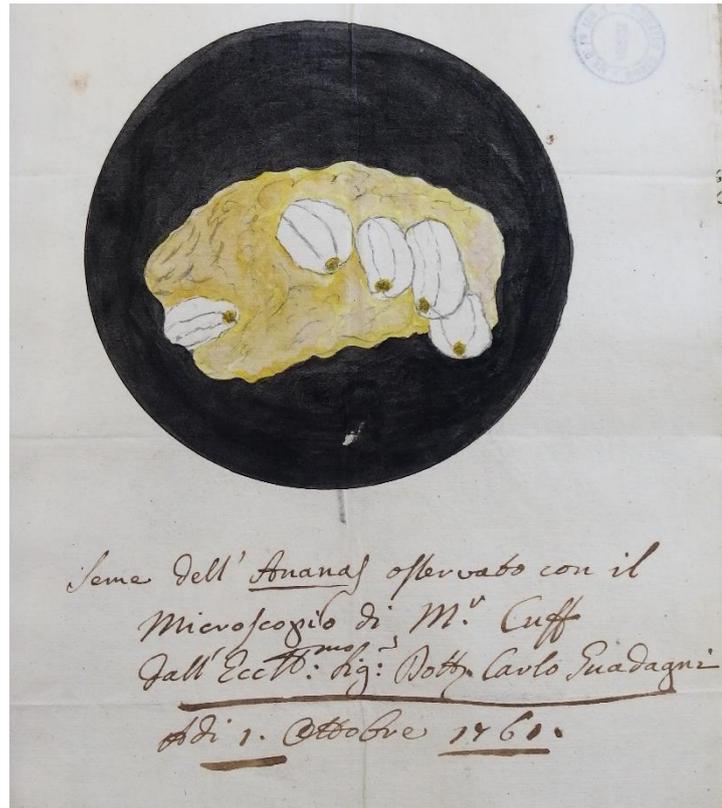


Figure 3 - Drawing of "Seeds of the Pineapple" by Dr Carlo Guadagni, BUB.

Long term observation and experimentation

Collecting plants in a botanic garden also allowed for long term observation. Since the plants in the gardens were living specimen, there was much to learn about their lifecycle, their growth, or the influence of the weather on their development.

In Florence, Ottaviano Targioni-Tozzetti published in 1810 his observation on the cultures he had been overseeing in the *Orto Sperimentale* for the *Georgofili*.³⁰ The document shows that he recorded variations of both the weather and the growth of his crops over the long term. For each year, the report mentions whether the spring was rainy, the winter cold, and other meteorological observations. These notes inform the results on the productivity of crops. In 1801, for example, the late rains led to a late and worse harvest than on years with a drier spring.

This was not unique to Florence. In Pisa, the plan of the garden from 1723 already shows that the roof of the buildings was equipped with receptacles to collect rainwater and measure precipitation. Monitoring the weather was common practice in botanic gardens. The long-term

³⁰ Ottaviano Targioni-Tozzetti, 'Osservazioni Ed Esperienze Dal 1801 al 1807', in *Atti Della Real Societa Economica Di Firenze Ossia de' Georgofili*, vol. IV (Florence, 1810), 418–25.

parallel observation of plant growth and the weather fit into the definition of natural history given by Pickstone because they are records of change. However, this double practice was also linked to experimentation because the plants had to be planted, grown, and kept alive. This was not a ‘controlled experiment’ where a botanist would, for example plant two identical seeds and voluntarily altered their growing condition (e.g. watering or not) to compare the results. Instead it was a form of ‘natural experiment’ where the conditions were not controlled but carefully recorded to be linked to the results. Their observation often was only possible because of an experimental process.

In 1786, Hope wrote to Casimir Ortega, through Robert Liston:

I have the pleasure of sending 38 sorts of seeds, all from the Cape, and all recent; unluckily however they came without names; but when they flower Professor Ortega will have pleasure in ascertaining their Names Genus and Species.³¹

This quote perfectly illustrates a common practice in all European gardens at the time.³² Seeds were sent to the gardens from all around the world with very limited information. The only way for Ortega to identify the species was for him to plant and grow the seeds. Botanic gardens were not limited to a role of passive collection for observation. Even the most basic level of taxonomy work – identifying the names, genus, and species of a specimen – required manual labour first, something most commonly associated with experimental sciences.³³

This part of the work done in botanic gardens, especially when it was conducted on completely unidentified seeds, could be described as pure exploration. Florike Egmond has argued that this process was experimentation in natural history.³⁴ In the cases studied by Egmond, these experiments were often motivated by pure scientific curiosity. Hope’s letter seems to suggest Ortega would grow the seeds for taxonomical studies.

Beyond these very theoretically inclined motivations, there were also more practical reasons to carry out these experiments. Historians like Emma Spary and Anatole Tchikine have

³¹ RBGE, Collection HOP - Hope, Dr. John (Regius Keeper 1761-86), Indices to NAS papers various photocopies etc, John Hope to Robert Liston, 21 January 1786.

³² Here, I have to make an exception for the garden of the *Georgofili*. Since it was focused on agricultural plants, there was a strict selection of what species should be grown.

³³ Crosland, ‘Early Laboratories c.1600–c.1800 and the Location of Experimental Science’.

³⁴ Florike Egmond, ‘Experimenting with Living Nature: Documented Practices of Sixteenth-Century Naturalists and Naturalia Collectors’, in *Gardens as Laboratories: The History of Botany through the History of Gardens*, ed. Fabrizio Baldassarri and Oana Matei, 2017, 21–43.

shown that the seventeenth and eighteenth centuries started to emphasize the usefulness of plants outside of medicine.³⁵ Because new plants were considered interesting for their practical uses as well as their theoretical identification, the physical labour of growing them was not only a means to the end of observing the end result. The growing of the plant itself was an experiment in gardening methods, the planting of any new seed, identified or not, was an experiment to determine what it was, if it would grow, and how.

Experiments on acclimatization were a good example of this interest in gardening methods. The idea of acclimatization was to move plant – or animal – species into regions with a different climate. Eighteenth-century naturalists believed that there were methods that would allow the species to get used to its new environment and be able to grow and thrive there, becoming the equivalent of a native plant. Carl Linnaeus summarised the process by describing it as “[collecting plants] from other places and cultivate [at home] such thing that don’t want to grow [here] but can grow [here]”.³⁶ Some earlier examples of acclimatization in Europe include citrus trees, such as the orange-trees studied by Ana Duarte Rodrigues.³⁷ New species becoming part of the landscape was the goal of botanists interested in acclimatization, but it was often hard to achieve – if not impossible – when dealing with plants from very different climates.

There are not many records of acclimatization experiments in Pisa, but there are traces of the end results. Nineteenth-century sources date to 1787 the planting of a famous Japanese *gingko biloba*.³⁸ We also know that the eighteenth-century garden had specimens of coffee, pineapples, and potato. And for a complete success story, showing that the gardeners figured out how to make the plant not only grow but also reproduce: the first Pisan banana was grown in 1769!³⁹ All those species ordinarily grew in completely different conditions than the Italian climate, and were different from each other as well.

In Florence, we already know that the *Società Botanica* grew pineapples. The *Georgofili*’s archives also show interest for experiments on cotton, tobacco, and rhubarb.⁴⁰

³⁵ Tchikine, ‘Echoes of Empire’; Spary, ‘Peaches Which the Patriarchs Lacked’.

³⁶ Koerner, *Linnaeus*, 1–13.

³⁷ Ana Duarte Rodrigues, ‘The Role of Portuguese Gardens in the Development of Horticultural and Botanical Expertise on Oranges’, in *Gardens as Laboratories: The History of Botany through the History of Gardens*, by Fabrizio Baldassarri and Oana Matei, 2017, 70.

³⁸ Ferri and Vannozi, *Giardini Dei Semplici*, 47.

³⁹ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 73.

⁴⁰ ADG, 4. Registro delle Adunanze dell’Accademia, p. 48; Accademia dei Georgofili, *Atti Della Real Società Economica Di Firenze Ossia de’Georgofili*, Giuseppe Pagani, e Compagni Stampatori della detta R. Società, vol. II (Florence, 1791), 5; Targioni-Tozzetti, ‘Osservazioni Ed Esperienze Dal 1801 al 1807’.

In Edinburgh, Hope carried out several acclimatization trials, one of the most famous ones concerning the tea bush, for which records of the process still exist. In 1775, Hope managed to have tea seeds smuggled out of China.⁴¹ To try to get them used to the cold European climates progressively, the seeds were planted in soil whilst sailing along the West coast of Africa.⁴² This would allow the shoot to come out and grow as the temperatures grew colder and the climate harsher. The catalogue of 1778 shows *Thea Bohea* in the collections of the garden and Hugo Arnot's guide to Edinburgh, published in 1779, mentions that "the tea-tree [...] was in full flower last summer", so it seems that the experiment was somewhat successful.⁴³ The success was unfortunately short-lived since it seems that the tea bush was dead by winter 1779, finally defeated by the Scottish weather.

Michelangelo Tilli and John Hope were by no means the first to attempt to acclimatize exotic vegetables. The same species they grew had been planted several times before in Europe, most famously by Carl Linnaeus. The repetition of trials all around Europe concerning those species – and many others – shows that botanists tried to improve on and replicate each other's work. Just because other attempts to grow tea in Europe had failed did not mean that Hope should not try and come up with a better method for it. As in any experimental process, the botanists were trying variations and learning from failures. Botanists replicating each other's work showed for example in the spread of pineapple culture through the writing of treaties on its cultivation. It was not enough to say that you could grow such or such species, if you had found a good method for it, others had to be able to replicate your results.

This experimental process allowed eighteenth-century botany scholars to build their knowledge of plants' needs – temperature, water, sun exposure, climate conditions – and life cycles.⁴⁴ The tea bush is an example of this since the species was implanted *en masse* in Northern India a few years after Hope's failed experiment.⁴⁵ From failed attempts, botanists understood that European acclimatization was not always possible, and the circulation of species took on a more global turn.

The experiments on growing techniques were also not limited to exotic species. Though the *Georgofil's* garden did supervise work on acclimatization, it was also the site of research on

⁴¹ For more on the economic aspect of this story, see chapter 9.

⁴² Jonsson, *Enlightenment's frontier*, 78.

⁴³ Arnot, *The History of Edinburgh*, 419.

⁴⁴ An interesting case study on the circulation of cultivation knowledge can be found in Ruth Levitt, "A Noble Present of Fruit": A Transatlantic History of Pineapple Cultivation', *Garden History* 42, no. 1 (2014): 106–19.

⁴⁵ Jonsson, *Enlightenment's frontier*, 85.

plants that had long been part of the Tuscan landscape such as olive trees or cereals. Though less spectacular, the experiments carried out on those answered the same research questions as the ones on pineapples and bananas. They were designed to help scholars understand what would help the plant to grow most and how to harness that knowledge to boost production.

The observation and classification practices that took place in the gardens depended on the physical and manual labour put in by the gardening staff. The importance of manual labour made botany closer to experimental and laboratory practices than could first appear.⁴⁶ Often this manual labour was partially or totally experimental, blurring the line between natural history and experimentation practices in the garden. The importance of the gardeners' efforts was also one of the major differences between field botany and botany in the gardens.⁴⁷ Gardeners were doing mostly physical work, and had varying levels of education in the theory of botany. Because of this, they could be considered craftsmen rather than scholars. Yet the work they did in the gardens was not crafts experimentation based on trial and error, but deliberate scientific research.

Based on the archives of these gardens, it is impossible to tell who was in charge of designing the experiments. The new species were usually acquired by the directors, which would mean that the impetus to try and grow them came from the theoreticians, but it is unknown who decided on the practicalities of the care that would be given on each specimen. The gardeners were given instructions by theoreticians, like laboratory assistants, but they might have had a big impact on the designing of the said experiments and therefore be even more important to the research than assistants.

Experimental ambitions

In 1766, the Grand-Duke Peter-Leopold visited the *Società Botanica* for the first time. He was welcomed with a speech about the society and its objectives.⁴⁸ The speech expressed the intentions of the members to “[sacrifice] our health and a small part of our assets for the cultivation of this garden”, motivated by “the desire of picking back up the thread of the philosophical experiments started by [the academy *del Cimento*], many years ago already, but never continued for lack of a protector [...]”.

⁴⁶ See for example Iwan Rhys Morus, ‘Invisible Technicians, Instrument-Makers and Artisans’, in *A Companion to the History of Science* (John Wiley & Sons, Ltd, 2016), 97–110.

⁴⁷ Sarah Easterby-Smith, ‘Recalcitrant Seeds: Material Culture and the Global History of Science’, *Past & Present* 242, no. 14 (1 November 2019): 215–42.

⁴⁸ BUB, Scaffale Msi, n°97, ff204-206, “Discorso preparato per S.A.R. quando gossa venuto all Orto de Semplici di commisiono de Soci Bottanici dal Senato. del Riccio Pres. della Società e da esse lettere nell'Adundanza del di 8 di Agosto 1766”.

The *Accademia del Cimento* was a seventeenth-century Tuscan academy created in Florence in 1657 and dissolved ten years later.⁴⁹ It had become famous for its natural philosophical experiments, for example on the possibility of creating a vacuum, or on the expansion of cold and heat. Though it only existed for ten years, the *Cimento* had become renowned in Tuscany and beyond and was often referred to as an embodiment of the spirit of scientific enquiry.⁵⁰

In this speech, the president of the *Società* was clearly stating the ambition of the society to not only take part in research and create new knowledge, but also to do it following the methods of experimental physics. The speech shows a clear awareness of experimental practices and an intention to make botany into an experimental science. The society defined themselves as researchers and their experimental knowledge-making activities in the garden were therefore very much intentional.

Beyond the practical experiments led by the gardeners, there were other ways that the gardens supported experimental work both in and out of its space.

Experimentation outside of the garden

Botanic gardens were involved in studying the uses of plants. Once grown, the plants could be used in various fields, from medicine, to agriculture, to industry. Botanic gardens had traditionally been working mostly with medicinal plants, but the seventeenth and most importantly eighteenth century saw this change.⁵¹ The investigation of the uses of plants was closely linked to the gardens, but this was the type of experiments that was most likely to take part outside the physical space of the garden so I will not go into too much details about them and limit this section to a few examples.

As collections of many plants, gardens could supply researchers with the material to use for research. Earlier in the century, Herman Boerhaave had conducted his plant-chemistry experiments on specimens from the botanic garden of Leiden, of which he was the director.⁵² In Pisa, by the second half of the eighteenth century, Giorgio Santi opened a new chemical laboratory

⁴⁹ See for example W. E. Knowles Middleton, *The Experimenters: A Study of the Accademia Del Cimento* (Baltimore: Johns Hopkins Press, 1971); Luciano Boschiero, *Experiment and Natural Philosophy in Seventeenth-Century Tuscany: The History of the Accademia Del Cimento* (Dordrecht: Springer Verlag, 2007).

⁵⁰ Cochrane, *Tradition and Enlightenment*.

⁵¹ Spary, 'Peaches Which the Patriarchs Lacked'; and chapter 9 of this thesis.

⁵² Ursula Klein, 'Experimental History and Herman Boerhaave's Chemistry of Plants', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 34, no. 4 (1 December 2003): 533–67.

in the house attached to the garden and may have used some physical resources from the collection to carry experiments, just like Boerhaave did.

The experiments on the plants could also take place completely outside of the garden. When, in 1762, James Mounsey brought rhubarb seeds from Russia to Edinburgh and the species was successfully acclimatized in the garden, experiments followed to determine how to maximise the production of drug made of dried rhubarb roots and how to best use it.⁵³ Clifford M. Foust describes the experiments on patients' bowel movement conducted in hospitals, included in Edinburgh.⁵⁴ Though the experimenting took place outside of the physical space of the garden, it was still involved as an institution.⁵⁵

Experiments in the garden

There were also more experimentation taking place in the physical space of the garden itself beyond the gardening practices. Edinburgh is the best and most complete example of this. The archives show practices that are much easier to relate to the image of experimentation normally associated with the nineteenth century.

In his chapter on Hope's lectures, Henry Noltie gives many details about the knowledge of vegetation they demonstrated.⁵⁶ In the parts on anatomy and physiology, he also shows how some of that knowledge came or was illustrated directly by experiments carried out by Hope in the garden, some of them illustrated. In one of those experiments, Hope put evenly spaced pins into the "young shoot of a plane (*Acer pseudoplatanus*)" and recorded the changes in the set up through time.⁵⁷ The illustration of the experiment shows the plants at five different dates in May and June 1772. It demonstrates that growth usually occurs at the apex. Comparisons with other species also informed on the variations of this rule. Other experiments had to do with the effect of light and gravity on plants. John Lindsay's drawings show plants under barrels to block the sun light, except for the light reflected by a mirror placed at the bottom.⁵⁸ Those experiments show plants orientating themselves towards the light, demonstrating the importance of sunlight to grow plants. Set ups that involved placing plants upside down also show how the plants correct their positioning to follow the sunlight as close as possible, a phenomenon called heliotropism. These practices

⁵³ John H. Appleby, "Rhubarb" Mounsey and the Surinam Toad—a Scottish Physician—Naturalist in Russia', *Archives of Natural History* 11, no. 1 (1 October 1982): 137–52.

⁵⁴ Foust, *Rhubarb*, 151.

⁵⁵ For more on this and on rhubarb, see Part III of this thesis.

⁵⁶ Noltie, *John Hope, 1725-1786*, 58–78.

⁵⁷ Noltie, 63.

⁵⁸ Noltie, 66–67.

clearly show Hope, and other colleagues who did the same, using experiments to try and create universal knowledge about plants, a process typical of laboratory spaces.

Noltie notes that Hope also reproduced other botanists' experiments, mentioning for example Stephen Hales, or Henri-Louis Duhamel du Monceau. This could be an example of the practice of reproducing results that I have already mentioned, but it was also important because both original and non-original experiments were used for pedagogical demonstration. Some experiments were not carried for knowledge creation but for knowledge transmission. This stresses the continuing importance of teaching in botanic gardens – at least universities ones, it is unclear if this practice existed in San Marco – and also shows how important experimental practices were to botanists. Hope himself noted in his lectures that he was teaching his students the “experimental method”.⁵⁹ Like the *Società Botanica*, he was explicit in his dedication to experimentation. His goal was to encourage more research by giving students the tools to become botanical experimenters themselves.

Experimental practices in and out of the gardens show how important experimentation was to the study of plant-knowledge. Botanic gardens were deeply involved in experimental knowledge-making. The scholars working in the gardens were not only aware that they were engaging in experimentation, they also pushed for it to become an ever more important part of their research. These experimental practices were made easier by the nature of the botanic garden itself, which offered a laboratory-like environment for botanical science.

Field-laboratories

Botany was not monolithic in its practices and should therefore not be opposed to other sciences, like the experimental ones, as a block. In his work on Linnaeus and his followers, Frans Stafleu identified two types of botanists: the *botanistes voyageurs* who travelled around the globe and studied plants in their natural habitat, and the *botanistes de cabinet* who, like Linnaeus, worked from their garden and collection in Europe.⁶⁰ A simple division into two seems reductive when there were many different type of *botanistes de cabinet* including ones who, like the garden directors, did not work indoors as much as the title would suggest, so, since I am not discussing *cabinet* practices, I will instead refer to the botanists studied here as “garden botanists”. The different types of botanists were connected and inter-dependent. The garden botanist needed the field botanist to send them new species and information. The field botanist needed the garden botanist to gather

⁵⁹ Noltie, 58–78.

⁶⁰ Stafleu, *Linnaeus and the linnaeans*; for the travelling botanist see also Londa Schiebinger, ‘Voyaging Out’, in *Plants and Empire* (Cambridge: Harvard University Press, 2004), 23–72.

the various strands of information from around the globe and keep them updated about the development of the discipline at home.

The work done by those two categories of people could be quite different, in part due to the specific environment provided by European botanic gardens. I have looked previously at how the garden's environment enabled certain practices like comparative observation and classification. In this last section, I want to focus on what made the gardens like the laboratory. The similarities between the two types of spaces of science set apart the knowledge-making practices of the garden botanist from the ones of the field botanist.

Greenhouses

As an indoor space, the greenhouses were an artificial environment for the plants where the staff could control many factors, from temperature, to humidity, even to sun exposure. Because of this high level of control, it is easy to identify greenhouses with laboratories.

The interest in greenhouses was not new to the late eighteenth century but their popularity grew significantly during the period.⁶¹ This was due to the interest in exotic plants and the experimental cultivation that came with it. In Tuscany, greenhouses had first been used by Michelangelo Tilli in the botanic garden of Pisa in the early years of the century.⁶² His successors built several new greenhouses in 1752, then 1804.⁶³ In Edinburgh, Hope inherited gardens without greenhouses, but all the proposed designs for the new garden included one or several greenhouses(see appendices). No matter the arrangement, the greenhouse was a required element. By the end of the century, the greenhouse had become a staple of botanic garden architecture.

This did not mean that every garden had a greenhouse. In its early days, the *Società Botanica* complained that they did not have the necessary resources to build a greenhouse, essential to grow plants from warm climate, and it seems they never could manage to.⁶⁴ Greenhouses could mark the inequalities between different botanical institutions. Famous and well-funded gardens were equipped with greenhouses, especially when they had access to many exotics through strong colonial or commercial ties and could therefore carry ambitious experimental programs. Edinburgh was trying to emulate this model. San Marco was but a secondary garden in the European landscape. Though it was also a laboratory space, its lack of means meant that it could not afford to compete with some of these other institutions in terms of research. This may be part

⁶¹ Yves-Marie Allain, *Une histoire des serres: de l'orangerie au palais de cristal* (Versailles: Ed. Quae, 2010).

⁶² Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 69.

⁶³ Garbari, Tongiorgi Tomasi, and Tosi, 73; 221.

⁶⁴ BUB, Scaffale Msi, n°97, ff52-57, "Memoria".

of the explanation for the change from the *Società* to the *Georgofili*. To compete in terms of research with other classic botanic gardens, San Marco would have needed a much higher budget. In a country where the garden of Pisa was already famous and equipped with greenhouses, it made little sense to duplicate that investment. Instead, the garden was given a more specific approach to research – agriculture and economy – which did not require greenhouses. The absence of greenhouses did not signify the absence of research or experimentation, but their multiplication in many gardens did highlight the development of experimental culture.

The multiplication of greenhouses also was not limited to one per garden. One garden would often have more than one greenhouse. For example, in 1752, the Pisan garden had a *tepidarium* and a *hypocaustum* which, like their Roman baths equivalents, suggests two different

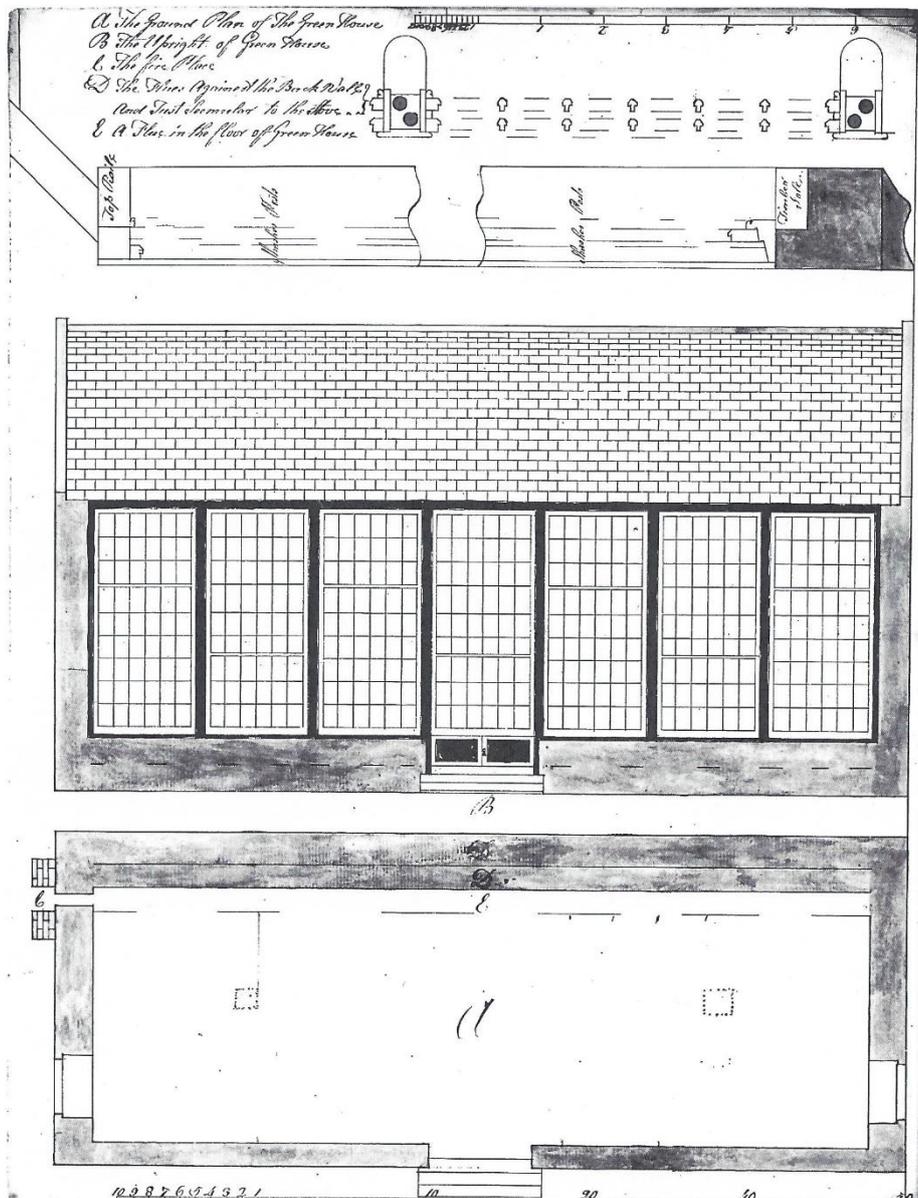


Figure 4 - Architectural drawings of the Leith Walk Greenhouse, RCAHMS.

temperatures: tepid and hot.⁶⁵ In its plea for more funding, the *Società Botanica* also indicated that it wanted several different greenhouses to create environments with different temperatures. As experiments on plants allowed botanists to refine their knowledges of various climates, the equipment needed to follow.

As instruments, greenhouses had their technical limitations. They were costly to build, but also to run. Botanic gardens needed regular deliveries of coal to feed the furnaces keeping the houses warm.⁶⁶ In Edinburgh, the accounts also show many visits from the glazier, coming to repair greenhouse's windows. The drawings for the building shown here show that only one side of it had windows(Fig.4). The technical abilities of the time did not allow for the greenhouse to have large glass planes as windows, so it is instead made of many small panes of glass in a wooden frame. Weather and atmospheric pressure would often lead the wood to shift and result in breakage of the glass. Therefore, the control of the greenhouse environment was not as complete as it may first appear, since accidents could cause intrusion of the outside quite often.

The history of greenhouses underlines the identification of botanic gardens as laboratory spaces, because greenhouses were tools for botanical experiments like acclimatization and observation of plants in different environments. Despite their limitations and cost, they show the increasing intent to control the environment of plants to allow more species to be observed and grown, and they were used in many of the acclimatization projects described earlier like bananas, pineapples, or tea.

“Planned and paid for”

Although the gardens were an outside space, they were not actually any less artificial than the greenhouse and they were tightly controlled as well. Weather, pests and other external conditions can only be monitored and not controlled, but everything else could, which was a stark contrast with the field environment. One factor that I have not yet discussed in the spatial organization of gardens is how the artificiality of the garden space was also used to help experimental practices. The artificial nature of botanic gardens meant that many different types of environments could be recreated in a small and limited space, including outside of greenhouses. The organization of space was designed to optimize the growing of the plants and recreate specific conditions.

⁶⁵ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 73.

⁶⁶ See numerous coal deliveries in the accounts of Pisa(ASP, 13/II°/Sez.F/1) or Edinburgh(HOP, 414).

In the botanic garden of Pisa, for example, a section of the plan was dedicated to “swamp plants”.⁶⁷ This meant that this section had to receive special care to recreate the conditions of the swamp environment. Any new seed that came from such a place that was sent to the garden could then be planted there directly to help its growth. Equipment such as ponds or fountains also helped since they could host aquatic plants. In Edinburgh, a section for alpine plants implied the same type of set up, presumably with arrangements made for the soil to recreate the dry, rocky quality of the mountains.

More general spatial components could also make a difference. The planting of the trees along the walls in Edinburgh helped shelter the plants inside the garden from wind. This reduced the influence of the wind in the experiments carried inside. Monitoring the conditions in the garden meant that gardeners could place species in the sun or the shade, in sand or in mud, on their own or close to others, depending on what they knew, or assumed, its needs to be. The frequent deliveries of manure visible in the accounts of most botanic gardens also speak to another form of control that the gardeners had over the plants in giving them extra food and heat or not.

Finally, the enclosed nature of the gardens and the continuous presence of staff also made it easier to monitor everything. In the observation published by Targioni-Tozzetti, tables of measures of oil production for various species show that the defined space and collections of the garden were closely monitored and could easily be measured.⁶⁸ The directors and/or staff of the botanic gardens living on site meant that measurements and notes on the progress of plants could be made every day. Measurements, recording, and documentation were important aspects of knowledge-making practices.

The level of control that the staff could exercise on the conditions of the gardens was limited by natural factors mentioned like pest or weather. Because of this, many of the experiments carried out in the gardens can be identified with the ‘natural experiments’ I described in the first part of this chapter. Nevertheless, the organization of space contributed to the creation of a controlled environment as possible. There was a clear objective to reinforce this control, illustrated for example by the growing commonality of greenhouses. The growing diversity of the sub-spaces dedicated to certain groups of plants shows the refinement of botanical knowledge. The research on specific needs of plants was becoming more and more precise.

⁶⁷ Michelangelo Tilli, *Catalogus plantarum Horti Pisani* (Florence: Typis Regiae Celsitudinis, Apud Tartinium & Franchium, 1723).

⁶⁸ Ottaviano Targioni-Tozzetti, ‘Osservazioni Ed Esperienze Dal 1801 al 1807’, in *Atti IV* (Florence, 1810), 420.

Conclusion

Botanic gardens were research centres for botanical knowledge, both theoretical and practical. Their collections were indispensable for the knowledge-making activities of the botanists based in Europe. The knowledge-making practices in the gardens show that, in contrast to the distinction imposed by Crosland, natural history and experimentation practices not only cohabitated but were also sometimes indistinguishable from one another. The research taking place in botanic gardens informed scholars' knowledge of plant taxonomy, physiology, life cycle, and supplied material for further experiments, for example in chemistry and medicine. This research was deliberate and planned, so it influenced the physical layout of the garden as well as its use in teaching.

Botanic gardens had in common with laboratories that they were spaces dedicated and designed for knowledge-making. They were also made to control as best as possible the environment the plants were growing in. The carefully constructed artificial space of the botanic garden was necessary for growing, monitoring and experimenting on the growth of the species, new and known. This artificiality also set them apart from other botanical knowledge-making spaces like "the field" where naturalists examined plants in their natural habitat. Although the garden was not totally a laboratory, it was also not wild nature. Botanic gardens were intermediate spaces, in between the artificial and the natural, the laboratory and the field, observation and experimentation.

Chapter 4: Access

In the late eighteenth century, André Thouin, former head gardener of the *Jardin du Roi* in Paris, visited Belgium, Holland, and Italy in the service of the revolutionary French government. In Florence, he visited the museum of natural history and described it thus¹: “Care, neatness, [and] order rule there and [make the collection] as practical for the instruction of students as [it is] pleasant even in the eyes of people who have no ideas about methods”. This off-hand comment is one of the rare testimonies addressing not only the objects of the collections shown in museums and gardens, but also their audience. In chapter 2, I have looked at how students interacted with the gardens, but the audience of botanic gardens was much larger than simply students. Who was given access to the space of the gardens, how, and why, was important in defining it as a place.

Who the non-student visitors were and how they behaved in the gardens is an interesting subject on its own. Nuala C. Johnson dedicated a chapter of her book to this topic, examining the reception of visitors and how it influenced the identity of each institution.² She showed that in the late nineteenth century, some gardens defined themselves more as spaces of leisure, including hosting events or parties, putting the lay audience’s wants first, whilst the university garden of Cambridge allowed visitors but focused above all on its academic mission. Clare Hickman also recently published on botanic gardens’ audience in the late eighteenth and early nineteenth century, using a sample of public and private gardens to consider the visitors’ experiences and the negotiation of space between them and the staff.³ These studies are difficult to replicate here, because of the scarcity of sources, a common problem when studying the audience for science in the eighteenth century in general.⁴ In Edinburgh and Tuscany, the staff rarely kept notes of who came by, and most of what is known about visitors comes from complaints about them. As a result, in this chapter, I will survey the available evidence to discuss the audience of the gardens but will focus on how they were perceived by the institutions, rather than examine the relationship between the two like Hickman.

The ways in which staff reacted to the visitors and tried to control them in the gardens’ space says a lot about how the said staff defined the botanic gardens. I argue that in the second

¹ André Thouin and Charles Joseph Trouvé, *Voyage Dans La Belgique, La Hollande, et l’Italie*, vol. II (Paris, 1841), 230.

² Johnson, *Nature Displaced, Nature Displayed*, chap. 6.

³ Clare Hickman, ‘Curiosity and Instruction: British and Irish Botanic Gardens and Their Audiences, 1760–1800’, 1 February 2018, <https://doi.org/10.3197/096734018X15137949591846>.

⁴ This problem was noted for the garden in Paris by Elisabeth Rochon, ‘Administrer le Jardin du Roi’ (Master thesis, Montréal, Université du Québec à Montréal, 2017).

half of the eighteenth century, there was a growing tension between the staff and the visitor's view of the gardens' space. An expanding audience started to consider the gardens as spaces of leisure, which clashed with the specialisation and professionalisation of the space. Though there were many different types of visitors, Thouin's description of *la Specola* helps define the easiest dichotomy: "people who have no ideas about methods" and people who do. Ultimately, I argue that this was the most important criterion of audience classification for botanic gardens, and the one that reveals a conscious effort to define botanic gardens as spaces of science.

First, I will discuss how gardens took on a role of leisure space and the unacceptable – to the staff – behaviours that came from this. I will then show how the definition of unacceptable behaviour enforced a hierarchy of respectability in great parts based on perceived knowledge.

External visitors and leisure

All of the botanic gardens studied in this thesis started the second half of the eighteenth century by being quite accessible to non-student audiences. This led to the gardens being used as spaces of leisure, which the staff disapproved of.

Open gardens

Some specific visitors could get private individual visits of the botanic gardens, by grace of their status or reputation. The Grandducal family of Tuscany was one extreme instance of this, for example when Peter-Leopold and his wife Maria-Louisa visited the botanic garden of Pisa during their first tour of the Grand-Duchy in 1766⁵, or when the garden of San Marco was cleared from all visitors, including students, for a visit of the Archiduchess a few years later.⁶ This could also apply for visitors with a pedigree slightly lower than that of the royal and imperial family of Habsburg. In the late 1780s, Arthur Young was given a private tour of the *Orto Sperimentale* by Andrea Zucchini due to his international reputation as an agricultural writer.⁷ These private visits, however, don't say much of what the audience for botanic gardens outside of students could really be.

There were open days where anyone was theoretically welcome and encouraged to visit the gardens. Although each garden did it in a slightly different way, the opening the collections to audiences was consistent across all gardens.

⁵ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 213.

⁶ BUB, Scaffale Msi, n°97, f477.

⁷ Young, *Travels in France & Italy during the Years 1787, 1788 and 1789*, 280.

Before the move to Leith Walk in the 1760s, the garden of Edinburgh was already open to anyone during the day for a fee. The gardeners would pocket the fee as an additional income and show visitors around the garden.⁸ An additional revenue was a good motivation for the staff to welcome visitors in the garden and it seemed to continue after the move and the reopening of the garden in 1765.

In Tuscany, the garden of San Marco had a seemingly more restricted access, but under both the *Società Botanica* and the *Georgofili*, the garden was opened “to anyone on holidays in the months of the good season” with no mention of a fee.⁹ No details are available on the opening times of the garden in Pisa, but we know that it was possible to visit it, thanks in great part to travellers’ accounts, like the previously mentioned Pandolfo Titi.

La Specola was, as often, an outlier in its openness. The museum wanted to be accessible to everyone. It was open three days a week. The first visitors were admitted at 8.30am and the museum was then supposed to stay open all day long, “like public libraries” according to Felice Fontana.¹⁰ The entry was free. It had to be booked the day before in the museum itself and after 1780 there was an official ticket system.¹¹

There is some evidence that suggests the staff – at least in some gardens – were keen to attract visitors. The botanic garden of Edinburgh, for example, included information on how to visit it in newspapers in the 1780s.¹² Similarly, the days and times of opening of *la Specola* were published in the *Gazzetta Toscana* by the curator of the Museum.

The publicity of these gardens, as well as the opening of San Marco on holidays implied that people should visit them in their spare time, therefore making the gardens leisure spaces. There was a specific type of leisure that the staff associated with the gardens, however, which was leisure of learning and education.

Leisure learning

Scientific spaces or activities taking on a leisure role was far from unique to botany. The work of historians like Bernadette Bensaude-Vincent, Christine Blondel, or Michael R. Lynn has shown that science came to be treated as a spectacle and leisure occupation during the eighteenth

⁸ RBGE, File WNJ - Williamson, John (Principal Gardener 1755-1780).

⁹ ADG, Carteggio amministrativo, Busta 45, 58, for the same rule in the *Società* see BUB, Scaffale Msi, n°97, ff108-110.

¹⁰ Contardi, *La Casa Di Salomone*, 179.

¹¹ Anna Floridaia, *Forestieri in Galleria: Visitatori, Direttori e Custodi Agli Uffizi Dal 1769 al 1785* (Florence: Centro Di, 2007), 75.

¹² NAS, GD 253/146/2/14/2, “Advertisment with respect to the seeing of the Botanic Garden”.

century.¹³ This spectacle was meant for wide and varied audiences, and its various forms, from public lectures to street demonstrations were often very attractive and popular. Those displays were usually meant to be – more or less – educational but did not require previous and strong scientific knowledge to enjoy and appreciate the spectacle. In Paris, the abbé Nollet electrocuted royal guards in front of the Court to demonstrate the power of electricity, whilst Perrin taught a dog to perform linguistic and mathematical tricks to impress the crowds of Paris.¹⁴ The demonstrators made their presentations more attractive by presenting knowledge content through an entertaining spectacle. Botanic gardens did something similar by providing a pleasant space to enjoy whilst learning about plants through the informal teaching strategies I have described in chapter 2.

Edinburgh and *la Specola* were the two institutions who actively sought to attract non-student visitors. Whilst we know that Pisa was attractive to tourists, it is difficult to judge whether it was intentional and if its staff were keen on receiving more ordinary visitors. Neither the *Società Botanica* and the *Georgofili* were best pleased with visitors, a fact I will come back to in the next section.

In the words of its founder, Fontana, the Imperial and Royal museum of Physics and Natural History of *La Specola* was supposed to be “a public space dedicated to science”.¹⁵ The main purpose of *la Specola* was to be open to and to attract the widest audience possible. Chapters 2 and Part III go into more details about the educative mission of the museum. For this chapter, I will only look at how the space was specifically designed to accommodate visitors. For the botanic garden, the reasoned and rational organisation meant that the plan adopted was extremely regular and simple as described in Chapter 1. The illustration of the garden(App.Fig.8) shows that the central alley was very wide, making it possible to accommodate large parties of visitors – about four or five people wide. The side alleys are much smaller on the picture. This is a classic design feature in gardens, which assumes that people spread into the garden in smaller groups. The garden borrows decorative elements from the traditional Italian garden, such as fountains, but stays very sober and simple. I pointed out in chapter 2 that the signage in *la Specola* was made easily understandable for any audience, including ordinary people, with common names of plants in Italian as well as their Latin names. The garden design reflects this approach as well, keeping

¹³ Lynn, *Popular Science*; Bernadette Bensaude-Vincent and Christine Blondel, eds., *Science and Spectacle in the European Enlightenment, Science, Technology and Culture, 1700-1945* (Aldershot: Ashgate, 2008).

¹⁴ Lynn, *Popular Science*, 1–2.

¹⁵ Quoted by Contardi, *La Casa Di Salomone*, xi.

everything as simple, straightforward and legible as possible, but providing enough space to accommodate many people.

This spatial organization was optimal for visitors, but not for plants. The size of the alleys limited the space occupied by the collection itself. The one and only illustration of the garden (App.Fig.8) does not showcase the plants as the main focus of the garden. Many beds are kept to a very minimalist representation, with very few leaves even sticking out. There are also only three characters out of ten who seem to be even looking at the collection. The man in red on the left is alone and is engrossed in the study of a bed, whilst two men on the right seem to be pointing at a plant and discussing it. The other seven characters – including the ones in the foreground – are firmly planted in the middle of the central alley, conversing with each other and paying no attention to the garden. This is the representation of a social space. This is not to say that the museum was not a site of learning, only that it was also thought of as a space of leisure. This was even reinforced by the proximity of the Boboli gardens. The grandducal gardens attached to the Palazzo Pitti spilled over into the museum's garden. The continuity between the two spaces made the botanic garden into an extension of the leisure grounds of Boboli.¹⁶

The garden of Edinburgh also blurred the lines between learning and leisure space, with a different approach. The landscape design of the *sylva botanica* in the garden of Leith Walk was a new feature for botanic gardens, one aiming to make the space more enjoyable and attractive to visitors. Chapter 1 has shown that the spatial organization of the *sylva botanica* also conveyed scientific information, though it was at first glance less legible than the garden of *la Specola*. Organising the garden in this way did not make its scientific information more accessible, but it made the garden more attractive. The garden was a space for leisure and enjoyment of nature outside of formal learning. The notes indicating that the paths were to be covered with gravel and that there were benches around the garden make this clear too.¹⁷ Benches were certainly not for students or for gardeners, they were for visitors. Gravel and benches encouraged visitors to walk around, admire the views, maybe sit and contemplate the plants, potentially read there.

La Specola and Edinburgh's spatial organization were both influenced by the need to accommodate visitors, but they present two different responses to this need. The two institutions opened a decade from each other – the Leith Walk garden in 1765, *la Specola* in 1775 – showing that the promotion of leisure learning was a trend shared by Scotland and Tuscany around the same

¹⁶ Alessandra Contini, Orsola Gori, and Laura Baldini, *Dentro La Reggia, Palazzo Pitti e Boboli Nel Settecento* (Firenze: Edifir, 2004).

¹⁷ Unfortunately, I was not able to consult the RBGE archives again due to the pandemic and I will complete this reference as soon as possible.

period. Although they were the strongest examples of this trend because of their eagerness to attract visitors, other gardens also *expected* visitors in the second half of the eighteenth century, though the staff were not always thrilled about it.

There was certainly an audience for public spaces of scientific learning at the time. Exact numbers are uncertain, but by the late 1780s, there were 20 000 visitors a year in *la Specola*! The museum was obviously more attractive because of the diversity of its exhibitions – the most popular one being the anatomical waxes collection according to visitors’ testimonies like that of Louise-Élisabeth Vigée Le Brun¹⁸ - but even a fraction of this number would have been a lot of visitors for gardens like San Marco, Edinburgh, and Pisa. Indeed, the influx of visitors created many issues for the staff and the gardens mostly because the audience failed to live up to the ideal of leisure learning the staff expected.

Unacceptable behaviours

Though the garden of Edinburgh was advertised and designed for visitors and with the exception of *la Specola*, most of the institutional sources mentioning visitors do so to complain about them or regulate their behaviours with new rules. The problems seem to stem from the attitudes and behaviours adopted by the visitors not matching the expectations of the staff. The types of behaviour that the staff disapproved of helps to understand, by contrast, the image of what they consider ideal behaviour for a visitor of a botanic garden, showing the development of an idea of ‘scientific’ and ‘unscientific’ behaviours.

Leisure gone too far

The activities of leisure-learning that the staff of botanic gardens wanted to encourage were mostly quiet, contemplative, and, most importantly, linked to the collections. This seems to have meant quietly taking a tour of the garden, presumably admiring and commenting on the plants. In fact, most gardens struggled with their visitors overstepping and using the space for unrelated activities, which caused issues both practically and ideologically.

First, there was a simple practical issue of overcrowding and people being in the way. John Hope, for example, wrote in an undated document that “much inconvenience has arisen from the crowds of promiscuous Company walking in the Botanic Garden, by which the necessary work has been interrupted”.¹⁹ The term “promiscuous Company” used here suggests that the use of the garden as a social space was not appreciated. Hope clearly stated here that the behaviour of the

¹⁸ Louise-Élisabeth Vigée Le Brun, *Souvenirs de Mme Louise-Élisabeth Vigée-Lebrun*, vol. II, 1835, 153–55, <https://gallica.bnf.fr/ark:/12148/bpt6k208331x>.

¹⁹ NAS, GD 253/146/2/14/2, “Advertizement with respect to the seeing of the Botanic Garden”.

crowd was disruptive to the work going. This was not the end of it as the quote continues: “a proper distinction of visitors [‘of knowledge and curiosity’ deleted in the final version] could not be made”. The text was later published as an advertisement for the garden in the press and the part about knowledge and curiosity was cut. But this first version shows the issue the staff had with people coming to the garden not only to quench an irrepressible thirst for botanical knowledge. Hope’s comment shows an ideological hierarchy of visitors between those with “knowledge and curiosity” and the others. This pattern is found in other gardens as well.

The *Società Botanica* in particular was vocal about their issues. As I mentioned, they never seemed particularly happy to host visitors and the complaints and requests to the sovereign to ban them were numerous. Though the official responses do not always exist in the archives, the continuous comments on the matter reveal that their requests were all denied. In 1759, they sent a letter to the government explaining that too many people visited the garden on holidays and that this afflux was harming the plants.²⁰ This complaint seems to have had no results and is an example of the practical issues caused by the visitors, this time not the interruption of work but the direct damage to the collections. Other documents, such as this description of the role of the gardener show attempts at protecting the collection from uncaring visitors²¹:

Finally it is the responsibility of the gardener that no group of ordinary people or children are admitted in the Garden, and only the Civil people will be allowed to bring in servants, male and female. Female servants without their mistress and vulgar Women cannot be admitted because they are well often drawn to superstition, a ridiculous belief in some virtues of the plants, they pick those same plants, and steal them. They should as well refuse to any other person, on the condition though that they are not a member of the academy, and have not be given the previous permission by the society, to go hunt in the Garden, to take dogs to run, and to fish in the Island [tn: the pond], it would not be possible to do such things without doing great damages to the plants. And for the same reason it is not possible to keep Lambs, chickens, or other similar animals to graze, or fatten, and no horse either, unless for a brief time.

There are many aspects to this short excerpt which I will cover here and in the next section. One can see once again the attempt to ban activities that would be damaging to the plants, like hunting, bringing animals, or plain plant picking. There is also a clear disdain for any actions that

²⁰ BUB, Scaffale Msi, n°97, ff108-110.

²¹ BUB, Scaffale Msi, n°97, ff103-105, “Incumbenze”.

were not of quiet leisure-learning and contemplation. This is the case of activities like running, and fishing, obviously, but also explains the ban on children. The archives show that other activities that got banned from the garden included “firing firearms, having fights, playing any game, having meetings, snacks, meals etc”.²² The need to ban any of these specific activities suggests they did take place. Not all of these were directly damaging to the plants, but they showed that the audience did not perceive the botanic garden solely as a site of learning. The people of Florence had tried to appropriate the space of the garden for their own activities, interpreting it as a social, recreational-leisure space.

The complaints made against these attitudes and the regulations trying to ban them stemmed from the perceived conflict between leisure and science. Leisure-learning was the only acceptable form of leisure and was on the side of the latter since it was geared towards learning the knowledge put forward by the gardens. The ideological aspect of this conflict is apparent when comparing the cases of San Marco and Edinburgh with *la Specola*. The museum had no complaints about the number of visitors, about them damaging the collection, or about them socialising in the botanic garden – it was even actively represented on the image of the building (App.Fig.8). Leisure and science were not necessarily incompatible, but the staff in Edinburgh and San Marco had a pre-determined idea what type of leisure was acceptable in a space of science. The garden’s staff were fighting against the appropriation of the space by the public. Visitors were not to enjoy the garden any way they wanted to by transposing their leisure activities in it.

In limiting or openly disapproving some activities in the gardens, the staff were protecting the collections, their own work, and shaping what was or wasn’t acceptable scientific behaviours, but they were also working towards defining the notion of science and knowledge that was underpinning all of this. Their new hierarchy of access was based on this definition.

Hierarchy of access

The issues created by the visitors inside the gardens’ space seem to have been recurrent during the period. The *Società Botanica* already complained about them before 1750. John Hope’s draft on the lack of knowledge and curiosity in his visitors dates from some time before 1782 (when the final text was published). The *Georgofili* took after their predecessors in San Marco and bemoaned the obligation to welcome visitors after they took over 1783.

²² BUB, Scaffale Msi, n°97, ff52-57, “*Memoria*”.

From the correspondence to the Grandducal administration, we know that the *Società* had already been actively trying to remedy the problem in 1759 and subsequent year by requesting restrictions on visitor access that were never granted. The rules to the gardeners quoted earlier show the *Società* trying to take matters into their own hands by enforcing some selection through the gardeners, since the public authorities declined to regulate from above.

They were not the only ones imposing some restrictions on access to their collections through the second half of the eighteenth century. The restriction of access came through regulations of behaviours inside the gardens as well as regulations on who could visit in the first place. Different audiences had different levels of access to the space and the collections. These audiences were often differentiated by social criteria, which reflected their perceived levels of knowledge. The strongest distinction being between those who were presumed to “know the methods”, and those who did not, as described by Thouin.

The instructions to the gardeners from the *Società* quoted above, like Hope’s notes, exemplifies the ideological debate over the definition of botanic gardens as places of *science*. Here, whilst mentioning the damage that some visitors did to the collections, the authors openly associate these actions with the “ridiculous beliefs” of “vulgar women”, which they identify with “superstitions”. The identification of superstitious women as the culprits of damages to the plants shows contempt for forms of plant knowledge considered to be un-scientific. Contrarily to the other activities banned in this example and other, the women’s actions *were* related to the collections and actually demonstrate a curiosity and knowledge of plants! This knowledge, however, was not deemed worthy of the botanic garden space. The gardens’ staff did not just want knowledge and curiosity but a certain type of knowledge and curiosity which was deemed ‘scientific’ enough. The members of the *Società Botanica* considered themselves the judges of what was or was not scientific knowledge and forbade the entry and the practice of unscientific behaviours in the garden. This process was not unique to Florence. Work on the *Académie des Sciences* in Paris has shown that it also defined itself as the judge of what was science and what was not.²³ Establishing the garden and the learned society managing it as authorities discerning real science from popular superstition was also part of the institutionalisation of science and defined the garden as a space of science.

Of course, the rejection of vulgar women, like that of servants unaccompanied by their masters also carries a strong social component. “Civil people”, as members of the city’s elite, were seemingly allowed in the garden without too many issues. The hierarchy was also one of

²³ Hahn, *The Anatomy of a Scientific Institution*.

respectability. But this respectability was not only based on social status. Indeed, some activity bans were more likely to target the elites than the common people of Florence such as the ban on duelling or on horses inside the garden. Instead the hierarchy of respectability was intertwined with that of knowledge on the basis of *perceived* or *potential* knowledge in the eyes of the staff. Members of the elites were more likely to be educated, including in the sciences since natural history and botany had also become fashionable hobbies for the aristocracy and the rising bourgeoisie.²⁴ Their behaviour was more likely to at least outwardly resemble the expectations set by the staff. Not because they were inherently better at science, but because scientific behaviours had often been shaped by people from this social group in the first place. The assumption was that people who knew how to behave were people “with knowledge and curiosity”.

This classifying of people based on perceived knowledge is subtly implied in the dismissing of children – not yet knowledgeable enough –, vulgar people – presumed uneducated –, and the gendered bias against women, naturally considered less intelligent than men. These assumptions about who is the most likely to know and to learn are even present in the depiction of *la Specola* (App.Fig.8). Despite the museum’s mission to educate everyone, the artist presented a scene of homosocial leisure: only men and all of them wearing attire more typical of the elites. Though this may say more about the artist’s bias than the institution’s one, it is telling of the contemporary perceptions about knowledge.

The distinction between types of knowledge was not a dichotomy, but a spectrum. There were many shades of knowledge between the people who knew about methods and those who did not, but the nuances were often only perceived in the upper classes of society.

San Marco was not the only institutions who tried to restrict access to their collections. In Edinburgh, Hope’s concern about “promiscuity” led to this new rule in 1782:

... it has become necessary to admit none without an order from the Professor of Botany. By this regulation it is not meant to render access to the Garden difficult – Strangers, the Gentlemen of this Country and any person of knowledge or curiosity upon sending their names to the shops of Mr Thomson Druggists, head of Niddry’s Wynd, Mr Sparkie opposite the Tron Church and Mr Moncrieff Apothecary on the Bridge [...] will receive an order for seeing the Garden, between

²⁴ Simon Schaffer, ‘Natural Philosophy and Public Spectacle in the Eighteenth Century’, *History of Science* 21, no. 1 (1 March 1983): 1–43; Lynn, *Popular Science*; Marco Beretta, ed., *From Private to Public : Natural Collections and Museums* (Sagamore Beach: Science History Publications, 2005).

the hours of twelve and three and during the summer at 6 in the evening every day, Sunday excepted.²⁵

Although the text claims that no one should be discouraged to visit the garden, the requirement to book the visit in writing in shops in other parts of the city made it difficult and complicated to plan for people outside of the upper-classes. The botanic garden of Edinburgh was keeping at bay the lower classes whose members did not have enough education to be recognised by the staff of the garden as worthy to visit their scientific collection. Here, the remote gate-keepers were not the gardeners but a druggist and an apothecary, two roles affiliated with the profession of medicine and with botany and therefore apt to judge one's scientific worthiness.

Just as there were different levels of (perceived) knowledge, there were different levels of access to gardens based on these levels. The Edinburgh Apothecary judging you a curious and knowledgeable person would grant you entrance in the garden under specific conditions, but higher or institutional recognition of your scientific knowledge would get you greater access. Members of the societies administrating San Marco were given much more access to the garden than the rest of the population. The new members of the *Società Botanica* were given a key to the one entrance of the garden when they joined and paid their fees.²⁶ They also enjoyed greater freedom in behaviour than even the elites once inside: the instructions to the gardeners suggests that they were allowed to hunt or fish for example – maybe to get rid of pests? After the French invasion of 1799, the *Georgofili* – after the constant refusals of the Lorraine administration – were finally allowed to “constantly [keep] the said Garden closed, and to give access only (by knocking on the small door) to the Academics Georgophiles, and to any other person ready, from whom there is no reason to fear bad behaviour”.²⁷

Importantly, this type of access was not just limited to members of the learned societies directly in charge of the gardens. In his recollection of his late 1780s travels, James Edward Smith – keen botanist and future head of the Linnaean Society in London – wrote about the Pisan botanic garden: “the Chinese palm [...] was here in fruit [...] Unluckily taking it for a *Chamaerops*, I neglected to preserve any, and the fruit of the *Rhapis* has not yet been described”.²⁸ This passing comment suggests that he would have been able to collect a sample had he wanted to. When

²⁵ NAS, GD 253/146/2/14/2, “Advertizement with respect to the seeing of the Botanic Garden”.

²⁶ BUB, Scaffale Msi, n°97, f377.

²⁷ ADG, Carteggio amministrativo, Busta 45, 58.

²⁸ James Edward Smith, *A Sketch of a Tour on the Continent*, 265.

ordinary people picked plants, it was considered “theft”²⁹ and “damage”, but when Smith did it, it was scientific behaviour. There was a clear distinction in how similar behaviours could be interpreted with different levels of education.

The people who enjoyed this type of access were members of the “scientific community” as defined by J. R. R. Christie in his article about Enlightenment Edinburgh.³⁰ Christie considers that the scientific community included students and professors from the school of medicine, as well as members of learned societies. Like any artificial definition, it has limitations, particularly its strong emphasis on institutions since not everyone interested or involved in science would be affiliated to an institution like a university or a learned society. Considering the popularity of learned societies, it is also debatable that all their members were active parts of the scientific community. Cochrane showed in his study of Tuscan academies that anyone of importance was a member of at least one society, regardless of their scientific or scholarly contributions. By 1760, more than 1000 people in Florence were members of academies for a total population of 75 000.³¹ Despite these limitations, the definition highlights one of the fundamental characteristics of this audience: its members were selected or vetoed by other members of the community. They had either an institutional or personal recommendation. This recommendation could be implicit like in the case of students who visited the garden for classes, or explicit like in the case of foreign scholars carrying letters of recommendation. The scientific community was also an international category. Its members could be locals or foreigners. Institutional links remained meaningful outside of their country of origin, as shown by Smith or Thouin. This selection and veto process were a way to guarantee they “knew about methods” or wished to (in the case of students for example). There was a growing institutional definition of proper ‘science’.

This selection process was what was emulated through Hope’s new system. For people outside of the scientific community, this vetting process had to be done by scientific agents like gardeners, professors, or indeed apothecaries on a case by case basis.

The fact that the members of the scientific community explicitly enjoyed greater access and freedom inside the gardens than any other visitor, including members of the elites – with the potential exception of the Grandduccal family – reinforces the idea that one’s respectability was not only based on social status, but also on their position on the knowledge spectrum. The botanic

²⁹ “rapina” in several documents from the *Società Botanica* or the *Georgofili*. Ex: ADG, Carteggio amministrativo, Busta 45, 58, 60.

³⁰ Christie, ‘Scottish Scientific Community’.

³¹ Cochrane, *Tradition and Enlightenment*, 38.

gardens were places of science and therefore sought to reserve their space for people appreciative of scientific values and able to understand what the staff perceived as high knowledge.

Somewhat ironically, this was probably made easier and the institutionalisation of science was reinforced by the creation of the most open garden/museum of all. In *la Specola* the only restrictions were on presentation, as visitors had to meet certain standards in terms of clothing and cleanliness.³² This measure would have disadvantaged members of lower classes more than the elite, but it was a very mild restriction. No one could be refused for lack of education, network, or improper attitude toward science. There was also no distinction on gender or profession. The museum was consciously trying to appeal to locals and commoners and even to soften the social differences inside its space. Indeed, the elites were also regulated upon entering the museum. All visitors had to leave their greatcoats and swords – symbols of their social status – at the entrance.³³ The rule might have been meant to make sure the collections would be safe from weapons and clumsiness – and to avoid duelling, which, as we learned from San Marco, was apparently a popular activity in gardens. By ensuring that commoners would be dressed up (relatively) and the elite dressed down, Fontana and his colleagues made the museum into a place set outside of social norms. The commoners were originally only admitted in the morning and the afternoon was for the upper-class visitors.³⁴ But this segregation was abolished in 1789, enforcing the idea that rank and social status did not matter in that place. It would be too strong to say that the museum promoted an egalitarian vision of society. Toning down social markers inside the museum created a specialised and professional space. One's background was irrelevant to the function of the said space: to educate and share scientific knowledge. *La Specola* was a place of scientific education for the masses. The opening of such a place in Florence shows the distinction between the “scientific community's” science and science for the masses physically manifested in space. The two were complementary and their separation in space made clear the specialisation of scholarly science.

Conclusion

In both Scotland and Tuscany, there was an expectation that the botanic gardens would help the education of populations other than university students. In Edinburgh, this expectation seems to have come from Hope himself, whilst in Tuscany, it was imposed on San Marco by the

³² Anna Maerker, ‘Uses and Publics of the Anatomical Model Collections of La Specola, Florence, and the Josephinum, Vienna, around 1800’, in *From Private to Public: Natural Collections and Museums* (Sagamore Beach: Science History Publications, 2005), 84.

³³ Maerker, 84.

³⁴ Maerker, 84.

public authorities. Because of this expectation, the gardens took on a function of leisure space, but in Edinburgh as in San Marco, there was tension between staff and non-student visitors over what type of leisure was acceptable. Whilst the staff saw leisure-learning as the only appropriate form of leisure in a space that they considered a place of science, the wider public did not always meet their expectations and sometimes tried to appropriate the space for non-science-related activities. The attempts by the staff to regulate inappropriate behaviours and restrict access to the gardens show the emergence of a hierarchy based on ideas of scientific knowledge. The restrictions imposed on the audience of gardens points towards an increasingly explicit definition of botanic gardens as places of scholarly science. It also shows the crystallisation of an identity for scholars who were deemed worthy of better access, a process that accompanied the crystallisation of a professional role for botanists, as Part II will show.

PART II – PEOPLE

Introduction

Overlooking [the Observatory] is the Garden of Simples, where are kept rare plants, and endless types of herbs, Flowers, and medicinal Plants brought from America, and from the East Indies, and also the rare and famous Museum of Natural things. Over this presides the Professor of Botany, such an office that the Doctor Angiolo Tilli currently occupies.¹

Angelo Attilio Tilli was professor of botany and director of the botanic garden in Pisa from 1740 to 1781. During this time, he “presided” over the space and the collections described here as well as over the team of gardeners and employees whose work was needed to maintain, care for, expand, and study the collection. Tilli’s – and his Tuscan and Scottish equivalents – “office”, described here by Giovacchino Cambiagi, is the subject of the second part of this thesis. This office represented an intriguing position in the history of science: a salaried job firmly linked to science and scientific research at a time when there were very few such opportunities, a proto-professional scientist position.

British historiography of science often situates the emergence of professional scientists, or “professionalization of science” in the nineteenth century.² For some historians, it started in the 1830s, based on the recruitment by the British state of geologists to conduct the Geological Survey of Great Britain.³ For others, it did not start before the late nineteenth century with education and university reforms.⁴ The criteria traditionally used to define the professionalization of science in the historiography are: (i) the existence of full-time salaried positions dedicated to “research for the furtherance of rational understanding about nature”⁵ that could sustain the people occupying them and potentially their family, (ii) the possibility for people in those positions to make a career

¹ From *Il forestiero erudito* by Giovacchino Cambiagi, 1773, quoted in Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 316.

² Ruth Barton, “‘Men of Science’: Language, Identity and Professionalization in the Mid-Victorian Scientific Community”, *History of Science* 41, no. 1 (1 March 2003): 73–119; Cahan, *From Natural Philosophy to the Sciences*; Paul White, *Thomas Huxley : Making the ‘Man of Science’* (Cambridge: Cambridge University Press, 2003); Paul White, ‘The Man of Science’, in *A Companion to the History of Science* (Hoboken: Wiley, 2016), 153–63.

³ James A. Secord, ‘The Geological Survey of Great Britain as a Research School 1839-1855’, *History of Science* 24 (1986): 223–75; Roy Porter, ‘Gentlemen and Geology: The Emergence of a Scientific Career, 1660-1920’, *The Historical Journal* 21, no. 4 (1 January 1978): 809–36.

⁴ White, ‘The Man of Science’.

⁵ Hahn, ‘Scientific Careers in Eighteenth-Century France’, 135.

in that field, (iii) the existence of specific, official and recognised qualifications giving access to those positions.⁶

An often unspoken fourth criterion is statistical significance. When discussing the professionalization of science in the nineteenth century, some historians mention in passing that there *were* qualified people being paid to practice science before 1800 but they estimate that their number was too small to really matter. Cyrus Mody, for example, writes “there were hardly any people professionally engaged in the study of nature” before 1800.⁷ Before Mody, Shapin already wrote somewhat dismissively that “the number of people paid by the State or its affiliated institutions to find out new knowledge of nature in the seventeenth century could probably be counted on one's fingers and toes”.⁸ It is irrefutable that the number of such people was still very limited even still in the second half of the eighteenth century, but limited is neither inexistent nor irrelevant. Part II seeks to retrace the history of some of those people. I argue that staff in botanic gardens, specifically the garden directors, were already part of a profession of science. Studying their role provides an alternative way of thinking about careers and opportunities in science in the eighteenth century.

Continental historiographies can differ from British analyses of professionalization.⁹ As far as the Italian territories are concerned, Bucciantini and Segala, for example, defend the idea that professionalization started in the mid-eighteenth century.¹⁰ This difference is partly due to slight variations on the definition of professionalization. The following chapters will show that it is also due to national differences between Britain and Italy in the way in which science was practiced and framed. The comparison will show those differences but also emphasise the parallels between the development of scientific roles and statuses in the two countries, showing that Britain was not so different.

Many studies around botanic gardens have looked at individuals working in them. Emma Spary, for example, dedicated a chapter to André Thouin's work in Paris and his network.¹¹ It is

⁶ Porter, 'Gentlemen and Geology'; Steven Shapin, *The Scientific Life : A Moral History of a Late Modern Vocation* (Chicago ; London: University of Chicago Press, 2008); Maurice P. Crosland, *The Emergence of Science in Western Europe* (London: Macmillan, 1975); Prud'homme, 'Professionnalisation'.

⁷ Mody, 'The Professional Scientist', 164.

⁸ Shapin, *The Scientific Life*, 35.

⁹ See for example Prud'homme, 'Professionnalisation'; Hahn, 'Scientific Careers in Eighteenth-Century France'.

¹⁰ Marco Segala and Massimo Bucciantini, 'Scienze e pseudoscienza: alle origini della professionalizzazione delle discipline', in *Toscana e Europa, Nuova scienza e filosofia tra '600 e '700*, ed. Ferdinando Abbri (Milan: FrancoAngeli, 2006), 315–27.

¹¹ Spary, *Le jardin d'utopie*, 75–125.

impossible to account for all the work done on Linnaeus. It is tempting to look only at individual accomplishment rather than institutional specificities when studying a figure like Linnaeus, whose accomplishment in the history of science extend way beyond his work in the garden of Uppsala. Even in the case of smaller gardens, each director tends to be treated like an individual entity. Morton and Noltie worked on John Hope and his work in- and outside the garden.¹² Garbari, Tongiorgi-Tomasi, and Tosi dedicated an entire section of the book on the garden of Pisa to the prefects of the garden, from the origins to the twentieth century, considering what they each brought to the garden, but not analysing their official roles.¹³ Leaving aside the biographical work, I would like in this section to look at what these scholars had in common and analyse their very specific status in the scientific landscape of the eighteenth century. The directors in Edinburgh, Florence and Pisa were less renowned than Thouin or Linnaeus and their accomplishment in their private work rarely outshone the development of the space they oversaw. This makes it easier to focus on what the role of garden director was and what the individuals who filled it in the second half of the eighteenth century had in common, defining a new group of official science practitioners.

Using the term “professional scientist” to talk about the people on whom this section focuses would both go against the established historiographical terminology and be too removed from actors’ categories. Although eighteenth-century scholars were extremely preoccupied by taxonomy, it is remarkably difficult to establish a taxonomy of eighteenth-century scholars. No clear-cut categories or defined roles existed for practitioners of science. In recent historiography, scholars like Pamela O. Long, Ursula Klein, or Emma Spary have shown that science practitioners could be put on a spectrum encompassing many different forms of knowledge and crafts and taking into account recognition and pay.¹⁴ Long’s artisan-practitioner, who used or developed some scientific knowledge in their practical and manual trade, can be put at one end of the spectrum, opposed to amateurs, as defined by Roy Porter: members of the elite who were rich enough to support themselves without working, and thus had both money and time to spend on scientific research as a form of hobby.¹⁵ Other groups to be found on this spectrum includes

¹² A. G Morton, *John Hope, 1725-1786, Scottish Botanist* (Edinburgh: Edinburgh Botanic Garden (Sibbald) Trust, 1986); Noltie, *John Hope, 1725-1786*.

¹³ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 27–115.

¹⁴ Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis: Oregon State University Press, 2011); Ursula Klein, ‘Artisanal-Scientific Experts in Eighteenth-Century France and Germany’, *Annals of Science* 69, no. 3 (1 July 2012): 303–6; Klein and Spary, *Materials and Expertise in Early Modern Europe*.

¹⁵ Porter, ‘Gentlemen and Geology’.

intermediaries, hybrid-experts, and practitioners such as gardeners or mining engineers.¹⁶ Recently, Easterby-Smith's *Cultivating Commerce* also highlighted the role of plant traders as intermediaries between polite science and practical uses of horticultural knowledge.¹⁷

As a group of science practitioners, the directors studied in the following chapters would probably exist on the spectrum between Easterby-Smith's plant traders and Porter's gentlemen. In the next few chapters, I will show that they were men¹⁸ who were paid by the State to practice science, not only in a practical or teaching sense, but as researchers as well, and that they had specific qualifications, therefore fulfilling both criteria (i) and (ii) of professionalization. To stay away from the anachronical term "scientist", I have decided to name them "institutional savants" or "institutional botanists" when they were extremely specialised.

The three chapters of Part II are very intrinsically linked and function as a demonstration and contribution to the historiography together. The first will look at the responsibilities associated with the position of director itself and how they created a fully formed science-related job. The second will examine the individuals working in the gardens at the time and what they had in common in terms of qualifications and specialisation to show that these jobs did require experts qualified by the standards of their time. The third chapter will build on both previous ones to show that those jobs and statuses were recognised by society – public authorities in particular – making the institutional savants into official figures of science.

¹⁶ Ursula Klein, 'Savant Officials in the Prussian Mining Administration', *Annals of Science* 69, no. 3 (1 July 2012): 349–74.

¹⁷ Sarah Easterby-Smith, *Cultivating Commerce: Cultures of Botany in Britain and France 1760-1815* (Cambridge: Cambridge University Press, 2018).

¹⁸ Although the Italian peninsula is well-known in the history of science for the more prominent roles that some women were able to occupy in some official institutions - see for example Monique Frize, *Laura Bassi and Science in 18th Century Europe: The Extraordinary Life and Role of Italy's Pioneering Female Professor* (Heidelberg ; New York: Springer, 2013)- botany in Tuscany seems to have remained a strictly masculine field as far as employment was concerned. Scotland was no more progressive and so this study remains a strictly male driven history.

Chapter 5: Responsibilities of institutional botanists

The people in charge of botanic gardens in the second half of the eighteenth century were called many things. They were prefects, intendants, directors, or *Regius Keepers*. They were demonstrators, lecturers, or professors. They could be a combination of some of the above. Despite the disparity in titles and the geographical differences, the roles of those we will commonly refer to as ‘garden directors’ were quite similar from one garden to the other. This chapter follows in the footsteps of Ursula Klein and Sarah Easterby-Smith by using the concrete activities of actors to define a new category of science practitioners.¹ It will define the role of garden director by looking at how the accumulation of their responsibilities, particularly teaching, collection management, and research, set them apart from other science practitioners of the eighteenth century. It will look at the evolution of the jobs in different gardens and show how they came to resemble each other enough that the position of institutional botanists in a botanic garden was almost standardized by the end of the eighteenth century. I will also show that this standardized position increasingly involved a research mandate.

Pisa: the job of prefect of the garden

In Pisa, the director of the botanic garden was called the “prefect”. His function was combined with that of professor of botany and director of the museum attached to the garden since Pietro Nati took over all three in 1672.² They had often been separated before but were systematically associated during the eighteenth century, even if they remained different titles.

The second half of the eighteenth century started with Angelo Atillio Tilli as the “professor extraordinary of botany” – a title that he combined with that of prefect.³ Angelo Atillio had inherited the position after his uncle’s, Michelangelo Tilli, death in 1740. Michelangelo had officially been in charge of “the lecture of Simples, and the custody of the garden” since 1685.⁴ The last of the Tilli dynasty was Angelo Atillio’s son, Gian Lorenzo. He took over his father for a year in 1781 without being officially promoted to the job of professor and prefect of the garden.

¹ Klein, ‘Artisanal-Scientific Experts’; Easterby-Smith, *Cultivating Commerce*.

² Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 348.

³ Garbari, Tongiorgi Tomasi, and Tosi, 70.

⁴ Garbari, Tongiorgi Tomasi, and Tosi, 65.

He was then replaced by Giorgio Santi in 1782. Santi was given the chair of “botany and natural history”, which came with the management of the garden.⁵

Though the inconsistency between the four men’s titles could suggest that the job was not yet permanently institutionalized, the titles consistently covered the same functions. All of them were prefects, and as prefects of the garden, they were officially in charge of managing the collection and its upkeep, and teaching the class on plant knowledge – simples, botany or natural history depending on the year – for the university. The university kept an eye on the budget and expenses, but the prefect was the highest authority in the garden. He was free to decide what should be done in it, and he was the one giving instructions to gardeners and other workers in the garden.

This combination of management and teaching was a clear example of what most botanic garden directors in Europe did. The consistency of functions despite title changes was also typical for institutional savants and establishes the need to look beyond titles at concrete responsibilities. In Pisa, the varying titles seem to always have been associated with a full job. The title could vary slightly but the prefects were full-time employees and paid for their work. Other places had gone through very different evolutions.

From a title to a job: Edinburgh

In Edinburgh, John Hope took over the garden as *Regius Keeper* and the chair of botany in 1761. His predecessor had been Charles Alston, but Alston had not occupied the exact same function as Hope. The role of garden director went through massive changes under Alston and then Hope.

After James Sutherland, gardener extraordinaire and first *Regius Keeper* of the botanic garden of Edinburgh, died in 1719, the two gardens he had been supervising, Trinity and Holyrood became two separate entities. There were therefore two different people employed as directors of botanic gardens for many years, with different responsibilities. The Trinity director worked for the Town Council and taught in the university, whilst the Holyrood one was officially in charge of the royal collection but more often than not had simply received the title of “King’s Botanist” as a Royal favour and did very little.

⁵ Garbari, Tongiorgi Tomasi, and Tosi, 220.

The two gardens were partially reunited under the – competent – management of Alston in 1738.⁶ Having been granted the title of King’s Botanist and the management of Holyrood garden in 1716, he was then recruited to be professor of botany in the university, and thus given the care of the Trinity garden in 1738. Though Alston combined the two functions, they were still considered separate.

Few sources are available on Alston and little is known about the details of his administration.⁷ He did have a project of creating a bigger botanic garden to support the teaching and accommodate larger collections, but could never act it out for a lack of funds. Hope’s memories of Alston suggest the money he spent for at least one garden had to come from his own wages as keeper and his personal fortune.⁸ Since there was no official budget for the gardens themselves, only wages for their keepers, Alston was very limited in what he could accomplish. It also meant that the content of the garden was considered his private property. After Alston’s death, his successor, John Hope, had to buy the content of the gardens from his widow.⁹ The receipt for the transaction does mention the content of the gardens as Alston’s property, showing that the status of the botanic gardens was still very ambiguous. The collections themselves were not the property of the public authorities, but the authorities paid Alston to help maintain them. The money he was paid was not expected to be for him. He was accumulating titles, but those titles did not come with actual salary, full-time work, or indeed obligation to work! Some of his predecessors in the royal garden had found it unnecessary to actually teach botany for example, like Charles and George Preston.¹⁰

The job of botanic garden director took on much more meaning under John Hope. Hope took over Alston both in the office of *Regius Keeper* and in that of professor of botany and *materia medica* in the university in 1761, combining the two titles like his teacher. Hope secured funding for a new, bigger garden, merging the previous two collections.¹¹ This also merged the two supervising positions into one, solidifying the association between the chair of botany – or “botany and *materia medica*” to start with – in the University and the management of the royal garden. The garden was granted a budget as well as a salary for its director, now officially named *Regius Keeper* and/or “*Regius Professor* of Botany in the University of Edinburgh”.¹²

⁶ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, 35–45.

⁷ RBGE, Collection ALS - Dr Charles Alston Ephemera.

⁸ Morton, *John Hope, 1725-1786, Scottish Botanist*.

⁹ RBGE, Collection ALS - Dr Charles Alston Ephemera, Box 2 of 2, NAS GD253/146/13.

¹⁰ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, 25–36.

¹¹ See Part III for more details on this.

¹² NAS, E201/12/1 *Regius Professor of Botany Account 1764-1769* ».

The joint responsibility of teaching and managing the garden was definitively crystallised under Hope. After Hope's death, his successor, Daniel Rutherford, was named professor of botany in the university on 25 November 1786¹³. His nomination to the office of *Regius Keeper* by the Privy Seal was not officially until the 20th of December, but the Register stated:

the salary, L50 sterling money, to commence from the 25th day of November last, the day on which the said Dr Daniel Rutherford was elected to a Professorship in the said University¹⁴

This shows that the salary as keeper of the garden depended on his appointment as professor. The two functions were no longer independent from one another, even after Hope. Before Hope, the function of *Regius Keeper* had been defined by whoever occupied it, and not been an institutionalised and standardised one. The occupant of the function and their personality still mattered a lot for the evolution of the garden after Hope's reform, but it was already a step away from the *Ancien Régime* system in which the man made the function instead of simply filling it. Hope and his successors as *Regius Keepers* had to teach the class and manage the collection to claim their salary. They did not get to define their own responsibilities or to own the collection. The formal job of *Regius Keeper* was created by Hope's reforms. It was also institutionalised; it did not depend on Hope as an individual but existed as a permanent status that could pass to other people subsequently.

Somewhat ironically, the creation of this job as a function not defined by whoever occupied it was made possible by the personal work and vision of John Hope. He was the one who defined his own job and lobbied the authority to make it official. Meanwhile, in Florence, the *Società Botanica* had been trying to get to the same result with a different approach.

Florence and the model of collective authority

The Società Botanica: first steps towards separating man and function

In Florence the *Società Botanica* had been consciously trying to separate the man from the function before Hope's time. The efforts to do so had been coming not from the director of the garden, but from the group of founders of the society. The archives show that the internal structure of the learned society changed several times after its creation.¹⁵ There was much debate over the

¹³ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, 68.

¹⁴ Cited by Fletcher and Brown, 68.

¹⁵ BUB, n°97, see many documents, including for example ff1-32 for 1724 rules.

exact shape that the society should take, but all the sets of rules had in common complex structures based on a republican model. The details of the differences between the successive set of rules are not useful to this chapter's argument beyond the overall principles: the affairs of the society were all to be handled by various committees and councils and not by individuals.

The complexity of the structure can be seen, for example, in one of the earliest versions of the rules entitled “*Capitoli e Leggi Proposte dal Sig. Pandolfo Pandolfini*”.¹⁶ The list of offices defined by this set of rules include “A President, a custodian of seeds, a Director of the garden regarding simples, two Supervisors [of the garden], a Chamberlain, a General Secretary, a custodian of the garden regarding the flowers, fruits, citruses, their cultivation, the grove of citrons [and other citrus trees]”. The list shows at least five different people directly working in the garden. Those people, and other regular members, were then sorted into three different councils. The *Consiglio Botanico*, of which the custodian of seeds and the president were members, oversaw “everything that [belonged] to botany, including provision, culture and maintaining the simples”. The *Consiglio d’Azienda*, in which sat the President, the supervisors, the Chamberlain and the General Secretary, looked at the expenses of the garden and the work carried in it. It was also in charge of making propositions of future projects for the said garden which were then sent to the *Consiglio Botanico*. The *Consiglio per I Negozi* was headed by the President and its other members were all elected by the general assembly. It dealt with businesses and generally with “external people”. It was the body representing the Society to the outside world, as well as the intermediary with the grandducal ministers and administration. It would debate over all the propositions and resolutions of the other councils and had the final say in the decisions. It was also the body deciding how much money the other councils were attributed for the year. Finally, the last entity administering the Society was the general assembly of the members, where the people sitting on any of those councils were elected. People elected to the various offices could only hold them for a year or two before having to go through an election process again.

Other versions of the rules have equally complex and administration-heavy structures. This collegial system based on elections and short-term mandates was typical of eighteenth-century learned societies. Cochrane makes the point that Tuscan academies were built as images of republics based on knowledge and merit.¹⁷ Those “societies within society”¹⁸ were also an example of an ideal that their members wanted to promote for the general population: individual citizens using their talents at the service of the group and as a part of the collective. For the people working

¹⁶ BUB, n°97, ff1-32, *Capitoli e Leggi Proposte dal Sig. Pandolfo Pandolfini nel 1724*.

¹⁷ Cochrane, *Tradition and Enlightenment*, 53–54.

¹⁸ Cochrane, 54.

in the garden, it meant that they theoretically had to always work as a team and constantly report to collective instances. Their individual authority and control over the garden was limited.

The organisation of the *Società* shows that it wanted to build itself as a lasting institution. The power to make decisions was not given to people as individuals but as representatives of the collective. The garden and the society were therefore not supposed to depend on individual personalities to function. In Edinburgh or Pisa, where the professor of botany was the only authority supervising the garden, what happened to the field depended entirely on the one person in charge and their personal investment in the position. By spreading the authority between all its members, the botanic society was trying to ensure that it could carry on its work regardless of the office holders' personal situations. An example of this is that of Saverio Manetti who, despite being officially in charge of the garden, did not manage to impose his vision of the use of classification in the garden.¹⁹ Collective decisions were always prioritised. The collegiality of decision-making was a conscious effort to not use a model in which the individual made the function. It took the focus away from individual personalities to instead create a structure supposed to work and sustain the society. This collective style of management was quite rare in botanic gardens of the eighteenth century.

The collective management may still have been more of a utopia than a reality. From the archives, it is difficult to say which version of the rules was actually used during the second half of the century. Most of the documents described were undated but must have been written in the early days of the *Società* after they were given the management of San Marco in 1718. In the 1730s already, Giovanni Targioni-Tozzetti was advocating for the director of the garden to get more authority.²⁰ In 1745, Giovanni Antonio Targioni was credited as "Director of the Plants of the Simples" and Francesco Saverio Manetti was the professor of botany operating in the garden. These were the only two salaried positions for members of the society.²¹ By 1750, Manetti was the sole person receiving a salary – outside of gardeners – for working in the garden. Though the debates on classification show that committees still had some influence on the garden, the day to day decisions were probably left to the Buoni family of gardeners and the professor of botany.

This emphasis on the collective might have been part of the problem that led to the *Società* losing the use of the garden for mismanagement. The system was so complex that it would have made day to day decision making for the garden – a living collection that required constant

¹⁹ See Chapter 2.

²⁰ Contardi, *La Casa Di Salomone*, 26–27.

²¹ BUB, n°97, ff616-617, "Bilancio 1741-42", and ff624-625, "Bilancio 1745-46".

attention – extremely difficult. Already in 1758, Targioni-Tozzetti thought the garden looked like “a badly cared for field”.²² Nevertheless, the model of the *Società* is an interesting and quite rare example of the collective management of a botanic garden. Even before 1750, the society was trying to separate man and function. This pattern was not as visible in other gardens as in San Marco, but it existed and was reinforced as garden directors’ jobs became more and more standardized and got precise definitions.

Changes under the Georgofili

The *Accademia dei Georgofili* took over the San Marco garden in 1783. The academy was also a learned society. It used, in part, the same type of collective authority model as the *Società*, but the *Georgofili*’s hierarchy was more streamlined. There were elections and reports to assemblies, but no multitude of councils and a limited number of offices. Amongst those offices, like in the *Società*, the one paid position was that of “Director of the garden”. The job was given first to the – well-named – Canon Andrea Zucchini in 1784, who held it until he officially fled Tuscany after the French invasion in 1799. The title was then given to Ottaviano Targioni-Tozzetti.

Unlike the other gardens, the *Georgofili* had a precise definition of the director’s function:

The Director [of the garden] will share with the Deputies the plan of his annual Lectures, and will agree with [them], as much as possible, on everything regarding the conservation of the garden, and the economic regulation of [it]; furthermore he also is in charge of the experiments assigned by the Deputies themselves, by the Ordinary Academicians, and the Honorary ones, and he has the ability to choose the temporary Workers, based on the number [of employees] given to him by the Deputies, [he] supervises their work; as well as the work of the permanent staff in the House of the said garden, all of this with the participation of the President, with whom lies the Economic part of the Society.

The function of director combined the management of the garden – with the precision that he was the head of staff – and the teaching of lessons in plant science. Both of those aspects were put under the scrutiny of the collective of the deputies or the ultimate authority of the President. From the *Società* to the *Georgofili*, the job of garden director in San Marco evolved towards a combination of the function of management and teaching, similar to what existed in

²² Quoted in Contardi, *La Casa Di Salomone*, 27.

other gardens. The main difference between San Marco and Edinburgh or Pisa was that the garden was an emanation of the learned society in charge and therefore controlled by collective decision making. In cities where the garden was attached to the university, the supervisor seemed to have much more unchecked authority. The responsibilities attached to the functions were similar, but the chain of command was different.

Although it could be slightly different in each garden, the combination of teaching and management tasks was a great part of what set the supervisors of botanic gardens apart from other scientific practitioners. As professors they fitted into the university and academic world. As heads of physical institutions, they were more visible to society in general and they provided specific resources to authorities. They were neither teachers, nor glorified gardeners. Their status combined several aspects of science practice. An often glossed over aspect of their work was the research they had to carry in the gardens. This element is present in the *Georgofili*'s description when it mentions the experiments in the garden. It also existed in other gardens.

The research mandate

The status of garden directors was not only defined by a combination of teaching and management but also by an increasing expectation that those jobs would include scientific research. Chapter 2 has shown that research was very present in botanic gardens and physically inscribed in their space. This section is to consider how this was reflected in the functions of the directors.

The historiography mentioned in the introduction commonly considers that any job that was related to science but did not include scientific research cannot be considered a professional scientist job. In his article about scientific careers in France in the eighteenth century, Hahn remarks that members of the *Académie des Sciences* were the closest thing to professional scientists and researchers, but that even they did not treat their membership as an occupational activity.²³ They entered the *Académie* based on their merit as scientific innovators, and received a salary, but the pay was not enough to actually sustain them and they found other employment on the side. The jobs that they would go for were often linked to scientific practices – teaching, mining or military consultancy – but did not include research as a requisite. An example of this phenomenon is a letter by D'Alembert to Laplace, quoted by Hahn, in which the first advised the latter to take

²³ Hahn, 'Scientific Careers in Eighteenth-Century France'.

on a teaching position because it only required teaching in the morning, leaving the afternoon free for research.²⁴ This leads Hahn to conclude that theoretical research was something that was carried out outside of professional boundaries before the nineteenth century. This chapter argues that the position of botanic garden supervisor showed a different model and one much more encouraging of research activities.

The role of garden supervisors in research

As chapter 2 discussed, growing and expanding the collections of the gardens was an act of botanical research. In Edinburgh and Pisa this was the responsibility of the garden director. In Edinburgh, for example, Hope went as far as to create a Society for the Importation of Foreign Plants and Seeds to bring North American species to Scotland.²⁵ His correspondence also shows he wrote to several botanists such as Carl Linnaeus in Uppsala or Casimir Ortega in Madrid to send and exchange various species of plants.

The director was indeed in charge of designing the experiments going on in the garden. Chapter 2 gave examples of the types of experiments going on in Edinburgh. The staff certainly helped in the manipulation and the day to day maintenance of the plants, but the design and the coordination of the experiments were down to Hope as the *Regius Keeper*. Noltie remarks that Hope's copies of Duhamel's and Hales' books were very heavily annotated by him.²⁶ The idea of replicating their experiments and of checking their theories must therefore have come from Hope and not one of his staff.

The experiments were intimately linked to Hope's function as the garden's director. They were carried out in the garden, with the collection and the resources of the garden, which were now technically property of the State and not his private property, as discussed earlier. The research carried out by John Hope used the garden's collection to inform his teaching; it was a product of his double function of management and professor. The research was essential to his and his equivalents in Florence and Pisa's roles of garden director.

In the *Società Botanica*, it is unclear who was exactly in charge of plant acquisitions under the different models, but it seems to have officially been the mission of one or several committees. The committees also took more responsibility in setting up the research objectives of the garden. Their archives contain a list of "Botanical arguments on which it is possible to reason, and make

²⁴ Hahn, 135.

²⁵ Roger L. Emerson, 'The Edinburgh Society for the Importation of Foreign Seeds and Plants, 1764-1773', *Eighteenth-Century Life* 7, no. 2 (1982): 73-95.

²⁶ Noltie, *John Hope, 1725-1786*, 62.

experiments” from 1767.²⁷ About 15 different potential areas of exploration were put on the list, like the first “we will check the pretended virtues of Linnaeus’ *Lobellia Siphilitica*, esteemed nowadays in the North specifically for the Syphillis”. The other items on the list ranged from making an inventory of the Tuscan tree species, to discussing the nature of the soil in specific mountainous places where perennials grew. Many of the tasks listed consisted in checking the properties of plants – like the *Lobellia*, the rhubarb, or some dyeing species later – or checking the old description of some species in the garden or in Tuscany to see if they were indeed what the previous botanists – like Micheli or Cesalpino – had estimated them to be according to new standards. The list does not show much original research, except on the specificities of Tuscan flora.²⁸ Many of the experiments were based on the work from other botanists – Linnaeus, Cesalpino – which shows an awareness of the work carried out outside of Tuscany and a will to integrate in the wider botanical discussions. All these research questions on cataloguing, checking results of other people’s work, testing properties of plants, and classification, seem to have been set collegially. They show a real institutional push for research, but it is unclear who was in charge of then applying them practically. This changed under the *Georgofili*’s administration.

The garden of the *Georgofili* in San Marco was called the *Orto Sperimentale*, the “Experimental Garden”, making its research mission very clear. As said earlier, the director was “in charge of the experiments assigned by the Deputies themselves, by the Ordinary Academicians, and the Honorary ones”, which means that he was also not the one designing the experiments, but carrying them out was quite literally in his job description.

The director also was in charge of presenting the results of the experiments to the members of the academy in annual “reports”. Zucchini’s seem to have been oral reports that appear in minutes of the academy’s meetings.²⁹ His successor, Ottaviano Targioni-Tozzetti, also wrote and published his in the *Atti* of the academy.³⁰ The reports show that the director was the one keeping track and collating information on meteorological observation, and measurements of plant productivity in the garden that were mentioned in chapter 2.

Research in the *Georgofili*’s garden was more formally organised than in the *Società*. The *Società* presented research as part of their ethos, but the actual steps taken to conduct that research

²⁷ BUB, Scaffale Msi, n°97, ff336-337.

²⁸ See chapter 9.

²⁹ For example: ADG, Verbali di Adunanze, 7 settembre 1791.

³⁰ ADG, *Atti* – Vol. VI, 1810, Art. VII, 424.

were never made explicit in the official texts. In the *Georgofili*, it was explicitly mentioned as a function of the director and it was formerly reported on to the members of the academy. The differences between the two institutions in terms of research show an evolution through the eighteenth century of the function of director regarding research. Research became increasingly valued and institutionalised towards the end of the century.

An example of how research became part of the role of garden supervisor can also be seen in Pisa. Santi was given the chair of natural history and the management of the garden, but he was not a keen botanist himself. His preference was for chemistry and other branches of natural history.³¹ He still took on a very active role in the management of the garden, supervising a complete renovation and reordering of the plants according to the Linnean system. He also did collect and describe new species of plants for a Tuscan Flora. The job of director of the garden required more strict commitment to the science actually at play in the garden and to the research in that area.

The importance of research was officially less explicit in Scotland than Tuscany, which makes it easier to miss. In Scotland, there was no written text or other indications that research had become an official requirement of the job of director. It seems to have been a *de facto* requirement, because of his teaching responsibilities. The experimental garden of San Marco also opened after the botanic garden of Edinburgh. In fact it opened three years before the death of Hope himself in 1786. Time is also a factor in the difference between those two institutions. There were probably also cultural differences. The trend appears to be that research occupied a more and more important place in botanic gardens across Europe, but it does not mean that it became an institutionalised requirement everywhere at the same time. Maybe because of the legacy of the *Cimento* and other contributors to science, Tuscany placed more overt emphasis on research than Scotland.

Another difference between Edinburgh and Florence was the overall hierarchy within the institution. Looking at the *Società* and the *Accademia*, they seemed to put more emphasis on the research in official texts, because the collective nature of the societies forced them to give very formal instructions to the garden's supervisor. In Edinburgh and in Pisa, the complete control of the supervisor over the garden meant that it was their choice to carry on more or less research. There were fewer contractual obligations. In this sense, the function of institutional savant was

³¹ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 75.

more formalised in Florence, but the similarities between all the gardens are strong enough for us to argue that the supervisors of Pisa and Edinburgh occupied a very similar position as Zucchini, for example. The comparison between the two countries shines a new light on the importance of research in the *Regius Keeper's* role, putting into question the traditional interpretation of professionalization of research in the nineteenth century. In both countries, the directors took part in research to sustain their role of teachers and managers, making them paid researchers.

The exception of la Specola

As per usual, *la Specola* presented a slightly different model to its university and learned societies' counterparts. The museum was not a space of research, nor was it a place of formal teaching. The responsibilities of Attilio Zuccagni, *custode* of the garden for the museum, seem to have been limited to the management aspect of the director's role.³² He was in charge of the collection and he supervised the building work for the extension of the garden in 1779. His role was supervised by Fontana, the director of the whole museum, who had a big influence on every decision, unlike the superiors of Hope or Santi in the universities. Zuccagni was a capable botanist and scholar. He had been chosen by Fontana to work with him on the project of the museum since the early stages.³³ As of today, little is known about Zuccagni. As far as botanic garden directors go, he was an anomaly amongst the other cases studied here. Any research or teaching that he might have conducted – he was recommended for a professorship in Pisa at some point – was not part of his role as *custode*. It was on his own time or attached to other functions he might have had.

Zuccagni provides here a counter example to the other men of this chapter. Because his job as head of garden did not include the same responsibilities as the others, he was closer to the figure of the savant as described by Hahn: paid for occupying a science related office, but not practicing research as part of his profession. The contrast with Zuccagni highlights the specificity of the cases discussed earlier in this chapter. Because of this, it is difficult to say that Zuccagni was an institutional savant. He did share many of the characteristics of his colleagues – as will be shown

³² Contardi, *La Casa Di Salomone*, 108.

³³ Simone Contardi, 'Linnaeus Institutionalised, Felice Fontana, Giovanni Fabbroni, and the Natural History Collections of the Royal Museum of Physics and Natural History of Florence', in *Linnaeus in Italy: The Spread of a Revolution in Science*, by Marco Beretta and Alessandro Tosi (Sagamore Beach: Science History Publications, 2007), 115.

in the following chapters – but his role was so different that he probably stands as the odd garden director who did not fit into this category.

Conclusion

Hahn argued that “research for the furtherance of rational understanding about nature”³⁴ was not encouraged enough in the eighteenth century to create a socio-professional class of scientists. This chapter cannot entirely refute this conclusion, because of the silent but ever-present argument of statistical significance. There were not enough botanic garden directors to make them into a fully-fledged socio-professional class. Even adding to them the supervisors of similarly minded institutions like observatories could not make them into such a class. This is also true because cities rarely had more than one or two of this type of institution. This means the supervisors could not actually form a physical group or community. However, at the end of the eighteenth century, Europe counted over 1600 botanic gardens. I would argue that this represents a statistically significant number of people across Europe whose status has been overlooked by the historiography and who presented an early vision of what professional scientists could be.

The botanic garden directors were given functions of collection management and teaching. Combined with the rapid evolution of plant knowledge at the time, this encouraged the development of research in the gardens. By the end of the century, the supervisors were conducting scientific research as part of their job. This was true in almost all the gardens studied here, apart from the exception of *la Specola*, a garden that was specialised in the instruction of the public. In other, more famous, European gardens, supervisors did conduct new research, but it was less apparent that the research was linked to their institutional role. Linnaeus was famous before his appointment in Uppsala, and his work before and after was not dependant on his work in the garden. The late eighteenth century saw Buffon rise to fame for his work on natural history, but that specific work was not tied to the *Jardin du Roi*. In fact, Buffon spent relatively little time in the said garden, managing it from his residence of Montbard. At the same time, in smaller gardens, some supervisors pursued research as part of their duties. That research did not make them internationally famous, but their situation was much more common than that of a Buffon. It was common enough that they constituted an important group of people that does not fit in the traditional narrative of the professionalization of science.

³⁴ Hahn, ‘Scientific Careers in Eighteenth-Century France’, 135.

Chapter 6: Qualification, specialisation and practice

In his 2016 chapter about the figure of the “man of science”, Paul White describes complaints in 1847 that positions of authority in the British Museum had been filled by “men of rank and general attainments” rather than men of science.¹ The traditional narrative in the history of science is that this type of appointment became less and less frequent over the course of the nineteenth century, in large part because of the development of official qualifications defining expertise.² Oxford and Cambridge did not introduce a bachelor’s degree in science before the early 1850s.³ This can give the impression that a profession of science could not develop before the nineteenth century, because there was a lack of public certification of scientific competence before then. It is again a teleological assumption to base the recognition of scientific qualification on our contemporary academic model where a specialised bachelor or PhD certifies one’s scientific aptitudes.

The study of botanic garden directors brings a different perspective to this analysis. This chapter will examine what the garden directors can teach us about the notion of qualification in the eighteenth century. It shows that standards emerged that defined expertise in relation to an individual’s academic qualifications rather than work experience. It will argue that the second half of the century saw the crystallisation of a knowledge hierarchy in the gardens and society that was at least partially based on recognised certification of expertise. This established a distinction between the expert botanist and other people, contributing to an early process of professionalization.

The chapter will first look at the non-academic criteria that came into play in the nomination of directors, focusing on notions of patronage. It will then show that patronage was no longer enough and that there was a crystallisation of the practice of hiring based on official qualifications. Finally, it will examine the different management styles of the directors to show the hierarchy of knowledge in action in the garden.

¹ White, ‘The Man of Science’, 158.

² See for example Shapin, *The Scientific Life*; Shapin, ‘The Image’; J. B. Morrell, ‘Professionalisation’, in *Companion to the History of Modern Science*, ed. Robert C. Olby et al. (London: Routledge, 1990), 980–89.

³ Morrell, ‘Professionalisation’, 983.

Of patronage

The Enlightenment and the French Revolution are often credited in general histories of expertise or merit as a time of great development for the concept of meritocracy.⁴ Meritocracy is sometimes considered to have replaced the system of patronage in the development of scientific careers. In the nineteenth century, for example, Thomas Huxley was outwardly irritated with people who he perceived as perpetuating the practices of patronage rather than applying the precepts of meritocracy.⁵ In the case of the garden directors, as in the case of Huxley, the promotion of scholars to the institutional positions was not only based on academic achievements. This chapter and this thesis are not claiming that the recruitment of directors was entirely based on merit of academic achievements. Instead they accessed their positions thanks to a hybrid system that included patronage and academic meritocracy.

By the mid-eighteenth century, patronage had long been an important mechanism in the development of science.⁶ The practice of patronage consists in being given advantages, privileges, or a position by protectors who are higher in the social order. As heads of royal or grandducal institutions, the directors were *de facto* placed under the tutelage of the King or the Grand-Duke once they took their positions. How they got to that position shows the various levels of patronage at play around botanic gardens.

First, some of the garden directors benefitted from the most traditional aristocratic patronage. John Hope, for example, named two beds of the garden in Leith after George III and Lord Bute, because the latter helped him to get nominated as professor of botany during his tenure as Minister of Scottish Affairs (1761-67) and later to secure funding for the garden from the King during his time as Prime Minister (1761-62).⁷ Both were considered patrons of the garden. Hope

⁴ See for example Ken Alder, 'French Engineers Become Professionals, or Meritocracy Made Knowledge Objective', in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago: University of Chicago Press, 1999), 94–125; Julia Evetts, Harald A. Mied, and Ulrich Felt, 'Professionalization, Scientific Expertise, and Elitism: A Sociological Perspective', in *The Cambridge Handbook of Expertise and Expert Performance*, ed. K. Anders Ericsson (Cambridge ; New York: Cambridge University Press, 2006), 105–26.

⁵ White, *Thomas Huxley*, 37–38.

⁶ Bruce T. Moran, ed., *Patronage and Institutions : Science, Technology, and Medicine at the European Court, 1500-1750* (Rochester: Boydell Press, 1991); D. J. Sturdy, *Science and Social Status: The Members of the Académie Des Sciences 1666-1750* (Woodbridge ; New York: Boydell Press, 1995); Hannah Wills, 'Joseph Banks and Charles Blagden: Cultures of Advancement in the Scientific Worlds of Late Eighteenth-Century London and Paris', *The Royal Society Journal of the History of Science* online (20 February 2019); Roger L. Emerson, *Academic Patronage in the Scottish Enlightenment Glasgow, Edinburgh and St Andrews Universities* (Edinburgh: Edinburgh University Press, 2008); Shapin, 'Property, Patronage, and the Politics of Science'.

⁷ Caroline Gillan, 'Lord Bute and Eighteenth-Century Science and Patronage' (Doctoral Thesis, Galway, NUI Galway, 2018), 10.

himself wrote that “it was to his Lordship [Bute] that [he] owed [his] office”⁸ acknowledging the role that the minister had played in his career. Lord Bute was himself very interested by botany and seems to have played quite an important role in the promotion of Hope and the garden.⁹ If he was indeed instrumental in getting Hope his office, it was because as a Scottish noble and a minister he had great influence both in the royal court – he had been the tutor of the Prince of Wales before he became George III – and locally in the city of Edinburgh, where the university professors were chosen.

Patronage for the directors could even come from higher than a minister like Lord Bute. In Tuscany, Giorgio Santi was made director of the botanic garden of Pisa on the express order of the Grand-Duke Peter-Leopold himself. Alessandro Tosi goes as far as to describe him as a “creature” of Peter-Leopold.¹⁰ Santi had been trained in medicine thanks to a public scholarship, which explains the term. He also travelled around Europe to perfect his knowledge and was recalled to Tuscany by order of the Grand-Duke specifically to take on the botanic garden in Pisa.¹¹ In his case, the appointment to a position of institutional savant seems ambiguous, between reward for scientific achievement and obligation to public service after having been supported by the State through his studies.

Scientific patronage was not limited to aristocrats and princes protecting scholars. It applied within the community of scholars as well. David J. Sturdy notes in his book about the French *Académie des sciences* that academicians had patrons and became patrons themselves too already in the seventeenth century.¹² In the case of botanic garden directors, scholarly patrons, individuals or groups, played this role as intermediaries between the botanists and the authorities. The resources given by the scholarly patrons were of a different nature than the appointment and money that political patrons provided. Most importantly for the careers of directors, scholarly patrons provided recommendations. In Florence in particular, it is easy to see how the Grand-Duke was relying on the scholarly community’s expertise to select the best candidates for the job of institutional savants. When the *Georgofili* recruited Andrea Zucchini as the first director of the *Orto Sperimentale*, the official nomination came from the grandduccal authorities, but correspondence shows that Zucchini had been chosen by the members of the *Accademia* and

⁸ Quoted in Noltie, *John Hope, 1725-1786*, 13.

⁹ Francis Russell, *John, 3rd Earl of Bute: patron & collector* (London: Merrion Press, 2004); David Philip Miller, “My favourite studies”: Lord Bute as a naturalist’, in *Lord Bute: essays in re-interpretation*, ed. Karl W. Schweizer (Leicester: Leicester University Press, 1988), 213–40.

¹⁰ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 220.

¹¹ Pasta, *Scienza, Politica e Rivoluzione*, 62–63.

¹² Sturdy, *Science and Social Status*, 39.

recommended as the best choice for the role directly to Peter-Leopold.¹³ There was recognition of the academicians' expertise and their ability to evaluate that of the candidates. In a similar way, Felice Fontana, first director of *la Specola* proposed a list of names of scholars who he thought competent to take on the direction of the various department in the Grand-Duke's museum – Attilio Zuccagni being on the list for the botanical collection. It is also possible that Lord Bute's interests in botany gave him credibility when recommending John Hope for the chair of botany in Edinburgh.

The weight that vetted experts could have in the evaluation of the potential directors' abilities meant that they were defining the boundaries of science within a community, as they did in defining space via the visitors ban. Patronage should not be opposed to meritocracy because it also functioned on merit and that merit was more and more evaluated by experts of their own subjects.

This is not to say that expertise and knowledge were the only criteria at play in the patronage system. It is easy to see, if only through the examples of the repetitions of the names Tilli and Targioni-Tozzetti, that family status and relations played an important role in scholars' careers. However, the two families show an evolution of the role of family throughout the century. From 1685 to 1782, there were three Tillis in charge of the Pisan garden: Michelangelo, Angelo Attilio – nephew of the first –, and Gian Lorenzo – son of the former.¹⁴ The office had obviously been passed down without anyone questioning it. When Angelo Attilio died in 1781, Gian Lorenzo took on what Tosi refers to as the “regency” of the garden. He had been educated all his life in the garden and, as we will see in detail later, he was already working there. Gian Lorenzo wrote to the Grand-Duke to ask to be officially given his father's position, probably not doubting that he would receive a positive answer. Yet the Grand-Duke preferred Santi and broke a century of tradition.

In the same way, by the 1780s the Targioni-Tozzetti family was well established in the Florentine scholarly circles thanks to Giovanni Targioni-Tozzetti.¹⁵ Giovanni had been the head of the botanic garden of San Marco under the Medici, catalogued the collection of the natural history cabinet of the *Uffizi* for the Lorraine, been the head of the Magliabechiana library, and written extensively on his naturalist travels around Tuscany. He was also a member of the *Società Botanica* and a founding member of the *Accademia dei Georgofili*. Yet when his son, Ottaviano, tried

¹³ ADG, Giustificazione di entrata e uscita, Busta 153, Ins.3, 58, Giovanni Neri to SAR, Florence, 18 September 1784.

¹⁴ Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 348.

¹⁵ Barbagli and Vergari, *I Targioni Tozzetti*.

to get the position of director in the *Orto Sperimentale* in 1783, he was rejected, and Zucchini was hired instead. It appears family links were certainly helpful but not enough to claim a position anymore. Ottaviano went on to work in the garden of the hospital Santa Maria Nuova, to help and replace Zucchini when he was away, and to take over as professor of agriculture after the French invasion so he was not out of work or unqualified, but his status as son of one of the founding members of the *Accademia dei Georgofili* still did not guarantee his recruitment there.

The patronage system surrounding the botanic gardens was complex. There was an increase of attention paid to scholarly merits as defined by the scholar community in the second half of the eighteenth century. Connections were useful but increasingly needed to be backed up with more and more scientific credit, a role that was played by good opinion among the scientific community and also official qualifications.

Qualified botanists

University qualifications

According to the Carr-Saunders/Wilson sociological approach, one of the stages of professionalization is the development of specialist qualifications, the creation of public certification of scientific competence to measure achievement by examination.¹⁶ The development of certifications is usually dated to the nineteenth century, with slight variations depending on the precise discipline being discussed.¹⁷ Botany seems to have been rarely considered under this angle, but because of its close association with medicine, an official qualification in botany existed long before the first British bachelor of science in the 1850s. This is exemplified by the directors' paths.

All of the garden directors in Edinburgh, Florence, and Pisa had had a formal education in universities. With the exception of Zucchini, who was a member of the clergy and therefore learned theology, all of them – including Zuccagni – were trained in medicine. John Hope started his training in the University of Edinburgh in 1740 or 1741.¹⁸ He then travelled to Paris for a few months before coming back to Scotland in 1749 and obtaining a doctorate in medicine from the University of Glasgow in 1750. His successor, Daniel Rutherford graduated from a doctorate in

¹⁶ As summarised in Morrell, 'Professionalisation'.

¹⁷ For example Shapin, *The Scientific Life*; Mody, 'The Professional Scientist'; Allan Chapman, 'L'Ottocento: astronomia. La professionalizzazione dell'astronomia in "Storia della Scienza"', in *Storia della Scienza* (Treccani online, 2003), [http://www.treccani.it/enciclopedia/l-ottocento-astronomia-la-professionalizzazione-dell-astronomia_\(Storia-della-Scienza\)](http://www.treccani.it/enciclopedia/l-ottocento-astronomia-la-professionalizzazione-dell-astronomia_(Storia-della-Scienza)).

¹⁸ Noltie, *John Hope, 1725-1786*.

Edinburgh in 1772. In Pisa, the three Tilli had been trained locally, all doctors of medicine, and Santi was a graduate (doctor) from the University of Sienna. The case was similar for the Florentines: Saverio Manetti studied in Pisa and Florence and became a doctor in 1745, Zuccagni studied pharmacy and medicine first in the botanic garden and the hospital Santa Maria Nuova in Florence, then moved on to get his doctorate from the University of Pisa¹⁹, Giovanni Targioni-Tozzetti was a medical doctor trained in Pisa²⁰, Ottaviano was also a doctor, trained in the hospital and in Pisa.²¹

The doctorate was the highest university qualification one could earn in the eighteenth century. Most of our garden directors studied in the universities of Edinburgh and Pisa. Like most European universities, Edinburgh and Pisa offered three defined courses.²² In Edinburgh they were divinity, law, or medicine, in Pisa theology, law, or arts – medical science was part of the arts degree. Those were the three official disciplines in which one could get a doctorate to prepare for the three traditional professions: clergy, law, or medicine.

Historiographical assumptions that the eighteenth century was a pre-professional age in science do not make sense when considered in relation to botany. The directors' profiles show that it was conventional to expect them to have studied botany formally at university. Although attached to the medical profession, the qualification in medicine of the garden directors was also a qualification in botanical science. Botany, or *materia medica*, was taught as part of the medical cursus in all universities. Students who showed interest in plant knowledge would therefore choose to train in medicine – as was the case for the Tillis, the Targioni-Tozzettis, and Hope. Botany was considered a part of medicine, which means that the garden directors were medical doctors with a specialisation in plant science. Other people could follow the medical cursus and specialise in other areas such as chemistry or anatomy.

This meant that it was logical for universities, learned societies or other authorities to recruit medical doctors as garden directors. With a doctorate in medicine, they could also practice

¹⁹ ADG, *Atti*, vol. VII, 1812, 38-46, "Elogio del D. Zuccagni".

²⁰ Renato Pasta, 'Targioni-Tozzetti, Giovanni', in *Dizionario Biografico Degli Italiani* (Online: Treccani.it, 2019).

²¹ ADG, *Continuazione Atti*, vol. VII, 1829, 240-246, "Dott. Ottaviano Targioni Tozzetti".

²² On Pisa see Marina Roggero, 'Professori e Studenti Nelle Università Tra Crisi e Riforme', in *Storia d'Italia, Intellettuali e Potere*, vol. 4 (Torino, 1981), 1039-84; Coppini and Tosi, *Sapienza*; Coppini and Tosi, *Sovrani Nel Giardino d'Europa*; On Edinburgh see Phillipson, 'The Making of an Enlightened University'; Grant, *The Story of the University of Edinburgh*; Robert D. Anderson, *The University of Edinburgh*; Morrell, 'The University of Edinburgh in the Late Eighteenth Century'.

as physicians, but that did not mean that they were not officially qualified in plant knowledge. They all held a degree relevant to the job they were occupying.

This degree was not inconsequential and defined the directors as a specific group of science practitioners. In his book about France, Roger Hahn notes that the members of the *Académie des Sciences* could be self-taught or formally trained.²³ The *Académie* had no preference either way. This was not a universal situation in eighteenth-century scientific institutions: the group of people studied here show a definitive preference for individuals holding degrees in a relevant field. All but one did. In sum, botanic gardens appear to have had a different selection process than the French *Académie des sciences*. In large and prestigious institutions like the *Académie*, members or employees were recruited based on their knowledge as well as the history of what they had accomplished for science. The *Académiciens* would be looking for extraordinary profiles, something much easier to do for such a prestigious and unique institution. In smaller and more peripheral institutions, people might be recruited because they fitted the criteria expected by the authorities recruiting. Those criteria put more emphasis on their training than on big accomplishments, which can explain the disparity. It was important for the garden directors to be formally qualified for their office, not necessarily to be famous and extraordinary figures.

Education was not as specialised in the eighteenth century as it would then become in the nineteenth and twentieth century. This did mean that degrees and qualifications could not be as precise as PhDs would later be, but it did not mean that scientific qualifications did not exist or were not recognised. From an eighteenth-century perspective, a doctorate in medicine meant that the garden directors considered here were qualified to occupy that function. A doctorate in medicine was not enough to prove qualification though. Since the specialisation in plant science was not explicit in the title of the degree, qualification in that particular branch had to be gained and reinforced in other ways.

Specialisation

The general medical degrees of the garden supervisors certified that they had received some formal training in plant science. Since they were then evaluated by other scholars in the field of plant knowledge or natural history, the future directors needed evidence of further specialisation in this particular area, be it in plant physiology or agriculture. Their specialisation could happen

²³ Hahn, *The Anatomy of a Scientific Institution*.

through more formal instruction or through practice. In most cases it sprang from a personal interest in plant knowledge that pushed the future directors to invest time, effort, and money into their specialised education.

The formal instruction route could be taken privately. John Hope, for example, took Bernard de Jussieu's class when he was in Paris, away from his *alma mater*. When Hope was in university it was common for students in Edinburgh to take some time to travel and further their studies abroad. Most medical students tended to choose Leyden as a destination, because of its excellent reputation for medical courses. Hope's choice of Paris was a bit more unusual and stemmed from his admiration for Bernard de Jussieu. He wanted to attend the classes in the *Jardin du Roi* specifically because he recognised Jussieu as one of the great botanic minds of his time. This was a choice motivated by the intention to specialise in plant science.²⁴

A specialisation by formal instruction could also be part of the normal cursus of medicine, with particularly close attention dedicated to the plant knowledge classes. The eulogies in the *Georgofili's* journal publication *Atti* often point to the specialisation of their past members. The text always mentions their medical degrees, but also emphasises the strong interest of the deceased for plant knowledge in particular. Often, this was done by mentioning the names of specific professors. In Zuccagni's eulogy, for example, the description of his studies mentions three professors by name: Lapi in Santa Maria Nuova, Guadagni and Tilli in Pisa. Lapi was the professor of pharmacy and botany, and the head of the hospital's garden of simples.²⁵ Tilli was obviously the prefect of the Pisan garden. Guadagni was the only one not teaching a botany related class, but he was a well-known physician, famously interested in plant study, and member of the *Società Botanica*. Ottaviano Targioni-Tozzetti's eulogy mentioned "his capable Master the Abbé Lapi", and of course his own father and family.²⁶ The mention of those names emphasized the importance that those professors were perceived to have had on the directors. According to the members of the *Georgofili*, their specialisation in plant science had been forged by those professors. Though no records of debates over recruitment exist, we can assume that these experiences came up in the discussion of candidates for the job of director.

The individual professors were extremely important to the specialisation of plant scholars. The specialisation was not proven by the name of the discipline on the diploma but by the attendance and efforts given to the class of a worthy professor. Many of the professors cited were

²⁴ Noltie, *John Hope, 1725-1786*.

²⁵ ADG, *Atti*, vol. VII, 1812, 38-46, "Elogio del D. Zuccagni".

²⁶ ADG, *Continuazione Atti*, vol. VII, 1829, 240-246, "Dott. Ottaviano Targioni Tozzetti".

also connected to botanic gardens. It was important to show the connection with the practical demonstration of botany, because expertise in plant science could not be based only on theoretical study in books only. The gardens therefore played an important part in the emerging specialisation of scholars as education tools.

Yet there was not a strong emphasis on previous work experience or written contributions to science. None of the directors cited here had previous experience in managing an institution like a garden (not even a private one), apart from Ottaviano Targioni-Tozzetti at the very end of the century. Their specialisation was also not determined based on publications. Hope never published any work, and Rutherford had but one publication at the time he was recruited, which was on chemistry! Saverio Manetti did write on plants, but only published after his recruitment as professor for the *Società*. He was probably the most prolific author of them all but is mainly remembered for his work on birds. Santi also published after he took over the botanic garden of Pisa, but mostly on chemistry. In *most* cases, experience and previous work did not count for much.

The strange case of Canon Zucchini and Dr Targioni-Tozzetti

Andrea Zucchini was the only one among all the other directors studied here to not have a doctorate. Zucchini's case acts as a counterexample demonstrating both the value of practical experience and the importance of formal qualifications.

Zucchini did not have a medical degree. He was a member of a profession as a canon in the Church but had no formal training in plant science in particular. In the letter announcing that the Academy had chosen Zucchini to be made first director of their garden to the grandducal authorities, Giovanni Neri wrote:²⁷

[W]e have not been able to find a subject more capable to fulfil the duties of the Directorship with great utility for the Academy and for the Public than the Canon Andrea Zucchini from Cortona, who has all the practice of agrarian matters, talent, genius, and passion for applying them to topics of public advantage, and on top of all of this has also given some demonstration of his application with some Publication. This subject [trn: person] for his experience, which he had since his childhood of the countryside for the studies and experiments he conducted on [the said countryside] was believed to be the most

²⁷ ADG, Giustificazione di entrata e uscita, Busta 153, Ins. 3, N°58, Giovanni Neri to SAR, Florence, 18 September 1784.

suitable [compared to] others who could have more erudition than him, to fulfil with true utility, and not with pompous appearance the Directorship of the Garden, and to give the Lessons that are attached to this office.

This excerpt put a strong emphasis on the value of practical experience. The fact that Zucchini spent his life in the countryside and already conducted experiments in agriculture was the reason he was considered for the position. The end of the excerpt even stresses that people with more “erudition” and theoretical knowledge would not be as suitable as he was. This was linked to the practical mission of the garden. The experimental garden was supposed to bring practical and tangible benefits to the population.²⁸ A man of practice who knew farmers and the countryside was supposed to be an asset for this mission.

Zucchini was indeed an example of a scholar being hired to work in a garden without formal qualification in medicine. However, Zucchini was still an educated man with a formal education, just not in a science related topic. He was not an actual farmer or manual worker. The recognition of practical knowledge did not extend to the expertise of actual artisan-practitioners or manual workers. Practical experience of experimental research or plant growing was desirable because it was how scholars could show their expertise in the precise domain of botany. It was not a complete substitute for a formal education.

It is also interesting to note that Zucchini remained the only exception among the directors of the gardens discussed here. His successor with the *Georgofili* was Ottaviano Targioni-Tozzetti, a certified doctor. Targioni-Tozzetti was also a medical doctor, born and raised in Florence and no more familiar with the actual experience of farmers in the countryside than any of his city-bound colleagues. He was also not a landowner or in charge of any agricultural domain other than the San Marco garden. Before he got the job, he only had one publication on *materia medica*, though he did have experience managing the hospital garden of Santa Maria Nuova, which did make him the most experienced of all the directors studied here.

The letter on Zucchini did indicate that their first instinct would have been to find someone who would “have more erudition than him”. Zucchini was the only exception and the people who recruited him *recognised* him as an exception, which is why Neri felt the need to justify their choice. Indirectly, this also proves the importance of formal training for garden directors.

²⁸ See Part III of this thesis for more details.

Although patronage played an important role in the designation of botanic garden directors, in the second half of the eighteenth century, a formal qualification in a degree that included some formal botanical or scientific training was almost always a requirement for selection. The proximity of botany to medicine meant that the former was associated with a formal university degree early on. An expertise in plant science specifically had to be developed through scientific practice both within the formal curriculum but also outside it. Practical experience such as that accrued by Zucchini, and practical based knowledge – still acquired in a formal university context – such as the one acquired in botanic gardens by the others was valued and required for the position of supervisors.

The criteria to qualify for both the formal certification of the doctorate and what qualified as specialisation in plant science were defined by experts. In the university, professors of medicine were in charge of evaluating the candidates for a doctorate. In the recruitment of directors, I showed earlier that the opinion of members of learned societies for example, was important to the selection of the best candidate. The *Georgofili* were the ones to decide that Zucchini's practical experience met their criteria for a director. Ken Alder has shown that in the eighteenth century, the adoption of official certification to access certain professions or jobs was used as a social tool.²⁹ This requirement placed an official boundary between people who could be institutional savants and the rest of the population. This contributed to the creation of a clearly defined group and was a step towards professionalization.

The adoption of the doctorate as a requirement to be seen as a good candidate was never done overtly or even explicitly. No rules clearly stated that only medical doctors could apply for those positions. As with a lot of phenomenon brought forward in this thesis, there were no conscious efforts to professionalise botany but a shared tacit understanding of what was needed. There was a progressive crystallisation of the practice of recruiting people with a degree, even though they were sometimes not that different from other members of staff in the garden in what they actually did, and having the same degree did not guarantee consistency in management style from one garden to another.

A day in the life of a botanic garden director

The expertise and the particular taste and inclinations of each director naturally influenced their management of their garden. Chapter 2 showed how Andrea Zucchini chose to focus the

²⁹ Alder, 'French Engineers'.

curriculum within his courses on farmers' lives in the countryside, whereas Ottaviano Targioni-Tozzetti was more concerned with ideas of commerce and the point of view of landowners. The previous considerations of their respective qualifications and upbringings help to explain those differences, because each tailored his teaching/research within the garden according to his own interests. These personal choices and preferences were not so strong that the directors' jobs were completely defined by who occupied them, but they do show that each individual could bring something different to a function defined by a framework laid down by each institution. One of the areas in which there were differences between the directors was the day to day involvement in the work conducted in the garden.

As managers, the directors worked with teams of staff under them. The permanent staff was made of gardeners, usually lower-class workers. A multitude of other professions, especially manual workers, also came in contact with the botanic gardens. The exact details of who all of these people were and what they did is not available in every garden, but the financial archives of Edinburgh³⁰ and Pisa³¹ in particular give great insight into this subject matter. Both show that day workers were hired for temporary work in the garden, sometimes to help the gardeners, sometimes to repair walls or dig sewers, for example. They also show the plant traders, pot makers, coal and dung delivery people who were supplying the gardens regularly, and the glaziers, painters, architects and artists who came to do specialised work on the greenhouses, the buildings, or the plants. All of those people had to be contacted, supervised, and paid.

In Edinburgh, John Hope had delegated many of these managerial responsibilities to his head gardeners, John Williamson and his successor Malcom M'Coig.³² As their title suggests, Williamson and then M'Coig were in charge of directing the team of gardeners. The head gardeners also controlled who came into the garden and charged them accordingly. They and the gardeners would give the tour of the garden to visitors. The head gardeners were even involved in some financial management: M'Coig, for example, paid the gardener Henry Porteous 11 shillings from the "Fund for distressed Gardeners" when he fell ill in August 1785.³³ The responsibility for the money and the budget, however, stayed with the director. Hope was accountable for it in front of the Exchequer, and he was the one paying all the workers in the garden – at least nominally – according to the receipts that they signed. The presence of the head gardener allowed Hope to not be in the garden every day. The house in the garden was inhabited by what seems like the entire

³⁰ RBGE, Collection HOP - Hope, Dr. John, E414/1-11.

³¹ ASP, Università di Pisa 13/515, and 13bis/F/VIII/1/A.1781/1782-1809-1810.

³² Noltie, *John Hope, 1725-1786*; Fletcher and Brown, *Royal Botanic Garden Edinburgh*.

³³ NAS, E350/21.

team of gardeners – with maybe some exceptions for those who had a family, but this is not clear from the archives. They were three in total and were the ones constantly on site. Hope lived in the city and presumably only came when he was teaching, and/or to give his instructions.

This organisation in Edinburgh created a clear hierarchy in the garden. Hope was the one with overall responsibility, but he did not seem to concern himself with the manual labour going on in the garden. It is impossible to say how often he was in the garden outside of the few months a year when he had to teach. On paper at least, Hope seems to have been a very busy man, carrying the responsibilities for the garden, the chair of botany, the Principal Physician of the Royal Infirmary, being a governor of the Orphan Hospital, a member of the University Senate, as well as involved in various colleges – he was President of the Royal College of Physicians from 1784 to his death in 1786 – and clubs and societies. For a number of years in his life, he occupied several of those functions simultaneously, and during all of that time, he also continued to practise medicine in his own practice. This might explain why he needed to delegate some functions to the head gardener. Hope's role in the garden was strictly of an overall manager. There is no doubt that he was actively involved in giving instructions on experiments that he designed, for example, but he was at least removed from the day-to-day action. This was not the case everywhere.

In Pisa, for example, the Tillis – both father and son – seem to have had a very hands-on approach. The day to day job of the prefect is known through some of Gian Lorenzo Tilli's writing. Before his death in 1781, Angelo Atillio Tilli had been very sick for years. His son had taken over many of his responsibilities during this time and then wrote to the Grand Duke to apply for the job of prefect, arguing that he knew the ins and outs of it.³⁴ I will quote his letter here at some length because it gives a detailed account of the duties that he had performed:

[Giovanni Lorenzo Tilli had] since the year 1772 as a result of the indisposition of health of the Dr Angelo Attilio Tilli his father [...] been granted to do on his behalf the Demonstration of the Plants in the Botanic Garden for the benefice of Students [...].

He represents as well that it has been five years already, that by another favourable rescript the supplicant was authorised to give the Public Lessons of Natural History, and the Demonstrations of the Natural Bodies which exists in the Museum of the same University for the benefice of the said Students [...].

³⁴ Quoted by Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*, 316–18.

In the same way, as expected considering the long and almost uninterrupted illness of his Father, the supplicant has always worked in his place, not only as a custodian of the Botanic Garden, and the Museum, but also on the arrangement of the Classes the material of both, having placed numerous Birds, Fish, and various Quadrupeds prepared by himself for conservation, and moreover [he] has taken the responsibility to satisfy anyone who came to observe [the garden], showing the Medicinal Plants of the Garden, and the bodies of the said Museum to the Students, and to the very numerous Foreign scholars, who very frequently pass by Pisa.

This letter gives a description of Gian Lorenzo Tilli's actual day-to-day work. It shows that in this case the director of the garden took charge of much more concrete tasks than Hope did. Tilli was teaching several subjects in the garden, including *material medica*, natural history, and botany, but he was not only teaching, he was also the one giving the tours of the garden and the museum to the various audiences – students, scholars, tourists. He was also not only in charge of choosing the organisation of the garden based on the classes he taught but doing some of the manual work by preparing specimens for the museum, which meant cleaning and stuffing them for display. There was an element of manual or practical work in what the prefect was doing in the garden.

Unlike John Hope, Tilli lived in the garden. The building attached to the museum contained the apartments of the prefect. This allowed Tilli and then his successor Giorgio Santi to keep a very close eye on the garden and the work of the gardeners. It is unclear if Santi was also carrying out practical work in the garden, but the proximity and closer involvement of the directors in Pisa could explain why there was no equivalent to the head gardener in Pisa.

The situation was slightly different in Florence, but it evolved. Under the *Società Botanica* (1724-1783), the house attached to the garden was inhabited by the main gardener, Ulderich Prucker. Prucker seems to have had an excellent reputation and was a figure of authority in the garden, both because of talent and seniority. Since the *Società* functioned on a complex hierarchy in which the administration of the garden was referred to many people, Prucker as the *de facto* head gardener acted as the day to day manager of the garden. When the garden passed to the *Georgofili* in 1783, the *accademia* asked to remove Prucker from the garden, so they could offer

accommodation to Zucchini.³⁵ Zucchini was therefore in a position more similar to the Pisan directors than his predecessors. This did not stop him from travelling and leaving the garden under the actual management of Ottaviano Targioni-Tozzetti for long periods of time. It is difficult to say more about the day to day management of the garden of San Marco, so it is still impossible to judge how involved were Saverio Manetti – who was professor of botany in the garden for the *Società Botanica* –, Zucchini, or even Targioni-Tozzetti compared to Hope and Tilli.

It does seem that Tuscan gardens encouraged a closer supervision of the garden by the director. Apart from Prucker – who did not hold any official position of authority but was well regarded because of seniority – there was no equivalent to the head gardener in any of the Tuscan gardens. Official qualifications did not necessarily mean that directors were purely managers in charge of administrative duties. In Pisa, the director directly participated actively in the maintenance of the collection. The Tuscan directors had some practical responsibilities in the gardens and were required to be on site.

The proximity of the directors to the work of the staff did not mean that they were on the same level as manual workers. Most of the practical work in the garden was still done by the gardeners or labourers but following the instruction of the director. Despite the value put on experience and practical knowledge of plants in the qualifications of the directors, there was still a very sharp distinction between gardeners and scholars. In 1758, Giovanni Targioni-Tozzetti wrote a report on the botanic garden for the *Società Botanica*.³⁶ He included a document entitled “Reflections on the duties to give to the gardener”. In this document he insisted that the duties of the gardeners were different from those of the botanists, and that the first ought to respect the latter – respecting intended as obeying. Targioni-Tozzetti thought that the state of disarray that the garden was in was due to the fact that the gardeners had had too much leeway and had not directly followed the instructions given by the *Società*. The value of practice did not extend to actual manual labour.

The division of labour between manual work and management tasks was not always very strict, but the distinction between gardeners and directors was made very clear by the qualifications – and pay – of the latter. Formal education allowed the directors to be taken seriously as scholars and therefore theoreticians, even when their work and their experiments were based on practical

³⁵ ADG, Giustificazione di entrata e uscita, Busta 153, Ins. 3, N°58, Giovanni Neri to SAR, Florence, 18 September 1784.

³⁶ Contardi, *La Casa Di Salomone*, 27–28.

realities. For all the recognition of Zucchini's experience, experience was never enough, and no gardener ever ascended to the direction of a garden in the second half of the eighteenth century, even when their talents were recognised, like Prucker's. In the strict social context of the eighteenth century, this may seem obvious, but just the previous century, James Sutherland had worked his way up from gardener to professor of botany for the University of Edinburgh. Even at the beginning of the period, Prucker held a place of authority in San Marco, but his successors for the *Georgofili* were not even named in the paperwork of the academy. Other gardeners in the botanic gardens, like Robert Menzies or James Robertson, managed to ascend to higher classes through their knowledge of plants and natural history but they did not climb the hierarchy within their own place of work.³⁷ Directors could garden, but gardeners could not direct. As official qualifications became more important, the gardeners' role was relegated to the background.

There were exceptions to this general statement in more well-known gardens, the most famous one of which was André Thouin in the *Jardin du Roi*. Thouin and his prominent role in Paris and international networks were the object of a study by Emma Spary in her book *Utopia's Garden*.³⁸ Thouin did get access to a position of power in the garden which can seem to contradict the idea that gardeners lost their importance. However, Thouin was very different from the Tuscan and Scottish gardeners in many ways.³⁹ He was a *collège* educated man, whose family had the means to emulate the urban élite, while some gardeners in Edinburgh were not even literate. He also worked in one of the biggest and most recognised botanic gardens of his time, which meant more staff to supervise and a global outreach. Yet, despite all of this and the fact that he was the one in charge of the daily administration of the garden when Buffon was away, he was still a head gardener and not the *Intendant* of the garden. That last honour went to Buffon, who was, admittedly, not a medical doctor, but was a member of the *Académie Royale des Sciences*, another clear certification of his scientific abilities.

Conclusion

By the definition of their time, all of the directors were qualified specialists who had much in common. Eliot Freidson theorised in the 1970s that medicine was the first formally recognised

³⁷ James McCarthy, *Monkey Puzzle Man: Archibald Menzies, Plant Hunter* (Whittles, 2008); James Robertson, D. M. Henderson, and J. H. Dickson, *A Naturalist in the Highlands: James Robertson, His Life and Travels in Scotland 1767-1771* (Edinburgh: Scottish Academic Press, 1994).

³⁸ Spary, *Le jardin d'utopie*.

³⁹ Spary, 49–50.

scientific profession.⁴⁰ Botany represents a very particular case in the history of science because of its close links to medicine, which meant that an eighteenth-century medical doctorate applied to both subjects and also allowed botanists to be formally qualified at that time. Botanists benefitted from that early recognition of medicine as a profession. The historiography has sometimes ignored the official scientific qualifications of the eighteenth century or failed to identify it as such.

The notion of patronage and the idea that it worked in opposition to meritocracy also blurred that picture. The cases studied in the botanic gardens show that those qualifications actually played an important role in the scientific context of the eighteenth century as part of the old regime patronage system itself.

There were expectations about the levels of expertise required to be hired as an institutional savant. As botany had become a more official and specialised science, the position of director of a botanic garden called for higher qualifications and specialisation compared to earlier centuries. It was not a new practice to be hiring medical doctors to work in botanic gardens, but the diminution of the authority of gardeners and the expectation that the director must have a degree show the crystallisation and institutionalisation of the role of garden director. The process of institutionalisation of the science created once again a clear divide between botanists and the rest of the population.

⁴⁰ Eliot Freidson, *Profession of Medicine: A Study of the Sociology of Applied Knowledge* (New York: Dodd, Mead, 1970); Geneviève Paicheler, 'Eliot Freidson, Professional Powers : A Study of the Institutionalization of formal Knowledge', *Sciences Sociales et Santé* 5, no. 2 (1987): 95–101.

Chapter 7: The value of hard work

The previous chapters have shown that botanic gardens offered opportunities for qualified men to find paid scientific work, including research. Being paid for this was still quite a rare occurrence in eighteenth-century science, and continued to be so in the next century, where Thomas Huxley could write “science in England does everything – but pay. You may earn praise but not pudding”.¹ The ideal figure of the scientific “amateur” has often dominated the eighteenth and early nineteenth century history of science.² Roy Porter writes for example that in the case of geologists in the early nineteenth century, most important scholars “derived only a token part of their income from geology”, because they did not need money and did not care to have a professional career in their field.³ They saw this as a positive thing as their science would not be corrupted by base concerns. The notion that practicing science was an elevating and useful hobby was very much present around the botanic gardens in the latter half of the eighteenth century, amongst the visitors and probably the members of the learned societies involved with the gardens. Both in the *Società Botanica* and in the *Accademia dei Georgofili*, everyone *but* the professors and directors was working voluntarily and on their free time. Yet the directors did earn money for their scientific work, even in those societies.

This chapter will look at what the “praise” and “pudding” could look like for the institutional savants in botanic gardens: what were the rewards, material and immaterial, of such a job? This question will be a way to look at the value of the job of garden director. On an individual level, this chapter will examine what motivated qualified people to apply for those positions, and how the responsibility was perceived in society. Focusing on the rewards associated with those jobs also shows how the people occupying them were valued by their institutions and their funders, and will therefore be essential to understand the institutionalisation of botany during that time period. The chapter will also compare the directors to two cognate professions: professors and public administrators, such as librarians, showing that this phenomenon mirrored developments in other areas outside of science, such as bibliography.⁴

¹ Quoted by Morrell, ‘Professionalisation’, 982.

² Porter, ‘Gentlemen and Geology’; Jack Morrell and Arnold Thackray, *Gentlemen of Science: Early Years of the British Association for the Advancement of Science* (Oxford: Clarendon Press, 1981); Shapin, ‘The Man of Science’; Shapin, ‘The Image’.

³ Porter, ‘Gentlemen and Geology’, 823.

⁴ Emmanuelle Chapron, ‘Pour Une Histoire Des Bibliothécaires Italiens Au XVIIIe Siècle’, *Bibliothèque de l’École Des Chartes* 166, no. 2 (2008): 445–79; Jean Boutier, Brigitte Marin, and Antonella Romano, eds.,

The chapter will show that directorships on their own brought no prospective of a scientific career, and that individuals did not always treat them as a full-time responsibility. In spite of this, institutions were moving towards a stronger professionalization of the role and authorities made it into a long-term, stable, and well-paid position.

Plants and ladders

Both Andrea Zucchini and Ottaviano Targioni-Tozzetti first worked as garden directors in the garden of simples of the Hospital Santa Maria Nuova in Florence before moving on to the *Georgofili's* garden. Targioni-Tozzetti had applied and been rejected when the *Orto Sperimentale* first opened in 1783.⁵ Instead, he took on the direction of the garden of Santa Maria Nuova. He also supported Zucchini in San Marco, replacing him when he was away. When Zucchini fled Tuscany in 1799, Targioni-Tozzetti applied again and was made director of the botanic garden of San Marco under the French administration. He then pursued his career under various administrations that made his titles and responsibilities very unstable. Despite the chaos created by political changes, it is clear that Targioni-Tozzetti saw the direction of the official botanic garden of Florence as a desirable career goal. He applied twice and did his best to stay close to the institution in the meantime. Like other directors, he had studied his particular field of interest and then did his best to gain employment in it. Targioni-Tozzetti's trajectory suggests that he did perceive the position in San Marco as more prestigious, creating a form of career progression for the institutional botanists. However, the study of the group of garden directors shows that Zucchini and Targioni-Tozzetti were the only ones with such a career progression in gardens.

The job of garden director was becoming well-defined in the second half of the eighteenth century, but it was an isolated role. The lack of other roles in the same area of expertise meant that there was no formal scientific career available to the individuals working in those roles. Most of the career development that the directors went through took place outside of the gardens themselves.

The absence of a cursus plantarum

This section will show that garden directorship was not a step on a defined career path, which might have culminated in appointments in more prestigious gardens or court offices. There seems to have been no prospect of advancement and many held the job for life. In Edinburgh,

Naples, Rome, Florence: une histoire comparée des milieux intellectuels italiens (XVIIe-XVIIIe siècles) (Rome: Publications de l'École française de Rome, 2013).

⁵ Barbagli and Vergari, *I Targioni Tozzetti*.

Charles Alston died, leaving both of his offices free for John Hope to grab. Hope himself died in 1786, still director of the garden after 26 years. In Pisa Angelo Attilio Tilli died in 1781 after 41 years of service as prefect of the garden. The other institutional botanists studied here did not die in office, but not for a lack of trying. Saverio Manetti lost his position as a professor of botany for the *Società Botanica* when the society lost the use of the garden. The third Tilli lost his to the Grand-Duke's new favourite. Andrea Zucchini was fervently opposed to the French Revolution and had to flee Florence when the French troops invaded the city in 1799 after 16 years working for the *Orto Sperimentale*.⁶ None of them left out of personal choice to pursue better opportunities.

Life-long employment was not necessarily an oddity in eighteenth-century intellectual professions. University professors could stay in their job for all of their life. In this regard, garden directors were not different from other professors at the time. However, the process of professionalization suggests that opportunities for a career, made of different stages, each more or less prestigious, should develop. In his chapter about the man of science in the early modern era, Steven Shapin pointed out that some science practitioners in the seventeenth century already used professorships as a stepping stone towards better opportunities.⁷ He cites in particular the examples of Newton, who left Cambridge to work at the Mint, or Galileo who taught in Pisa, then Padua, and left for a position at the Medici court.

In her study of eighteenth-century Italian librarians, Emmanuelle Chapron also showed that there was a conscious effort on the part of the authorities in various Italian states – amongst which Peter-Leopold is directly mentioned – to organise and formalise the career of some intellectual professionals in the second half of the century.⁸ Some of the jobs were therefore more prestigious or better paid than others and there was a planned progression from one to the other. Some could be a reward for a long career, or a way to find work in a different area of public service or administration. The push for professional careers in intellectual jobs did exist in eighteenth-century Europe. However, none of the directors used their role in the gardens studied here as a stepping-stone before progressing to a more prestigious role.

This could mean a directorship of a publicly funded garden should be seen as the culmination of a career. Zucchini and Targioni-Tozzetti were the only ones who had any experience as garden-director before getting their positions. The others had none and were also usually named as directors quite early. John Hope became garden director at 36 years old, so did

⁶ Admittedly, this was in fact his attempt to *not* die in office.

⁷ Shapin, 'The Image', 183.

⁸ Chapron, 'Pour Une Histoire Des Bibliothécaires Italiens'.

Giorgio Santi. Angelo Attilio Tilli was 31 when he took the reins in Pisa, and Saverio Manetti was 23 when he did the same in Florence. The youth of the men who were put in charge of the gardens means that the job of director was not the crowning jewel of a long career in plant science, nor the recognition of great accomplishments. For several of them, like Hope and Tilli, it was even their first public appointment outside of their medical practice.

The development of the role of garden director in the second half of the eighteenth century showed a form of professionalization of botany, yet it did not result in the creation of a career path in this discipline. Instead, advancement and professional or social progression past the position of director could be found elsewhere.

The accumulation of positions

Some of the directors were cumulating their responsibilities in the botanic garden with other positions of jobs. Manetti for example was a permanent member of staff in the hospital Santa Maria Nuova for his entire life, including during his time in San Marco. Hope was probably the busiest of all the directors. He not only kept his private medical practice open his entire life, he also worked as the director of the Royal Infirmary of Edinburgh, and in the orphanage. He also worked for the government when he was part of the board for Annexed Estates.

This accumulation of positions was not exceptional in the eighteenth century. In the scientific context it made the directors closer to the famous amateur culture so often brought up in connection with eighteenth-century science, where science practice was only one part of larger portfolio careers. Chapter 5 discussed how research was often not part of science practitioners' official roles, and how many would combine their work and writing with jobs as professors, tutor, engineers, or other completely unrelated professions. Often this came from the fact that jobs linked to science were not paid enough to sustain the people occupying them. In the Paris *Académie*, most of the *academiciens* salaries were too low to be the only source of income of a working man, prompting many of the non-senior members to pursue other careers.⁹

This fits exactly the case of Manetti, who, as will be detailed later, was only paid for the classes he gave in the garden, and was therefore the poorest paid of the institutional savants. In his case, the classes he gave in San Marco were probably seen as the supplement to his regular income from the hospital. The other Tuscans seem to have been much more focused on their

⁹ Hahn, 'Scientific Careers in Eighteenth-Century France'.

position in the botanic gardens.¹⁰ It does not seem that Tilli or Zucchini held other roles during their tenures in Pisa and San Marco. Santi did teach several subjects, but only in the University of Pisa, and most of them were linked to the garden – botany and natural history. Apart from Manetti, it seems to have been clear in Tuscany that the directors were first and foremost the head of the botanic gardens. It was their main role and main source of income, as will be detailed later.

This is an area in which the contexts of Scotland and Tuscany were different. It is very difficult to say which one of Hope's roles was his main job. Because of his role in the renovation of the botanic garden, he is mostly remembered in historiography as the director of the institution and a professor of botany. His eulogy though, published in both the *Scots Magazine* and *The Caledonian Mercury*, described him as “Dr John Hope, President of the Royal College of Physicians, Professor of Medicine and Botany in the University of Edinburgh, Senior Physician in the Royal Infirmary, and Fellow of the Royal Societies of London and Edinburgh”.¹¹ The garden was of course associated with his professorship and the text of the eulogy mentioned his work there further down, but it was not mentioned in the list of descriptors. Director of the garden was not perceived as his main role.

The accumulation of various roles in the case of Hope, could have been linked with social ambitions. The lack of career progression in botany *stricto sensu* could have been a motivation to seek other opportunities to improve his standing. His job in the Infirmary was almost certainly a paid position. His private practice was also a big source of income. He did not leave private accounts that would allow us to precisely see how much it brought in for him every year, but it was enough that he declined writing and publishing more on botany because taking time away from his practice would decrease his earnings.¹² It is impossible to say if Hope saw himself as a committed botanist who happened to hold other medical appointments, or an ambitious doctor for whom garden director was one aspect of his role.¹³

Based on the idea that professionalization of science requires the multiplication of opportunities for full-time positions, the phenomenon was stronger in Tuscany than it was in Edinburgh where the director was holding on to a multitude of titles. Since Hope valued his revenue from his private practice so much, one can wonder what was in it for him to be the director

¹⁰ Zuccagni's career is again a mystery so it is difficult to judge where he would fall on this.

¹¹ RBGE, Collection HOP – (various) IBB's scrapbook, memoirs, misc, etc..., *Scots Magazine*, 1786, vol XLVIII, p571, and *The Caledonian Mercury*, November 15. 1786.

¹² Noltie, *John Hope, 1725-1786*.

¹³ See Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge; New York: Cambridge University Press, 1992), 8–10 for a similar discussion on Davy's self-fashioning.

of the botanic garden. The answer seems to be that in both Scotland and Tuscany, a directorship was a stable source of income and prestigious – even without a formal career path. Regardless of how the directors themselves viewed their positions – in particular how Hope saw his as a part-time occupation – the latter were becoming more institutionalised, as I will show in the next section. The authorities and institutions supervising the gardens in general did perceive the job of institutional savant as a full-time profession for which they had to attract the right sort of people.

Compensating expertise

A middle sort of men

In regard to their social origin and social status, the gardens' directors seem to have been quite a homogenous group. It is difficult to speak of social hierarchy in the eighteenth century in absolute terms.¹⁴ To give a quick assessment, the directors of the gardens were part of the very elusive “middle class” or “middle sort”.¹⁵ The boundaries of this social category in the historiography can be defined by range of earnings, occupation types, or even shared cultural interests, but are all blurry at best. In basic definitions of the social group, we often find listed occupations such as “doctors, surgeons, and apothecaries... military and naval professions... the London ‘monied interest’”¹⁶ or “people who worked but ideally did not get their hands dirty”.¹⁷

As physicians – or member of the clergy in Zucchini's case – all the directors fitted in any of those definitions of the middle sort even before they were hired to work in the gardens. Within the middle sort it is also possible to identify most of them as part of the “urban élite” since most of their families did live in the city and were part of organised professions.¹⁸ Their graduation from

¹⁴ See for example Henri R. French, ‘The Search for the “Middle Sort of People” in England, 1600-1800’, *The Historical Journal* 43, no. 1 (March 2000): 277–93; Peter Borsay, *The English Urban Renaissance* (Oxford: Clarendon Press, 1991); Dror Wahrman, ‘National Society, Communal Culture: An Argument about the Recent Historiography of Eighteenth-Century Britain’, *Social History* 17, no. 1 (1992): 43; Margaret R. Hunt, *The Middling Sort : Commerce, Gender, and the Family in England, 1680-1780* (Berkeley: University of California Press, 1996); Jonathan Barry and C. W. Brooks, *The Middling Sort of People : Culture, Society and Politics in England, 1550-1800* (Basingstoke: Macmillan, 1994); David Cannadine, *Class in Britain* (London: Penguin, 2000).

¹⁵ Keith Wrightson, *English Society, 1580-1680* (London: Routledge, 2003); Penelope Corfield, ‘Class by Name and Number in Eighteenth-Century Britain.’, *The Journal of the Historical Association* 72, no. 234 (February 1987).

¹⁶ Borsay, *The English Urban Renaissance*, 172.

¹⁷ Peter Earle, *The Making of the English Middle Class : Business, Society and Family Life in London, 1660-1730* (London: Methuen London, 1989), 3.

¹⁸ The chapter will mostly use the notion of “middle sort” because the absence of information on some of the directors makes it difficult to deem if they came from urban milieu or not. Zucchini seems to have spent at least part of his life in the countryside, according to the *Georgofili's* own account, and the life of Zuccagni is an almost complete mystery.

university alone showed resources and education. Part of those resources and education, they inherited from family. The Tilli and Targioni-Tozzetti families have already been mentioned in previous chapters, showing that those directors were traditionally part of the middle sort, and did not rise from labouring poor families. Some of them were connected to prestigious families, like John Hope, whose cousin was the Earl of Hopetoun, but Hope himself was not part of the main branch that inherited the estate and the money.¹⁹ Hope's father was a surgeon in Edinburgh, a profession usually considered less prestigious than that of physician, but still part of a qualified middle-sort. The directors – and their families – also shared aspects of the middling sort of culture identified by historians such as the involvement in societies, local institutions, and political activism.

Since the authorities were increasingly looking to hire people with university qualifications to be directors of the botanic gardens, they had to try and attract members of the middle sort of people. People with an even higher social status could have been qualified as well, and in other countries, nobles such as the Comte de Buffon were working in those positions, managing scientific institutions. But no one amongst the directors studied here came from nobility. It is possible that Scottish and Tuscan universities and learned societies' gardens were not prestigious enough for the nobility to consider taking on those responsibilities. In all likelihood, the position of director, like that of librarian did not have enough “social value” to attract the members of the highest élites.²⁰

The job of garden director therefore had to be attractive and fit for the social ambitions of the middle sort. One of the distinctive characteristics of the middle sorts is that its members worked for a living. Of course, their needs were much higher than that of the labouring poor, since they needed to maintain the lifestyle that matched their perceived social status. This was probably part of what motivated Hope to accumulate jobs. To attract qualified members of the middle sort, the gardens – and the authorities funding them – had to compensate their level of education and social aspirations with incomes allowing them to live better than the poor sort of people. This mirrors the developments identified by Chapron in the profession of librarian in Italy where individuals “[aspired] to get a viable income from the competences they acquired during their

¹⁹ Noltie, *John Hope, 1725-1786*.

²⁰ Chapron, 'Pour Une Histoire Des Bibliothécaires Italiens', 458.

studies and personal work”.²¹ This led to changes in the remuneration of librarians and was also at play in the botanic gardens.

An income to match their social status

All of the jobs of directors in the gardens studied here came with salaries. Salaries were a guaranteed, regular, and annual income. It was different from the “wages” paid to labouring poor such as the gardeners. Wages were usually paid weekly and did not guarantee a continuous employment or a stable income. An actual salary was already the mark of a higher status and an institutionalised role.

Here, a description of the salaries and advantages given to the directors is necessary to understand how the institutions made those jobs attractive to the qualified experts. Table 1 offers a brief overview and comparison of the Tuscan ones.

1 Salaries of Tuscan Botanists

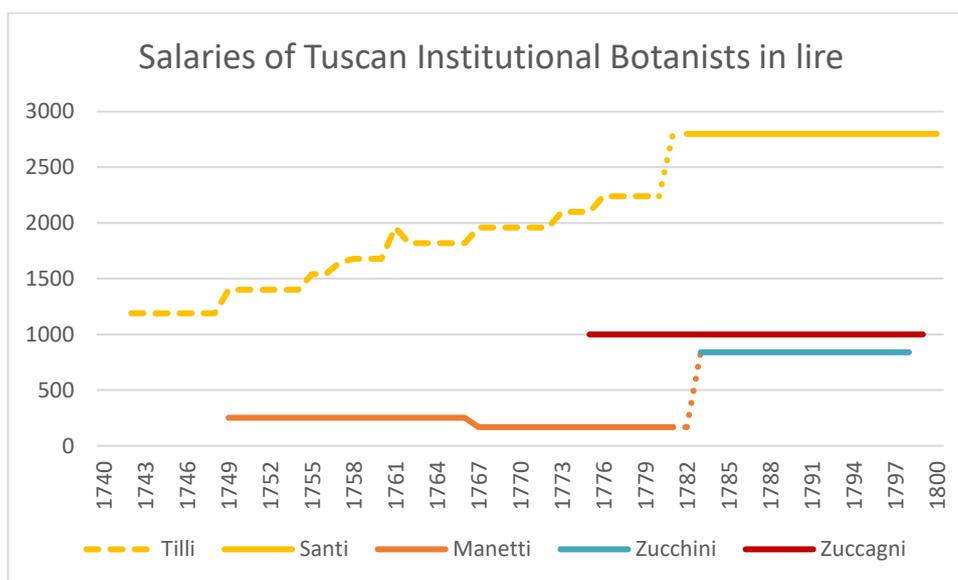


Figure 5 Salaries of Tuscan Institutional Botanists

Salaries do not seem to have been subject to bonuses and raises, apart from Tilli’s in the University of Pisa. Manetti’s salary, already the lowest – probably due to the fact that he was credited only as a professor and not prefect – seemed to decrease after 1767, not because of institutional changes but because of financial issues in the *Società*.²² When the *Società* was dissolved, it was noted that he was due some back pay. The theoretical salary had not changed, only the

²¹ Chapron, 447.

²² BUB, Scaffale Msi, n°97, f669.

practicality of payment. Though it is obvious here that university professors were much better paid than other botanic garden directors, the table shows an overall tendency to increase the salaries. The dotted lines linking the salaries of Manetti and Zucchini, and of Tilli and Santi to underline the continuity between their administrations of the same garden spaces clearly show a sharp increment of the salary with the new hires. Zuccagni's salary also adds to the picture that the job was becoming more valued as he was paid much more than Manetti even though his work did not include teaching. This did not even take into consideration the advantages in kind that any of them would receive, as detailed in Table 2, this time including Hope for a comparison with example years.²³

Fees collected from the students was probably a big perk of professorship in Edinburgh and may have been an advantage granted to Manetti as well. It is unlikely that it was a custom in Pisa, since the salary was already so high, and the practice is not mentioned anywhere. With the added bonus of accommodation, it is clear that Zucchini's salary was a big improvement on Manetti's.

²³ The comparison is done in Lire to avoid converting too many numbers, in the hope to increase accuracy. The conversion rate was based on the one used by *la Specola* in their dealing with instruments makers in London: "The previous 30.19.6 pounds sterling worth in the conversion 26 2/3 of our Lire each make 826 Lire, or 118 of our Scudi" ("Le retroscritte Lire 30.19.6 sterline valutate al cambio di Lire 26 2/3 nostre per ciascheduna improvino lire 826, o sieno Scudi nostril S 118."). MG, ARMU . Affari 4. luglio 1789 - dicembre 1790, note from Jacopo Zipoli on a letter from London, 27 december, 1789, F 66.

With his accumulated benefice, Hope was also clearly above everyone else, but life may also have been cheaper in Tuscany than in Scotland so the comparison gives a general idea of range rather than an exact quantification of the differences.

Table 2 Annual salaries of botanic garden directors

Director	Date of the salary	Sum in the original currency	Sum in Tuscan lire	Advantages in kind	Garden/City
Saverio Manetti ¹ (lecturer of botany only)	1758	36 scudi	252	Probably fees collected from the students	San Marco <i>Società Botanica</i>
Angelo Attilio Tilli ¹ (as professor in Pisa)	1777	320 scudi	2240	(for the director of the garden) Free accommodation in the garden	Pisa
John Hope ¹	1768	Royal Botanist £50 ----- Professor £77	1333 1866	Fees collected from the students (on average from 1761 to 1786: £164 per year)	Edinburgh
Andrea Zucchini ¹	1784	120 scudi	840	Free accommodation in the garden	San Marco <i>Georgofili</i>
Attilio Zuccagni ¹	1789	1000 lire	1000		La Specola

The salaries were comfortable salaries and clearly designed to be attractive to the middle-sort of men that directors ought to be. In her book on middling sort, Margaret Hunt defines the

middling sort as people with “incomes in the range of £80 to £150 [a year]”.²⁴ Hunt is referenced here because she is one of the historians giving a precise amount to define the middle sort, but other definitions would expand this bracket, in particular upward. Hope’s total income from the garden and the university was well above £200 a year, meaning that as a professional from the middle sort, he would have been earning well. Although the fee collection has here been included in the advantages in kind, it should not be considered an unintentional perk of his position. It was well known and expected that university professors in Scotland would make most of their income from the students fees.

One can contrast the directors’ salaries with the pay offered to gardeners – part of the labouring poor – in those very same institutions (table 3).

Table 3 Botanic garden gardeners’ annual salaries

Garden	Date of the salary	Sum in pounds	Sum in Tuscan lire
Edinburgh	1782	18.2	485.33
La Specola	1789		760
Pisa	1782		288
San Marco	1758		317

In Edinburgh, different employees were paid different amounts. The wages given for Edinburgh here are based on the contract of the gardener Henry Porteous which gives an exact amount.²⁵ Porteous was an ordinary gardener – not a head gardener – and his contract was a renewal, so he should be representative of the average wages of regular workers. The budget of *la Specola* also gives an exact sum for the salaries of the gardeners. The other numbers are calculated average based on the general spending on regular gardeners and the number of employees. The *Georgofili*’s accounts do not provide any details on the spending of the garden so it was impossible to include them here. Apart from *la Specola*, where the budget specified an actual annual salary, it

²⁴ Hunt, *The Middling Sort*, 289.

²⁵ NAS, GD 253/146/2/12 (1-6).

seems that gardeners were paid weekly wages, but the lack of details of the budgets in the archives made it easier for comparison sake to only use the annual sums.

Overall, the directors earned much more than the gardeners. Hope made more than twice as much as his gardener. The professors in Pisa were also extremely well compensated compared to manual workers. This kept the social hierarchy intact within the garden and clearly making the position of director a profession for the middle-sort.

Recognition by the state

One of the distinctive features of public administration in eighteenth-century Tuscany was a trend towards paying salaries that were sufficiently generous that a post-holder could dedicate himself fully to his job, rather than having to hold multiple posts. This was shown by Chapron through the example of librarians who had very varied salaries, but saw an increase in their pay in the eighteenth century.²⁶ In Florence, the salary of the librarian of the *Biblioteca Magliabechiana*, one of the most prestigious public libraries of the time, went from 50 scudi a year (350 lire) to 120 scudi a year (840 lire) in 1746. The superintendent of the library described the change as giving the librarian “a decent income”.²⁷

We see the same evolution in San Marco in Florence. Manetti’s low official salary shows clearly the evolution between the two learned societies. Under the *Georgofili*, the position of director and professor in the garden was re-evaluated and found much more important. Documents about the hiring of Zucchini even show that the budget of the academy did not allow them to pay him enough to their liking, which was why they decided to compensate by adding the rent-free use of the house as a perk of directorship.²⁸ According to those documents, this was what was needed to make the position sustainable for Zucchini. In fact, Zucchini’s salary was 120 scudi, the same as the librarian of the Magliabechiana. This means that public authorities estimated that this was a comfortable salary – and even more so with the rent-free house.

Edinburgh followed the same model as Tuscany: an increase of institutional botanists’ salaries with institutional changes. Charles Alston is not on table 2 because, as we recall, he was not paid in the same circumstances as Hope. His earnings as *Regius Keeper* were both his salary and

²⁶ Chapron, ‘Pour Une Histoire Des Bibliothécaires Italiens’, 454.

²⁷ ‘il suo decente mantenimento’ Chapron, 454.

²⁸ ADG, Giustificazione di entrata e uscita, Busta 153, Ins. 3, N°58, Giovanni Neri to SAR, Florence, 18 September 1784.

the budget for the garden: Alston received £50 a year for the garden.²⁹ He would have also collected fees from students and have been paid as a professor, but his income as director *stricto sensu* was thought of by the public authorities paying him as less than £50 – in reality much less since most of the money and often more from his own pocket went to the garden anyway. After the reorganisation of the garden’s funding, Hope was paid much more than his predecessor, since he received the full £50 as salary, as well as a separate garden budget. Although he collected salaries from his other positions, Hope would not have needed that extra income to qualify as a member of the middle sort. This was a change compared to his predecessor. This evolution may not have been as clearly organised or conscious as what happened in Tuscany, but the comparison does shine a light on the fact that the two situations mirrored each other. It also shows that the authorities recognised the importance of a separate budget for the garden, meaning there was no assumption that the director ought to be rich to sustain the collection, which in itself is a sign that the position of director was taking on a more institutionalised status and away from the amateur investing in science as a hobby model.

The salaries paid to the director by the public authorities funding were an indication of how the directors’ work was perceived by the said authorities. In all the cases studied here, the salaries were designed to be living wages for the middle sort of people. Whether or not some of the directors secured external sources of income, the money they were paid – or given access to in the case of university professors – as directors could have been a full income. The job of director was more and more perceived as an important and valuable responsibility by the authorities.

Conclusion

In the second half of the eighteenth century, botanic garden director was not a position that one occupied as part of a defined career in botany or science. It had many aspects of a profession but did not lead to professional development in the form of professional progression. However, the authorities funding the gardens seem to have considered it more and more as a full-time occupation, which can be seen reflected in the way the job was compensated. The responsibilities of the directors of botanic gardens comprised both teaching and research and were supported by living wages designed for educated specialised people from the middle sort. In both Scotland and Tuscany, the position of director of a botanic garden made it possible already in the second half of the eighteenth century to live from science in its restrictive definition of “scientific research”. This chapter found that though not all individuals placed the same value on it or dedicated themselves only to this profession, the recognition by public authorities as a position of value,

²⁹ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, chap. Charles Alston.

worth the investment to attract and recruit qualified people contributed to the institutionalisation of the profession.

Botanic gardens in the second half of the eighteenth century saw the crystallisation of the figure of institutional botanist through the job of garden director: a middle-class man with a degree relevant to his discipline, being paid as a professional to teach, manage a scientific collection and practise research in a dedicated space. Overall, Part II has shown that it is important to re-evaluate the place of institutional savants in the scientific world of the eighteenth century. Much work has been done, and rightly continues to be done on amateurship, its definition and its achievement in this period. Whilst this work convincingly argues that amateurs' contributions should not be ignored, it often opposes the figure of the amateur to that of the "savant". The category of the savant is not much better defined than that of the amateur and tends to be considered in relation to large institutions such as the *Jardin du Roi* in Paris. This debate has left on the side other nations and more local scholars who had the opportunity to practise scientific research for a living. Part II of this thesis has brought nuance to both the classic historiographical tale of nineteenth century professionalization of science and the debate on the classification of science practitioners in the eighteenth century, by defining the role of the institutional savants and showing that thanks to the institutionalisation of botanic gardens the timeline of professionalization for botany was very different from that generally assumed for other sciences.

PART III : INSTITUTIONS

Introduction

The botanic garden of Pisa was created in 1544 by Luca Ghini on the impulse of the then Grand Duke, Cosimo I de Medici.¹ Cosimo seems to have commissioned the garden before Ghini even arrived in Pisa. He had already personally sent the naturalist 250 ducats to contribute toward the creation of the garden in 1543.² The garden was not officially attached to the University of Pisa until 1545. From then on, the University oversaw the management of the garden, but for two years, the project of and then the actual garden had been under the direct authority of the prince.

By attaching the garden to the University, Cosimo removed his personal link to it. The garden was not his personal property as an individual anymore. It was part of an official institutional system. The support from the Grand-Duke was now official rather than personal, and therefore continued long after Cosimo's death. When Ghini left to return to Bologna in the 1550s, he was promptly replaced as head of the garden by Andrea Cesalpino, starting a long line of directors. It was not Cosimo and Ghini's garden anymore. Instead there was now a grandducal garden and a director to said garden. Those changes represent very early steps in the process of institutionalisation of the garden.

Just like the pre-professional status of the directors, the status of gardens as institutions was not entirely new but evolved and was crystallised in the second half of the eighteenth century. Some aspects of this process have been explored before in this thesis. The previous parts have shown how the changes in both space and staff contributed to the process of reinforced institutionalisation of the gardens by making them more stable, more impersonal, more specialised organisations. Part III will look at how gardens functioned as institutions and how they related to society. A focus on botanic gardens offers a corrective to a view of eighteenth-century scientific institutions that has focused on learned societies and academies, the front of what James McClellan has called the "organisation of science", which started in the seventeenth century.³

¹ Meschini, 'Ghini, Luca'; Savi, *Notizie*, 5.

² Meschini, 'Ghini, Luca'.

³ James McClellan, 'Scientific Institutions and the Organization of Science', in *The Cambridge History of Science* (Cambridge: Cambridge University Press, 2003); for examples of studies focusing on these institutions see Cochrane, *Tradition and Enlightenment*; Testa, *Italian Academies*; Shapin, 'Property, Patronage, and the Politics of Science'; Emerson, 'Sir Robert Sibbald'; Teich, 'Institutionalisation of Science'.

The following chapters will show that although botanic gardens did sometimes follow some similar trends to the academies and learned societies, shifting attention from the academies to the gardens sometimes shows slightly different patterns, geographical patterns especially.

The first chapter will look at the relationship between the gardens and public authorities in their respective countries. Public authorities are here defined as the people, or institutions, legally holding power over public life. In the cases studied hereafter, it mostly refers to representatives of the executive power on national and/or local level: the Prince, the government, the royal administration, the municipality. That chapter will show how the support from those public authorities made the gardens into public institutions themselves. The second chapter will build on the previous one by investigating why public authorities took interest in botanic gardens. It will reflect on the relationship between the gardens and their respective countries, showing that their status as public institutions was also fashioned by a redefinition of their purpose in society to serve the “public good”.

Chapter 8: State mandate and support

The general trend in the eighteenth century, as identified, for example, by James McClellan III was an increase in the support to institutions of science from public authorities, in particular the state or central authorities.¹ This happened in different ways in different places, and France and Britain are often taken as the two main examples, thanks to the prestigious institutions of science that they each possessed.

It is common to see the Royal Society and the French *Académie* as the two main examples discussed when talking about institutions of science in the eighteenth century.² In that historiography, they are also often shown as opposing models, which assumes that the *Académie* was an obvious model for continental governments and that the Society shows the exception of the British model. In the British model amateurs are at the centre of scientific practice and the public authorities are not an active participant in their work. In the continental model, the central authorities are instead the driving force of most scientific practice, investing in and organising them in a utilitarian goal.

Colin Russell provided an early example of this model in *Science and Social Change*. In the chapter on “Royal Science” he uses the Royal Society and the French *Académie des Sciences* to argue that professionalization of science was encouraged on the continent but not in Britain.³ In France, the King, through the *Académie* hired a limited amount of people, considered to be at the top of their field, and then paid them to continue their research. In eighteenth-century Britain, the members were the ones paying for the privilege to be Fellows and there was no cap on the number of members. This meant that members did not need to be scientific practitioners to become fellows and in fact many were not. This, Russell argues, made the Royal Society part of the English culture of gentlemanly science and showed that science in Britain was driven by individual amateurs and not royal authorities.⁴ His analysis also reinforces the idea of British exceptionalism through a comparative frame singling out Britain against continental Europe.

¹ McClellan, ‘Scientific Institutions and the Organization of Science’; McClellan, *Science Reorganized*.

² Teich, ‘Institutionalisation of Science’; Wolfgang Van Den Daele, ‘The Social Construction of Science: Institutionalisation and Definition of Positive Science in the Latter Half of the Seventeenth Century’, in *The Social Production of Scientific Knowledge*, ed. Everett Mendelsohn, Peter Weingart, and Richard Whitley (Dordrecht: Springer Netherlands, 1977), 27–54; McClellan, ‘Scientific Institutions and the Organization of Science’.

³ Russell, *Science and Social Change*, 69–76.

⁴ Russell, 175.

Russell's model has remained present in the historiography, though there have been some more nuanced takes on the subject. In his article on the Royal Society and the emergence of science as an instrument of state policy, John Gascoigne shows that the relationship between the Royal Society and the British government was actually not so different from that of other academies and governments.⁵ The Royal Society was also used as a scientific resource by the public authorities in Britain. However, Gascoigne still uses the *Académie des sciences* as a counter point, arguing that the different character of the British state meant that the way that the Royal Society and its members were serving the government was different. The Society's main purpose was not to serve the state as an institution, but individuals attached to it would be called upon for help and could recommend some of their colleagues. Gascoigne shows this relationship with the state was mostly built by Sir Joseph Banks after he became president of the Royal Society in 1778.

Gascoigne, like Russell, attributes the contrast between the Royal Society and continental academies to differences in cultures. The British state's reliance on oligarchical patterns of patronage and influence would put a stronger emphasis on the individual than the institution. The stronger links between the Society and the government in the second half of the century were due to personal links between people working for the authorities and fellows. Another strong difference with the French model was that, in Britain, public service was considered part of a gentleman's duty and should therefore be performed for free.⁶ This meant that those science practitioners who advised the state and whose work was used as an instrument of state policy were not employees of the state. They also rarely worked on impulse from the state. In contrast to the continental model, there was no upstream investment and control in the work of the scholars and the two models stay very different.

This image is not false, but I would argue that by focusing on those two famous institutions, Russell, Gascoigne, and many others, ignore many ways in which royal – and other public – authorities interacted with scientific practice and institutions in the eighteenth century. This chapter will examine the relations between the botanic gardens and the public authorities of their respective countries to show that the prevalent dichotomy between British and Continental models is overly simplistic. I argue that gardens, as British scientific institutions, were far more like their continental counterparts than they were like the Royal Society. Whilst Peter-Leopold's politics

⁵ John Gascoigne, 'The Royal Society and the Emergence of Science as an Instrument of state Policy', *The British Journal for the History of Science* 32, no. 2 (1999): 171–84.

⁶ Gascoigne, 182.

do show strong parallels to the French model, looking at botanic gardens gives a very different image of the British state relationship with science, especially in a comparative context.

The chapter will first analyse the control structures surrounding the gardens and how they related to the public authorities. It will then consider more closely the finances of the gardens and relate them to European trends of the time. Finally, it will discuss what the institutional links of the gardens to the public authorities meant for their status.

Control and support structures

As we saw in Part II, the garden directors had a lot of leeway in how they wished to organise their garden. Institutionally speaking, this meant that the gardens were very autonomous, but none of the gardens studied here were independent. They were all under the control of a hierarchy, pieces in wider institutional networks. For all the gardens, public authorities were involved in this hierarchy, one way or another. The cases studied show a lot of variations in those structures and how they operated from one garden to another.

Supervising San Marco

In 1718, the management of the garden of San Marco had been given to the *Società Botanica Fiorentina* by Cosimo III.⁷ The San Marco garden was the property of the Tuscan state and the right to use it was an honour that attached the *Società* to the grandducal authorities. Cosimo III gave the use of the garden as well as his official protection to the *Società* itself. This protection was renewed by his successors, including the Lorraines when the control of Tuscany passed over to the Habsburgs.

The *Società* being an amateur learned society who was being rewarded by this honour for the work they were doing might make one think of the British model embodied by the Royal Society, but the very close control over the management of the garden and heavy involvement of the Crown, for example through the attendance of an inaugural meeting by Peter-Leopold⁸, shows differently.

⁷ Tchikine, 'Echoes of Empire'.

⁸ BUB, Scaffale Msi, n°97, ff2004-206.

The group administration of the *Società* has already been analysed in Part II. The director of the garden answered to several committees. He and those committees were also accountable for the development of the garden to the entire society. This accountability was manifested through inspections of the garden carried out by a group of members called the *censori*. The rules of the society ordered that the censors visit the garden regularly and give a report “to the entire body of the gathered members”.⁹ Several reports have survived, for example those of 1758, 1764, and 1771.¹⁰ The reports show that censors were evaluating the state of the garden. They listed plants that were not doing well, suggested improvement that could be made – such as the construction of additional glasshouses for pineapples, for example – commented on the gardeners’ work, and could request changes in the rules of the society if they thought it would benefit the garden. The reports show that the garden was not doing so well under the administration of the *Società*.

The system of the *censori* shows a close monitoring of what was going on in the garden by a superior instance, in this case, the *Società*. The director of the garden and his team were held responsible for their work by the other members. The society did not employ most of its members and could be considered a simple association of private citizens, conducting private business. Yet, the botanic garden they were managing was the property of the Grand Duchy, and the members themselves in this case were part of a wider hierarchy.

Thanks to the patronage of Cosimo III and his successors, the *Società* itself came to be under the control of the grandducal authorities. The original charter ordered “that there will be inspection by the General Supervisor of the Royal Gardens, to give report on the Botany Society [and on the garden] administrated by it, and recognise the state the garden is in, giving note to HRH when [the Society] failed to do his good service”.¹¹ There was therefore a double system of inspection for the garden. This document is undated but was probably written in the early years of the society’s management of the garden around 1720.¹² It outlines the relations between the prince and the academy in many details: all sixteen items listed in it, as well as its introduction, concern the garden and its care. Some have to do with the general administration and others with details of the work to be carried in the garden. Clause VIII, for example, names Giovanni Targioni-Tozzetti as custodian and director of the garden, whilst IV explains that the cedar trees need to be removed from the garden to make space for rarer plants. The authorities were more interested in

⁹ BUB, Scaffale Msi, n°97, f415.

¹⁰ BUB, Scaffale Msi, n°97, ff92-99, 195-197, 415-418.

¹¹ BUB, Scaffale Msi, n°97, ff 52-57, “Memoria”.

¹² The file of the archives indicates that the earliest documents in it date back to 1724.

what happened in the garden than in the *Società botanica* itself because the garden was not only given to the *Società* as a favour and a payment. It was a reciprocal arrangement in which the society gained a garden, and the prince outsourced the management of the garden.

Despite the various committees and other organs of the academy managing the garden, it seems that the Grand Duke officially had the final say in the decisions about the garden, though it is unclear if this was used in practice as the society's archive did not keep reports by the General Supervisor. There was, at least in theory, a clear supervision of the garden by Grandducal authorities. The management was left to the *Società* but the garden itself was still under the control of the prince.

The grand ducal control over the *Società Botanica* was not an isolated case. Since the Medici reign, there had been a movement in Tuscany to bring all learned societies closer to the authorities. Cosimo I, for example, had worked to make the academies dependent on the Prince for money, by providing prizes and other funding to them.¹³ This was a deliberate strategy to gain the support of academies' members, who were all prominent people in Tuscan society, and establish his authority on the thinking sphere of his time. According to Cochrane, this transformed the academies and learned societies into semi-official institutions. This system was still in place and only grew stronger in the eighteenth century. According to the grandducal legislation, any voluntary association of people had to proceed from the prince alone, no matter the object of the association.¹⁴

By giving their protection and the administration of the garden to the *Società*, the Grand-Dukes were continuing this exact strategy. They also granted financial backing to the society. Outside of the fees paid by the members, most of the budget came from the grand ducal authorities. The *Società*'s accounting books show that from the 1720s to their loss of the garden in 1783, their main source of revenue was from the “*Uffizio della Parte*”¹⁵, an old grandducal institution essentially similar to a ministry of public works”.¹⁶ The funds given to the *Società* came from public money, as part of the state budget. This emphasises that the support of the Grand Duke was not given as an individual patron, but as the representant of the public authority.

¹³ Cochrane, *Tradition and Enlightenment*, 30.

¹⁴ Cochrane, 51.

¹⁵ BUB, n°97 and n°98-Diari della Società Botanica Fiorentina 1718 a 1774, to see all accounting documents.

¹⁶ Toccafondi and Vivoli, 'Cartografia e Istituzioni Nella Toscana Del Seicento: Gli Ingegneri al Servizio Dei Capitani Di Parte e Dello Scrittoio Delle Possessioni'.

If considered in relations to the two classic models of the *Accademie* and the Royal Society, the *Società Botanica* was really a hybrid system which shared aspects with both. The Grand-Duke was using amateur members to carry scientific related work for him – in this case the management of the garden – but he was also funding the material enterprise – in particular the garden and the salaries of those working in it – with public funds. The control by the grandduccal authorities only grew in the late eighteenth century.

The *Società Botanica* was made to surrender the garden by the Grand-Duke after bad management issues in 1783. The institution replacing them, the *Accademia dei Georgofili* – which actually shared many members with its predecessor – was placed under an even tighter control. Its affiliation to the government made it a strong example of state-organized and supported scientific institution.

The *Georgofili* had been founded in 1753. It was also a learned society and functioned in a similar way to the *Società Botanica*. It had numerous members who paid fees for entering the association. Just like the *Società Botanica*, it had had to get the approval of the Grand ducal authorities.¹⁷ The *Georgofili* had the same agreement than their predecessors regarding the garden. They were managing it for the state and received funding for their scientific activities from public funds. However, the academy was even closer to the authorities than the *Società*.

The rules shows that the President of the *Accademia* was supposed to meet with the Grand Duke to deliver him his reports in person (it is unclear if those meetings did take place).¹⁸ The said President was also to be nominated by the Grand Duke and occupied the function “at His pleasure”. Almost all of Peter-Leopold’s ministers were also members of the academy, blurring the lines between the government and civil society.¹⁹ Publications by the academy bore the mention “with approval”.²⁰ The *Registro* of the academy, which contains the minutes of all their meetings from 1753 until (presumably) nowadays, even mentions that the academy was officially affiliated to the government, for example: “The first [motion] was not approved by His Excellency Schmidveiller director of the Royal Finances, which department our academy belongs to”.²¹ This tighter control may have come from the extensive administrative reforms put in place by Peter-

¹⁷ ADG, *Statuti, regolamenti e memorie*, 6. “Regolamento dell'Accademia presentato al granduca di Toscana, Pietro Leopoldo, dal direttore annuale Niccolò Panciatichi e da lui approvato 4-22 ott 1783”.

¹⁸ ADG, *Statuti, regolamenti e memorie*, 6. “Regolamento”, p2.

¹⁹ Cochrane, *Tradition and Enlightenment*, 38.

²⁰ ADG, *Atti della Real Società Economica di Firenze ossia de'Georgofili - Volume I*, 1791.

²¹ ADG, *Registro delle Adunanze dell'Accademia*, p 27-28, 21 August 1793.

Leopold after his arrival in Tuscany in 1765. The *Accademia dei Georgofili* being attached and supervised by a ministry made the garden of San Marco very clearly into an official garden sponsored by public money.

As such, the academy received direct instructions from the Finance Secretary's office to undertake specific tasks. In 1791, they ask members of the *Georgofili* to examine a manuscript from Francesco Henrion to decide if it should be printed or not.²² In March 1795 and March 1796, the academy was also asked to examine the possibilities of new crop cultures in the Tuscan countryside by the same secretary. The decisions concerning the garden were still taken by the director and the members of the academy, but the heavy presence of government officials amongst the members meant that they could have a strong influence in this too. They also saw the annual director's reports and those of the five *deputati*, the members in charge of controlling experiments and check on the garden, like the *censori* before them.²³

The examples of the *Società Botanica* and the *Georgofili* show that, even in learned societies celebrating amateur culture, the Tuscan authorities had not only influence but direct authority. There is a clear evolution of formalised control and involvement of the government with the societies in charge of the garden, the reasons for which will be revisited in chapter 9. Thanks to the garden of San Marco, the two learned societies were a particularly strong example of how the grandducal authorities brought learned societies under their control by providing material resources. This pattern was repeated in Pisa, though in a different form.

The University of Pisa as intermediary

Like Florence, the garden of Pisa kept close links with the grand ducal authorities after its creation sponsored by the Medici. In accounting books of the 1750's, it continued to be designated as the "Garden of Simples of His Imperial Majesty".²⁴ This link was not only honorific. The government was also funding the garden. As in Florence, the annual budget of the garden shows that all the entries come from government funds.²⁵ First, between 1751 and 1758, the budget was delivered to the director on behalf of a "Commissioner".²⁶ In 1759, the garden started to be paid

²² ADG, Registro delle Adunanze dell'Accademia, p 13, 21 August 1793.

²³ ADG, Statuti, regolamenti e memorie, 6. "Regolamento", p5.

²⁴ ASP, 13/515.

²⁵ ASP, 13/515, 516, and 13bis/F/VIII/1.

²⁶ Università di Pisa 13. 515, 12 novembre.

by customs officers, probably because custom offices were the closest public facilities with safes in Pisa.²⁷ Whether it came from the palace or the customs, the garden was funded by public money.

Despite this direct link with the state, the botanic garden of Pisa was also supervised by the University it was attached to. The money was delivered directly to the directors, but the expenses were monitored by the authorities of the *Studio Pisano*. This control did not leave many traces, except for the signatures of Gasparo Cerati and, later, Angelo Fabroni on the accounting books.²⁸ Cerati and Fabroni were the two *provveditore* of the University of Pisa in the second half of the eighteenth century. This shows that the university was the institution checking on the administration of the botanic garden, but it was a much less close inspection than that of *censori* in Florence since no one checked the actual garden, just the accounts.

As in Florence, the people supervising the garden were part of a hierarchy headed by the grandducal authorities. In this case, the university was acting on behalf of the authorities playing a similar role as the *Società Botanica* in Florence. Since the creation of the office in the sixteenth century, the *provveditore* was part of grandducal administration.²⁹ He was chosen by and reported directly to the Grand Duke, so the latter had a better control over the Pisan university. In the eighteenth century, the *provveditore* had in fact become the head of the institution and his scrutiny of the garden's finances shows that the garden was considered a department of the university.

When Peter-Leopold took over Tuscany in 1765, he continued a long policy of reinforcing grandducal control over the University of Pisa which had started under the Medici several centuries earlier.³⁰ One of the most important reforms giving control over the university to the Grand Duke was the change in funding. When Peter-Leopold came to power, the tradition was that the Church funded the University of Pisa.³¹ As part of his reorganisation and ordering of Tuscany, the Grand Duke declared the University had to be attached to public authorities, which should be distinct from the Church. In the 1780s, the Church's grant for the University was replaced by an annual grant from the state of 16 000 scudi a year "to be paid to the university treasury by the Royal Depository via the custom office of Pisa".³²

²⁷ ASP, 13/515, 516; and 13bis/F/VIII/1.

²⁸ ASP, 13/515 and 13bis/F/VIII/1.

²⁹ Fiorenza Gemini, *Archivio di Stato Pisa* (Viterbo: BetaGamma Editrice, 2010), 47; Giovanni Cascio Pratilli, *L'Università e il Principe: Gli Studi Di Siena e Di Pisatra Rinascimento e Controriforma* (Firenze: Olscki, 1975).

³⁰ Roggero, 'Professori e Studenti Nelle Università Tra Crisi e Riforme', 1069.

³¹ Coppini and Tosi, *Sapienza*, 26.

³² Coppini and Tosi, 27.

This did not have a direct effect on the botanic garden itself. The garden's budget, as showed earlier, was separate from the University's from the start. Indirectly it strengthened the hold of the Grand Duke on the institution responsible for the supervision of the garden. The garden could even have been part of the grandducal strategy to control the university. It was an essential piece of equipment for the University. It had been founded by the Grand Duke. Two centuries after its creation, the University had been put in charge of supervising it on behalf of the Crown, but it was still not entirely attached to the university since its budget still came directly from the public authorities. As in Florence, the Grand Duke was giving the use of it to the University. Considering that the University also ended up receiving its public funding via the same process – customs – as the garden had been for years when the change occurred, the garden may also have served as inspiration for the reorganisation.

Peter-Leopold was a very important figure in the history of the garden of San Marco and the garden of Pisa. In both places, he showed the same ambition to strengthen the links between knowledge institutions and the grandducal authorities, though he did it in different ways. The various nature of the institutions involved in the management of the gardens in both places and their long histories are probably the reasons for the differences. It also explains that *la Specola* presented yet another model, when it was created as a blank slate in 1775.

La Specola and the pyramidal model

Peter-Leopold's personal interest in the sciences and their uses for government was also at play in the creation of *la Specola*. The name of the “Imperial and royal museum of physic and natural history” already contained a double clue as to the institution's links to public authorities. The project had been designed by Felice Fontana and Peter-Leopold himself in the 1760s.³³

The museum was partly based on pre-existing collections, but Fontana help them grow considerably.³⁴ To prepare for the creation of the museum, he commissioned and bought many new instruments as well as natural history collections. Those acquisitions were made on behalf of the Grand Duke, so the money Fontana used to buy those collections was provided by the grandducal authorities. For example, in 1771, Fontana bought the Van Spreckelsen museum in Livorno.³⁵ The news of his successful negotiations of the collection's price was sent to the *Segreteria di Finanze*, the same ministry that oversaw the *Accademia dei Georgofili*. There was a preliminary

³³ Contardi, *La Casa Di Salomone*, 55–76.

³⁴ Contardi, 67–71.

³⁵ Contardi, 71.

investment in the museum and its collections by the authorities. This investment continued after the official creation of the museum with a budget entirely provided by the grandducal finances.

Simone Contardi observes that the institution of *la Specola* was extremely hierarchised and organised in a pyramidal pattern.³⁶ Each one of the heads of collection reported directly to the Director, Fontana. Fontana himself answered to the grandducal authorities, executing the direct orders concerning the museum, and being held accountable for its operation. This structure with the Grand-Duke as the ultimate authority and his administration as an intermediary between himself and the scientific institution is familiar by now, but here the intermediary was Fontana, an individual employee of the state, instead of a society or an organisation. In *la Specola*, the hierarchy had been set from the beginning, showing that this was now the ideal model that other organisations had to tend towards when modifying older systems.

In Tuscany, the government took progressively more space and influence in the direction of all the botanic garden, old and new. The late 1770s and 80s really marked a turning point in this evolution with the foundation of *la Specola*, the taking over of the University of Pisa's finances, and the management of San Marco going to the *Georgofili*. A strong government influence on institutions of knowledge was reminiscent of the continental model as described by Russell, but in fact the details of the administration of each garden shows that things were not so straightforward. Learned societies showcased amateur culture, the University overseeing the garden of Pisa used to be under the influence of the Church, and *la Specola* could also be seen as a personal patronage project by Peter-Leopold rather than a public undertaking due to his interest in science.³⁷ There was not a clear dichotomy between amateurs vs state support, but there was an evolution towards a more streamlined, codified and official control of institutions of knowledge by the grandducal authorities.

Edinburgh

Up until the middle of the eighteenth century, the botanic garden of Edinburgh had had a very different history from its Tuscan counterparts. When it had been created in 1670 by Andrew

³⁶ Contardi, 74.

³⁷ See for example Bellatalla, *Granduca-educatore*; Wandruszka, *Pietro Leopoldo*; most of the chapters in Barsanti, Becagli, and Pasta, *La Politica Della Scienza*; for more references Renato Pasta, 'Pietro Leopoldo d'Asburgo-Lorena, granduca di Toscana, poi imperatore del Sacro Romano Impero come Leopoldo II in "Dizionario Biografico"', in *Dizionario Biografico degli Italiani* (Online: Treccani.it, 2015).

Balfour and Robert Sibbald, the garden was a group-owned garden, administered, organised and paid for by individual physicians.³⁸ This start as a private – i.e. not owned by public authorities – garden made it very different from the Tuscan gardens, all opened on the impulse of the Grand-Dukes. The origins of the botanic garden of Edinburgh do evoke the culture of amateurship and private leadership of progress that has been associated with Britain in the state support model. However, I argue that a century after its creation, it had become as strong an example of state supported science as the Tuscan gardens.

Public authorities started to get involved when the same doctors created the Physick Garden as an extension of the first one, next to the Trinity hospital, in 1675. James Sutherland was recruited as gardener by the physicians, but his salary of £20 a year was paid by the Town Council.³⁹ This was the first contribution of a public authority, using public money, to support the botanic garden in Edinburgh. This example was followed later by the king himself who also started to contribute an extra £50 a year to Sutherland's pay in 1693.⁴⁰ The town announced in 1677 that its contribution to Sutherland's salary would continue to be paid to his successors. Once again, the depersonalisation of the reward contributed to the institutionalisation of the gardens: the salary became attached to the function, not the man. The same happened with the Royal contribution to Sutherland's salary when William III gave Sutherland the title of King's Botanist in Scotland in 1699 and the £50 became an institutional pension.⁴¹ This office was tied to the Holyrood garden, whilst the Town's support was linked to the Trinity garden.

Support from public authorities for the botanic garden in Edinburgh started with the local authorities. Gascoigne points out in his article about the Royal Society and state policy that one of the major differences between the "character" of the British state and that of its continental counterparts, was that the latter were much more strongly centralised and functioned on an absolutist model that did not apply to Great Britain. The heavy involvement of the Town Council in the support of the botanic garden in the early eighteenth century is an illustration of the importance of local authorities in the development of institutions of science and fits this theory. This situation changed significantly in the second half of the century.

By the 1760s, when Hope took over both gardens, none of them were completely formed as institutions in themselves. In both gardens, the funding was going to one person as a

³⁸ Fletcher and Brown, *Royal Botanic Garden Edinburgh*, 3–10.

³⁹ RBGE, SUT, « Excerpts from Town Council Records anent Mr. James Sutherland, Professor of Botany in Edinburgh College 1676-1706 ».

⁴⁰ *The Register of the Privy Seal*, V, p.126.

⁴¹ Fletcher and Brown, *Royal Botanic Garden Edinburgh*.

salary/grant rather than as a budget for the actual garden. Hope used his connections to secure Royal funding for a new, bigger garden, merging the previous two collections in a real institution with an annual budget on top of a salary for the director.

I have mentioned that Hope's plan benefitted from the patronage of Lord Bute. John Stuart, third Earl of Bute, had been George III's tutor and become a very influential member of his court in the early 1760's.⁴² Bute was the descendant of a very influential Scottish family and was seen as a patron and protector of Scottish interests during the years he spent at the court and in government.⁴³ This connection does work as an example of the culture of "oligarchical based patterns of patronage and influence" described by Gascoigne. In Tuscany, the botanists had had a more direct access to the Prince and seemingly no need to use rich noble patrons as intermediaries. But this intermediary was necessary in a country much bigger than Tuscany, especially in the case of Scottish scholars who were far away from the Court and rarely had a chance to even meet the members of the Court. This difference is significant but did not represent an irreconcilable ideological gap.

In 1761, John Adam estimated the cost of building a new botanic garden following Hope's new project in a document entitled "Abstract of the estimates for making a new botanick garden & for erecting the necessary building therein".⁴⁴ He estimated the price of the project at £1502.7.3. This project was submitted to the Scottish Exchequer for review who approved the project but concluded that £1040.19.6 would be sufficient.⁴⁵ The Scottish Exchequer was therefore the first royal institution to give its approval to the new botanic garden. The Exchequer's report to the Crown on the creation of such an institution also included the annual price of maintaining it and the salaries to be paid to all the staff. The final amount was also based on the project for the garden and an estimation of maintenance costs, rather than an arbitrary number that would then determine what the people in charge of the garden could or could not do. This was an important step in the process of institutionalisation of the garden, since there was now an actual budget attached to the institution rather than the function of director. The first iteration of this budget was due to the Crown and Royal Institutions.

⁴² Alice M. Coats, *Lord Bute: An Illustrated Life of John Stuart, Third Earl of Bute, 1713-1792* (Shire Publications, 1975); James Lee McKelvey, *George III and Lord Bute: the Leicester House years* (Durham: Duke University Press, 1973); Alexander Murdoch, 'Lord Bute, James Stuart Mackenzie, and the government of Scotland', in *Lord Bute: essays in re-interpretation*, ed. Karl W. Schweizer (Leicester, Royaume-Uni: Leicester University Press, 1988), 117–46.

⁴³ Murdoch, 'Lord Bute, James Stuart Mackenzie, and the government of Scotland'.

⁴⁴ RBGE, HOP, "Hope, John (various)".

⁴⁵ NAS, GD253/146/2.

When the money was officially granted by George III, it was paid through the Receiver general of His Majesty's Land Rents & Casualties, an officer of the Exchequer, and by one of the Barons. This was similar to the organisation in place in Pisa, where a local official institution was making the payments to the garden, though the funding came from the national level.

The Town Council continued its support for the garden by paying £25 a year towards the salary of the staff. The influence of the Council did greatly decrease, however, because this became a small portion of the overall budget. Before the move to Leith Walk, the Town Council had sent inspectors to report on the garden – possibly yearly – but this stopped after the move. Instead, John Hope had to report every year to the Royal Exchequer by submitting the accounting documents of the institutions, as the Pisan director did with the University. He was held accountable by the royal authorities rather than the Town Council. The balance of influence had shifted in favour of the Crown.

Another way that the links between the botanic garden and the royal authorities was strengthened was through the university. Hope's new title of *Regius Professor* shows that the relationship between the Crown and the University of Edinburgh was evolving. Traditionally, the Town Council of Edinburgh had been responsible for the supervision of the university and it controlled appointments to most of the chairs for professors.⁴⁶ The new title meant that although the chair was with the university, the Crown sponsored it. In the eighteenth century, and particularly after the Union of the Crowns, the Crown started to invest more in the university. Several new chairs were opened under royal patronage: Ecclesiastical history (1695), Public Law (1707), Rhetoric (1762), Natural History (1767), and Practical Astronomy (1786).⁴⁷ This was an example of stronger involvement of the royal authorities in the university. The chair of botany and *materia medica* had originally been created in 1676 by the Town Council. It changed patrons later in the eighteenth century, when John Hope was granted royal patronage for the botanic garden.

The increase of the number of *Regius Professors* in the University of Edinburgh in the eighteenth century mirrors the evolution of the University of Pisa going from Church to state funding. The Grand Dukes had started the process of taking over the University of Pisa long before the British Crown started to invest directly in the University of Edinburgh, but both universities saw the take over intensify in the second half of the eighteenth century. Despite the different “character of the British state” the pattern seen in Edinburgh shows that the Crown was

⁴⁶ Morrell, 'The University of Edinburgh in the Late Eighteenth Century'.

⁴⁷ Morrell, 162–63.

actively engaging in efforts to centralise authority and influence over education and science institutions.

Despite what the example of the Royal Society might suggest, the British royal authorities were very much involved in the support of institutionalisation of science, a fact that is also observable in similar institutions such as observatories of the Board of Longitudes.⁴⁸ State support was instrumental in the institutionalisation of the botanic garden of Edinburgh and this support was not only based on rewarding amateurs for work done on their own time and dime. The state was investing upfront in long term institutions such as the botanic garden and increasing its influence in traditionally independent institutions like the University of Edinburgh. The long-term process that led to it may have been different, but by the 1770s, Edinburgh was very much on par with its continental equivalents. This is not to say that the British state was merely catching up with its continental equivalents. From the mid-century onward, it was following the same trends at the same moments too.

A renewed interest

The alignment of Britain with the continental trends in matters of public authorities' involvement in science institutions is particularly salient when looking at financial matters. The increased support of European states for science described by McClellan was increasingly directed at institutions rather than individual scholars, as had been the case in the previous centuries.⁴⁹ The first part of this chapter has shown how this support affected the botanic gardens through influence and control. That trend can also be shown through numbers when looking at the details of the gardens' funding.

In Edinburgh the strong surge of interest for the garden from the public authorities was first manifested by a big ad hoc payment of £1330 between 1765 and 1769.⁵⁰ This was to establish the garden. The more interesting numbers are those to do with the maintaining of the garden, because they show continuous interest and stable investment. The annual maintenance grant was less than what the original Exchequer report had prescribed: £69.3. This turned out to be insufficient. Hope went £20 over his budget on average every year, and the garden was constantly

⁴⁸ See the many outcomes of the Royal Museum Greenwich's Board of Longitude project: <https://www.rmg.co.uk/work-services/what-we-do/learning-partnerships/partnerships-outreach/board-of-longitude/project-outcomes>

⁴⁹ McClellan, 'Scientific Institutions and the Organization of Science'; McClellan, *Science Reorganized*; Moran, *Patronage and Institutions*.

⁵⁰ NAS, GD253/146/2.

in debt.⁵¹ The director asked several times for emergency help from the Treasury. In 1774, for example, he petitioned the Treasury for extra money, referring to a previous payment of £281 meant to help the garden pay its debts.⁵² In 1776, Hope got another gift of £600 to the same effect, but rather than have to petition the Crown every other year, he wanted a structural change to the financial arrangements.⁵³ There was a first raise of £50 of the garden's annual budget in 1776, and then another raise of 100 more in 1783, which brought the budget to £219.3 per annum. Over twenty years, the funding by the state had tripled. It seems these raises and grants came on the basis of paperwork alone as there are no mentions of garden visits or checks anywhere.

The Town Council's payments to the garden, on the other hand, stayed stable at £25 a year. With the loss of control of the University chair, the lack of municipal inspection, and the vastly far superior monetary investment of the Exchequer, the influence of the Town Council on the botanic garden had been completely overtaken by the royal authorities by the 1780s.

In Florence, from 1724 to 1783, the *Società Botanica* was paid 300 scudi per year by the Grand Duke. The amount did not change during their administration of the garden.⁵⁴ Some additional money came from the activities of the society, for example entrance fees from new members or sale of publications.

The budget changed for the *Accademia dei Georgofili*. Apart from two years where they only received 300 scudi, the budget given by the grandducal administration was generally 400 scudi per year.⁵⁵ Like the *Società*, they also had other sources of revenue that increased their overall budget. This shows an increase of the budget for the San Marco garden from the grandducal authorities in the 1780s.

In Pisa, in 1750, Angelo Attilio Tilli received 1400 lire per year, in two separate payments. Unlike in Edinburgh, Tilli did manage to finish in the black most years in the beginning. The garden still received additional help in the year 1781-82, when customs made three extra payments

⁵¹ RBGE, HOP, "John Hope (RBGE Sibbald Trust) Original Letters donated via Sibbald Trust + Ex-Registry File".

⁵² NAS, GD253/146/2.

⁵³ Evidence of the garden's financial state is scattered in the boxes E414 of the HOP collection.

⁵⁴ See many different "*Ristretto dell'Entrata e Uscita della Società*" in BUB, Scaffale Msi, n°97 and n°98.

⁵⁵ ADG, Busta 148, Ins.1-3.

of 105 lire to help pay more workers in the absence of a principal gardener.⁵⁶ In 1782-83, after the nomination of Giorgio Santi as director, there were still payments of 105 for the management of the garden without a gardener, but only two during the year which might mean that they managed to recruit one. Despite this rise in the budget, both in 1781-82 and in 1782-83, the garden was in debt at the end of the year. In October 1782, Tilli was left with 70 lire overspent, and in 1783, Santi was 98 lire over his budget. This overspending probably explains the subsequent increase in the budget under the administration of Giorgio Santi. In 1783-84, the budget literally doubled. From then on, the garden received two instalments from customs, both of 1 400 lire.⁵⁷ This allowed the garden to regularly finish the year with savings in the next decade.

I will not do here a detailed analysis of the budget of *la Specola's* garden, largely because it is extremely difficult to find information about the spending of the garden itself compared to the museum. It also seems superfluous when the very fact that the museum was created shows a strong interest and investment in science since the Grand Duke ordered the purchasing of a palace and of many collections, the hiring of the entire staff and many other expenditures in the 1770s.

By converting again all of the above sums into basic Tuscan lire, we can compare the state funding of the gardens through time. The graph only contains the data regarding regular budgets. Emergency help and set up investments are not taken into account. Only the increase of the budget for Pisa when they lost their gardener is, because it lasted more than a year.

My goal is not to show the comparison of the specific sums to judge the levels of investments in Britain versus Tuscany or vice versa. The currencies and the national contexts were different enough that the absolute comparison would be meaningless. Instead, I want to show that the evolutions in the investments through time are almost perfectly aligned.

⁵⁶ ASP, 13bis, F/VIII/1, "Entrata e Uscita dei Giardino de Semplici di Pisa - A.1781/1782-1809-1810".

⁵⁷ Ibid.

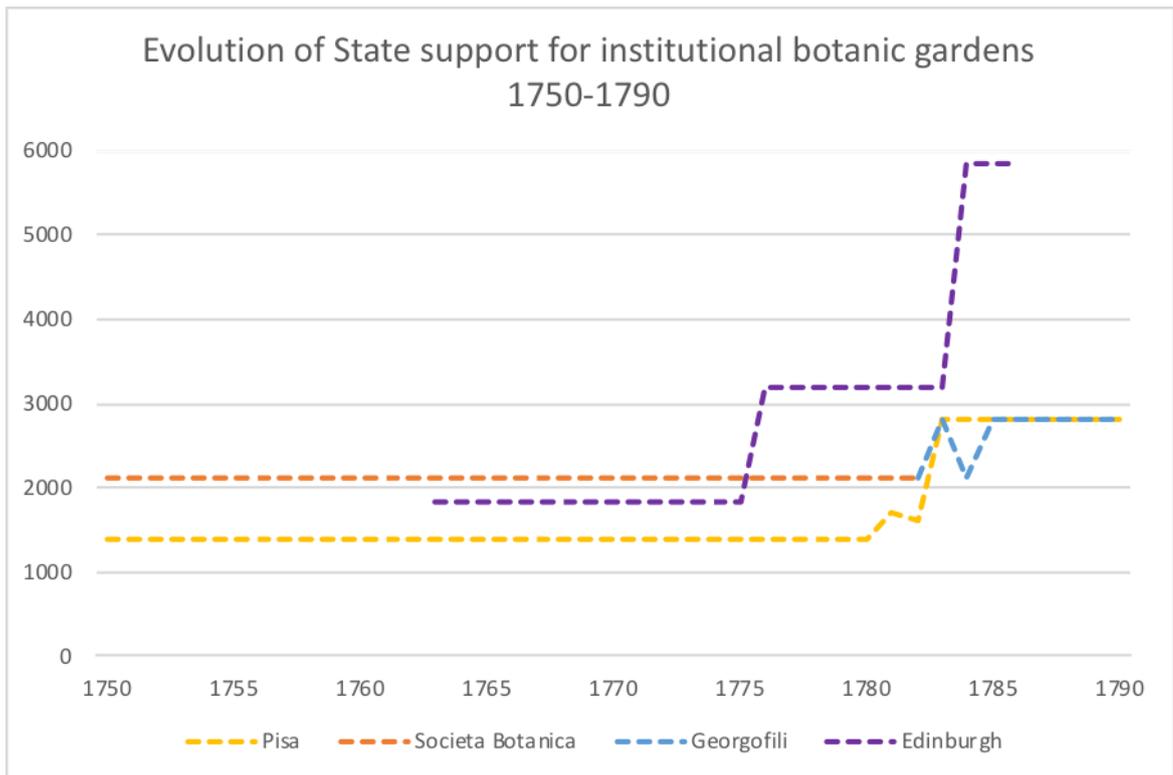


Figure 6 - Evolution of state support for botanic gardens

The comparison of those three gardens shows a clear increase of state funding in the early 1780s. The first increase of Edinburgh's funding also occurs in the mid-1770s, at a time when the Tuscan state had also been increasing its investment in science by creating *la Specola*. There is a clear parallel between the decisions of the two states showing that the British state was indeed following the same path as its continental counterpart, suggesting a European trend rather than an isolated phenomenon.

Public institutions

This influx of public funding added to the increased control over the gardens by central authorities encourages us to consider that the botanic gardens were increasingly becoming public institutions. Part I has shown that they were not public *spaces*, since the access to the actual space seems to have become more and more restricted, but their organisation and structure did make them public institutions, i.e. institutions owned and operated by the state.

By the end of the eighteenth century, the botanic gardens had lost most of their autonomy from the state. Between the customs and the university, Pisa was entirely controlled by grandducal institutions and officials. In Florence, not only had the *Società* been under the influence of the

Grand Duke, but their successor the *Georgofili* were literally attached to a ministry. Edinburgh was entirely dependent on the state for its budget and administration. The phenomenon described by Cochrane about learned societies being brought under the authority of the prince through symbolic and financial means to control them and make them into “semi-official institutions” had also been applied to botanic gardens.⁵⁸ The botanic gardens were now part of the Royal administrations of their respective countries and worked under the supervision of civil-servants and bureaucrats.

The difference between gardens and learned societies was that the gardens had an actual permanent and paid staff, as discussed in Part II. Cochrane wrote that learned societies were only “semi” official, because their officials were still private individuals. In the case of the gardens, they were institutional savants. As institutional savants and pre-professional scholars the botanic gardens directors were employees of the state, since the state was the one paying them.

It is no coincidence that this whole process happened during the rise of the civil servant figure in Italy. Roggero argues that in the eighteenth century, the new figure of the professor had become that of a public servant.⁵⁹ The universities were reformed as a way for the states to control the formation of their subjects, not least because they needed to create more qualified public servants for the complex new functions in administration, finances, or bureaucracy. In this context the garden directors were also public servants, the link being all the easier to make that most of them were professors as well. The science-focused civil servant and public institutions have attracted attention in Germany and France, mostly in the frame of geology and mining.⁶⁰ These case studies show that they existed in botany as well.

It is harder to speak of “public servant” in Britain, where the state apparatus was less centralised, and many state officials still held offices on a voluntary basis.⁶¹ Hope’s role still made him part of the state’s apparatus since he collaborated with official institutions such as the Exchequer, attached to the Treasury, one of the very rare central state institutions in eighteenth-century Britain.⁶² Though the term of “public servant” might not be appropriate to discuss

⁵⁸ Cochrane, *Tradition and Enlightenment*.

⁵⁹ Roggero, ‘Professori e Studenti Nelle Università Tra Crisi e Riforme’, 1068.

⁶⁰ Peter Konečný, ‘The Hybrid Expert in the “Bergstaat”’: Anton von Ruprecht as a Professor of Chemistry and Mining and as a Mining Official, 1779–1814’, *Annals of Science* 69, no. 3 (1 July 2012): 335–47; Klein, ‘Savant Officials’; Klein, ‘Artisanal-Scientific Experts’.

⁶¹ Eckhart Hellmuth, ‘The British State’, in *A Companion to Eighteenth-Century Britain*, ed. H. T. Dickinson and Historical Association, trans. Angela Davies, Blackwell Companions to British History (Malden ; Oxford: Blackwell, 2002), 19–29.

⁶² Hellmuth, 23.

Edinburgh, the position was similar enough to the Tuscan ones that it shows a parallel evolution towards an official public status for garden directors.

Conclusion

Taking the focus away from the biggest and most commonly studied institutions of science shows that the opposition between Britain and the continent in terms of state support for science is skewed. The differences in government and character did not actually change the fundamental ways institutions interacted with the state, mostly the timeline. For the second half of the eighteenth century, the details of organization changed for each garden, which shows that the relationship between botanic gardens and public authorities was not yet standardized, but the evolutions of the gardens' links to public authorities were becoming more streamlined and similar, showing a process of standardization. Scientific institutions gained more support from the central authorities, showing the interest of the said authorities in their work, but also lost their autonomy to become part of the public services. The botanic gardens had become public institutions of science, a status that had implications for their organizational structure, as this chapter showed, but also their general purpose.

Chapter 9: Gardens and Public Good

In his work on the garden of Kew and the empire, Richard Drayton studied the link between botanic gardens and power.¹ In the first part of *Nature's Government*, Drayton proposes that the interest of authorities in botanic gardens in the late eighteenth century was largely due to the representative power of plants as symbols of power on one side, and agricultural utilitarianism on the other. In Drayton's perspective – which is one focused on the empire – even the agricultural mission of the garden was conceived in relation to global relations and the representation of power that came from the commercial aspect of agriculture. This approach makes sense for Kew garden, which, at the end of the century, was rapidly becoming the scientific epicentre of an expanding British empire. Emma Spary found a similar dynamic in France and showed how, in the seventeenth and early eighteenth centuries, the French state had explicitly encouraged scholars to see their craft as linked to commerce and economic development.² Once again, the discussion takes place in the context of colonial and global trade. In Spary's and Drayton's footsteps, this chapter will look both at the symbolic and practical missions of botanic gardens in Edinburgh, Florence and Pisa. It will show that they shared the utilitarian approach of botany, but that it was more practical, and often more inward looking than that of the London or Paris gardens. The gardens were less objects of representation. They justified their support by the state not by projecting an image of power, but by promising to produce wealth.

Paradoxically for a space that was becoming less accessible to most people, the botanic garden had to be useful to all, not only a small number of privileged people, giving it a public mission. This idea could be expressed differently in different places but was particularly present in the discourse surrounding the Italian gardens. In Florence, the *Società Botanica* argued in their *Memoria* for the new Grand-Duke 1765 that he should continue supporting them because their garden of San Marco was “necessary” and of “utility to the very faithful subjects of HRH”.³ When the *Georgofili* took over, they defined their academy's mission as “to make itself useful in general to all the classes of inhabitants of Tuscany”.⁴ The same document said that the academy would always aim to work “to the biggest advantage of the public”. In his studies of *la Specola*, Simone Contardi gives to this idea its most common name: “*pubblica utilità*” or “public utility”.⁵

¹ Drayton, *Nature's government*.

² Spary, 'Peaches Which the Patriarchs Lacked'.

³ BUB, Scaffale Msi, n°97, ff52-57, “*Memoria*”.

⁴ ADG, Statuti, regolamenti e memorie, 6. “Regolamento dell'Accademia”, 1783, p1.

⁵ Contardi, *La Casa Di Salomone*; Barsanti, Becagli, and Pasta, *La Politica Della Scienza*.

The concept was more rarely openly mentioned in discourse surrounding the Edinburgh garden. One of its most explicit mentions shows that the garden had been associated with the notion before the late eighteenth century: in 1695, the Town Council declared that the garden had “proven so usefull and beneficiall to all persones resorting to this City”.⁶ Later on, “public utility” was often implied, but rarely named. This chapter will argue that similarities with Tuscany show that the gardens shared some of those objectives though they did not address them openly. The funding of the gardens by the public authorities was not disinterested. Botanic gardens served certain functions that motivated the authorities to support them because most of these functions related to public utility.

The idea of public utility as it is used here relates to the philosophical notion of “common good”, which has been given many different names through the history of philosophy. Maximilian Jaede mentions that its synonyms include “common profit”, “common utility”, and “common weal”.⁷ Jane Mansbridge also said that historically “common good” was interchangeable with “public good”, and “public interest”.⁸ The expression “common good” refers to both the facilities provided by members of a community for all members – in which case it is a material good – or the interest of the community that those facilities are serving – in which case “good” refers to an immaterial concept, like “benefice”.⁹ In the case of our botanic gardens: the physical gardens themselves were common goods (material), and their purpose as institutions was to serve the common good(immaterial), which means the interests of their communities.

The type of interests that was served by common goods evolved through time. Jaede notes that “It is generally agreed that, at some point in the history of political thought, conceptions of the common good shifted from concerns with moral virtue and an ideal political community towards more pragmatic considerations of the material wellbeing of individuals”.¹⁰ He supports the common view that this change occurred around the seventeenth century, thanks, in particular, to the work of Thomas Hobbes. I will refer to this concept as “public utility” in the rest of this thesis because it is the closest expression to the phrasing of the eighteenth century and the sources.

⁶ RBGE, SUT, “Excerpts from Town Council...”.

⁷ Maximilian Jaede, ‘The Concept of the Common Good’, in *Political Settlements Research Programme* (Global Justice Academy, University of Edinburgh: The British Academy, 2017).

⁸ Jane Mansbridge, ‘Common Good’, in *The International Encyclopedia of Ethics*, ed. Hugh LaFollette (Hoboken: Wiley-Blackwell, 2013), 914.

⁹ Waheed Hussain, ‘The Common Good’, in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta (Metaphysics Research Lab, Stanford University, 2018).

¹⁰ Jaede, ‘Common Good’, 3–4.

This chapter will look at the purpose of botanic gardens as institutions in the second half of the eighteenth century. It will argue that whilst representation and economy were important missions of the gardens, there were others and that the support from public authorities was overall more motivated by the idea of domestic public utility than imperial politics and symbolic portrayal of power. It will also explore how the said gardens were aiming to fulfil their public mission and to what extent they were effective in it. I will begin by exploring the limited evidence for the role of botanic gardens as symbols of power as described by Drayton. Then I will discuss the role of medical and general education in the gardens for the public good. The chapter will then consider the economic mission of botanic gardens and examine both what they wanted to do and their limited effectiveness. Finally, the chapter will look at gardens as centres of expertise.

Glory and prestige

Drayton, and other historians such as Beth Hyde and Chandrika Mukerji, have shown that plants had an important symbolic power in the representation of power and wealth.¹¹ Collections of plants, in particular of exotic plants, were a visual demonstration of power, influence and wealth. Here I will consider “exotics” species that had either been introduced in Europe recently (first half of the eighteenth century) or species that were known to Europeans but not grown in large quantities because their cultivation outside of their exotic region of origin was too difficult (like pineapples). A collection of exotic plants showed that the owner had global connections and money to pay for expensive travelling, equipment – like greenhouses – and qualified staff – like knowledgeable gardeners. For figures such as the King, collections such as a botanic garden could take on a political meaning. In his dedication of the *Species Plantarum* to the King and Queen of Sweden, Carl Linnaeus wrote that the sovereigns should have a garden assembling “deputies of the whole wide world”.¹² Exotic plants were representatives of faraway lands. Botanic gardens often created collections that acted as maps, Drayton argues, and maps of plants could show political power over land, a miniature empire.¹³

This ideal of political prestige applied very well in Kew gardens and in other botanic gardens at the centre of colonial or commercial empires such as France, Spain, and even Sweden

¹¹ Elizabeth Hyde, *Cultivated Power: Flowers, Culture, and Politics in the Reign of Louis XIV* (Philadelphia: University of Pennsylvania Press, 2005); Chandra Mukerji, *Territorial Ambitions and the Gardens of Versailles* (Cambridge: Cambridge University Press, 1997).

¹² Drayton, *Nature's government*, 24.

¹³ Drayton, 24–26.

– once Linnaeus did convince the King and Queen. For smaller institutions like our case studies, political prestige still played a role but a much more subdued one.

There was certainly an interest in exotic plants in Edinburgh, Florence, and Pisa, but the source of this interest was different from the political message described by Drayton. For example, both San Marco and the Pisan gardens grew pineapple plants. In Florence, the pineapples were in San Marco under the *Società*'s administration. Exchanges from 1775 show that the Grand-Duke asked for pineapple plants to be transported to his garden of Boboli for part of the year.¹⁴ The plants would be in Boboli during most of the year but would be brought back to San Marco at the time of their flowering so that students could observe their fruitification. The special interest of the prince in the pineapple plant illustrates Drayton's point about the prestige of botanical collections. Because of its rarity and exoticism, the pineapple plant was a curiosity and a perfect symbol of power.¹⁵ Peter-Leopold wanting to present the pineapple plants in Boboli, the gardens of the grandducal palace in Florence, shows that same fashion existed in Tuscany. But it was Boboli, not San Marco, that was the principal space of symbolic display for the monarch.

In Pisa, the pineapples had their own smaller greenhouses, as shown by expenses of 1782, which mentions repairing them.¹⁶ Contrarily to their Florentine cousins, nothing indicates that the Pisan pineapples were disturbed by princely requests. It seems that they lived their lives peacefully in their private "*stufiglie*" (little green houses) in the middle of the garden. The difference of treatment can be explained by the status of the garden itself. In Florence, the role of San Marco in representing the grandducal power was overshadowed by Boboli. In Pisa, where the government and parts of the Court stayed half of the year, the botanic garden had a more prestigious position than San Marco –it was older, attached to the prestigious University, strongly associated with the city, and there was no other big princely garden. It was more visited by tourists and had been the object of a symbolic visit of the new Grand-Duke when he first arrived in Tuscany in 1765. It seems the garden of Pisa was perceived as more of a symbolic space for power than its Florentine equivalent.

Although the stories of the Tuscan pineapples show that they were indeed a symbol of power, they also point towards the fact that the botanic gardens themselves were not the preferred stage for those symbols. Logically, the grandducal palace was. The Boboli gardens were obviously a much closer equivalent to the royal gardens at Kew than the botanic gardens of San Marco or

¹⁴ ADG, Documenti Varii, Busta 131, 26, march 1775.

¹⁵ Fran Beauman, *The Pineapple: King of Fruits* (London: Chatto & Windus, 2005).

¹⁶ ASP, 13bis/F/VIII/1, p5.

Pisa. The distinction between the botanic and the princely garden in Florence highlights the difference in the representational power of each collection in a way that is impossible to apply in Kew. The same pineapples served different functions in different gardens. In San Marco they were objects of teaching and in Boboli they were objects of power. They were also not at all object of economy since they was no intention to start a pineapple plantation from the botanic gardens.

This is not to say that exotic plants as symbols of power were completely lost in botanic gardens. As curiosities, they were aimed at a different audience. As explored in chapter 4 of this thesis, botanic gardens were attractive for tourists and visitors. In his guide to Edinburgh from 1785 Hugo Arnot lists exotic and curious plant species – including the amazing “moving plants”!¹⁷ – as attractions in the garden. A collection of exotic species was a curiosity that would bring people to see the garden. It could also be a demonstration of the prince’s power and influence in front of those visitors. Despite access restrictions, botanic gardens could be a demonstration of imperial power and influence for a wider audience than the people admitted in the Court’s gardens.

This applied particularly in a garden like Edinburgh, more so than in Tuscany. Edinburgh was so far away from London that George III never visited. Because of this distance, royal institutions had an important representational role to play in the Scottish capital. They were expressions of the royal authorities in the landscape. Scotland had lost its political power after the Union of the Crowns in 1707, and subsequently had gone through two Jacobite revolts in 1715 and 1745. In this context, it made sense for the Crown to invest in the botanic garden of Edinburgh in 1763, for it could be a be a spatial demonstration of the King’s global power for both visitors and locals alike.

Smaller botanic gardens could have a symbolic function like Kew. This symbolic function was linked to the power of the public authorities but had little to do with the public utility mission of the gardens. In this aspect, the gardens were still serving the person of the Prince rather than the collective “public”. However, I would argue that this role was far from their first function and that it was an extremely secondary preoccupation for those gardens as institutions.

Medical Education and the Public Good

As we saw in chapter 2, a key function of botanic gardens was as instruments of teaching for medical students. Pisa, Florence, and Edinburgh all started as medical gardens, like most of

¹⁷ Arnot, *The History of Edinburgh*, 419.

their contemporary equivalents. The authorities and the garden's staff still emphasised this function of the garden strongly in the second half of the eighteenth century.

In Florence, future physicians, surgeons, and pharmacists could be trained in the Santa Maria Nuova Hospital. The *Società* still defended the idea that their garden was useful to their training too, allowing them to learn “to know Herbs well, to follow with all exactitude the ordonnances of the Physicians, and to not put noxious or venomous herbs in the body of gentlemen instead of healthy ones”.¹⁸ The garden indirectly serves society – or at least gentlemen – by insuring a high quality of education for the medical profession. San Marco proves that gardens could also be considered instruments of public health separately from a university.

Edinburgh had started with the same teaching and medical mission as its Tuscan counterparts. The Town Council in particular put emphasis on this. In the nomination of James Sutherland as professor of botany in 1675 they already considered the garden to help spread “knowledge wherein the health of all persons wether be it for food or medicine is so nearly concerned” in a turn of phrase reminiscent of the *Società Botanica*'s.¹⁹ This vision of the garden continued in the Town Council. In the early 1760s, the support for John Hope's project of merging the two gardens of Holyrood and Trinity was encouraged “in consideration of the benefice which will arise to the Public and to the City in particular from the study of medicine”.²⁰

In these sources we can see that the medical teaching function of botanic gardens was the first one to be associated with public utility. They had become not only assets for Universities but for the local or regional population who benefitted from a better trained medical profession.

Centres for wider education?

The teaching role of botanic gardens was not only perceived as beneficial for the public because of improvement of the medical profession. As we saw in Chapters 2 and 4, gardens were designed to teach not only students but also more casual visitors. This design choices were also the result of deliberate efforts to use the gardens and their institutional resources as tools of education for the wider public, an ambition inspired in part by Enlightenment ideals.

In Tuscany, Peter-Leopold conducted important reforms on education, trying to make it more accessible and widespread amongst the whole population.²¹ Peter-Leopold and his administration

¹⁸ BUB, Scaffale Msi, n°97, ff52-57, “*Memoria*”.

¹⁹ RBGE, Collection SUT, “Excerpts from Town Council...”.

²⁰ Edinburgh Town Council, « Town Council Minutes Vol. 78 », pp. 348-352.

²¹ On education see for example Emmanuelle Chapron, ‘The Politics of Libraries Under the Habsburg-Lorraines’, in *Florence After the Medici* (New York: Routledge, 2020), 63–86; on female education specifically

considered public instruction and public opinion to be intimately linked and education to be necessary for a peaceful and progressive society. The “instruction of youth” – even when it was not in medical subjects – was an important topic of Enlightenment philosophy and politics and these ideas shaped the botanic gardens as institutions. The *Accademia dei Georgofili*’s archives provide substantial evidence of their concern for the education of peasants: the academy published almanacs – more likely to be used by peasants than more traditional academic publications –, offered prizes for “discovery, or observation useful for the advancement of agriculture”²², and repeatedly discussed topics such as the “project of creating in the countryside public schools of Agriculture”.²³ The strong emphasis on *la Specola*’s educative mission also came from these ideas.²⁴ Botanic gardens were thought of as education tool for the wider public.

The contribution of gardens to public education was less prioritized in Edinburgh. Though it did not appear in documents describing the garden, it cannot be completely ruled out as a mission for the garden. Making science accessible to wider audiences and using it to educate the people was too common in Europe to say it was considered irrelevant to the concerns of the public authorities supporting the garden. The idea was also known in Britain and in Hope’s circles. In 1761, for example, John Hill wrote to Lord Bute about the *Flora Danica* that he had started reading. The botanist deemed that the botanical publication was very simple and not very scientific, but that the King of Denmark was funding it “for the Information of his subjects”.²⁵

The effectiveness of these projects varied. It certainly does not seem that the *Georgofili* managed to attract many peasants to their garden. The involvement of the *Segreteria* and their many projects aiming at engaging with the countryside population show that this had been thought of as one of their institutional purposes nonetheless. The different approaches to education that the *Georgofili* and *la Specola* took show that participating in the progress of education in general, and not only medical education, was an important role for the gardens as institutions.

The educative mission of the museum of *la Specola* was clear, but the type of education it provided in the garden was symptomatic of another role of the botanic gardens. By labelling each plant with its common name and its practical uses, the collection of the museum aimed to give people the tools to exploit natural resources themselves. Many of those plants were showcased for

see Maria Grazia Bianchi, *Le zitelle povere a Firenze e in Toscana : la condizione femminile sotto il governo di Pietro Leopoldo di Lorena* (Florence: Semper, 2005).

²² ADG, Giustificazione di entrata e uscita, Busta 153, Ins. 2, F6, Antonio Seccivori on 12 July 1783.

²³ For example: ADG, Registro delle Adunanze dell’Accademia, p62, 7 June 1797; or as an essay topic in *Atti della Real Società Economica di Firenze ossia de’Georgofili* - Volume I, 1791.

²⁴ Contardi, *La Casa Di Salomone*, 189–90.

²⁵ Rothasay, Bute Archive at Mounstuart, BU/98/4, John Hill to Lord Bute, 1st September 1761.

their roles in industry, like species used for dyeing or weaving. Knowledge of these plants was encouraged because they were perceived as likely to boost the economy.

The economic role of the gardens

The support of public authorities for botanic gardens in the eighteenth century was increasingly motivated by their perceived economic role. This was not a new phenomenon, as Spary shows, botany had been gathering support from the state for its economic role since the previous century.²⁶ The economic role of the gardens was defined by how they could influence the management of resources on a national scale. Since the economy was a matter of national policy and its development was beneficial for the general population, the economic role of the gardens was often discussed as their most important mission in term of public utility. There were different paths that the gardens could take to fill this role: one was to study indigenous plants less ostentatious and symbolic than exotics, but often more impactful on the economy, another was to work on acclimatisation and study of exotics species.

The practicality of the indigenous

The focus on indigenous plants in Tuscany only grew stronger through time. In San Marco, it had started in the early eighteenth century, under the administration of the famous Antonio Micheli.²⁷ Micheli had developed the collections of the garden with exotic plants but was also very dedicated to the study of the local flora, because he thought it was the key to improve his nation's countryside. Micheli died in 1737, leaving a collection of 2000 species in the garden and passing down his interest in Tuscan plants to his intellectual heirs in San Marco and around Tuscany.²⁸ When San Marco passed to the *Georgofili*, the proportion of indigenous plants in the garden grew even more since it was focused on agriculture. Later, *la Specola* only had indigenous plants in its garden.

On a practical level, this focus on the local can be explained by the limited reach on the Tuscan Grand-Duke on the international stage. Drayton has shown that exotic plants were especially important deputies in the context of empires, and Tuscany had no empire.²⁹ The Grand-Duke had little means for imperial ambitions outside of Europe. So instead of using the gardens as laboratories of empire, Peter-Leopold, and his subjects, focused on the local. The role of the indigenous collections was not so much the display of power, but to be used for the development

²⁶ Spary, 'Peaches Which the Patriarchs Lacked'.

²⁷ Tchikine, 'Echoes of Empire'; Luzzi and Fabbri, 'I Tre Orti'.

²⁸ Barbagli and Vergari, *I Targioni Tozzetti*.

²⁹ Brian Anthony Brege, 'The Empire That Wasn't : The Grand Duchy of Tuscany and Empire, 1574-1609' (Doctoral Thesis, Stanford, Stanford University, 2014).

of Tuscany. This in itself took on a symbolic meaning, showing the dedication of Tuscany to improve itself and use its own resources, highlighting its strengths, when competing in the hunt for exotics would have underlined its weaknesses.

Edinburgh did have access to a colonial empire and Hope did value exotic species and took advantage of the resources of the British Empire, but the Leith Walk garden's access to those resources was slightly limited by practicalities. Hope had placed his new botanic garden on the road to Leith, because the proximity to the port would make deliveries of plants to the garden easier. He had hoped that specimens would be delivered directly from the colonies to Edinburgh without stopping by London, thus bringing more prestige to the Scottish capital.³⁰ Alas, his specific instructions to collectors were never enough, and London was still the first port of the Empire. Despite the Edinburgh garden's good reputation, it was still difficult for its director to step out of the shadow of the British capital and to get those exotic species to Edinburgh to study. In such a context, encouraging the study of local species as what was done in Tuscany was also a way of giving the garden of Edinburgh a speciality, a function that could not be served by Kew gardens.

The focus on indigenous resources was often presented in direct opposition to the hunt for the exotic. John Hope wrote in a letter to the Earl of Findlater: "Whilst we are occupied in researching the woods of America and anxious to be acquainted with every article need in the aconomy of foreign life Your Lordship knows we have been absolutely inattentive to the natural productions of our native Country"³¹. This was a clear statement of Hope's perception that imperial interests were dominating local ones. He also added: "We have been equally inattentive to preserve the knowledge we once had of the virtue of many indigenous simples their uses in dying or in any of the arts of Living!". This highlights his resolution to help explore the natural resources of Scotland, like others did those of the colonies.

This was part of a general trend in Europe of local travel and study practices.³² As voyages of exploration were becoming more and more common, there was also a movement towards more systematic study of European landscapes and resources. In Tuscany, Micheli himself visited and studied his country. Giovanni Targioni-Tozzetti was also a prolific author of works on the Tuscan countryside and cities in the mid eighteenth century, publishing his observations on everything

³⁰ RBGE, HOP, GD253/145/7-10, p253.

³¹ NRS, E727/47/1-5.

³² See for example E. Vaccari, 'The Organized Traveller: Scientific Instructions for Geological Travels in Italy and Europe during the Eighteenth and Nineteenth Centuries', *Geological Society, London, Special Publications* 287, no. 1 (1 January 2007): 7–17; Charles W. J. Withers, 'Geography, Natural History and the Eighteenth-Century Enlightenment: Putting the World in Place', *History Workshop Journal*, no. 39 (1995): 136–63.

from history to geology, agriculture to architecture, and botany to art.³³ In Scotland, the Reverend John Walker was example of a traveller with the same objectives.³⁴

Hope's letter was presenting a scheme to study Scotland, and in particular the Highlands. Hope was lobbying to organise a campaign of national exploration and information collection with the support of public authorities. In this case, it was the Board of Annexed Estates – the council in charge of the administration of lands confiscated to the nobles who revolted in 1715 and 45 – who funded five yearly trips by James Robertson, one of the botanic garden's gardeners, around Scotland and its islands between 1767 and 1771.³⁵ This exploration scheme was organised and coordinated by the botanic garden as an institution collaborating with official authorities, which was quite rare outside of international exploration voyage like those of Captain Cook or La Pérouse. This made the garden a centre of study of the Scottish natural resources. Knowing the resources would lead to a better exploitation of those same resources. This would contribute to the progress and the improvement of Scotland, a task of public utility. The second of Hope's quotes clearly links the knowledge of indigenous species with their practical uses. Those practical uses, Hope argues, were what could help further the development of Scotland.

The ideas of progress and development fostered by the philosophy of the Enlightenment found a great forum of expression in the topic of “improvement” in the eighteenth century. “Improvement” was used to talk about any scheme that would enhance the productivity or help with the cultural development of places often considered backwards by the urban elite designing those schemes. In Scotland, it was in particular used to talk about the Highlands.³⁶ Famously not a great region for field agriculture, the Highlands were considered to be wild and empty spaces by the Lowlanders. People in Edinburgh also saw the Highlanders as less civilized than themselves. A common idea in Edinburgh's learned societies and circles was that the Highlands were wasted space at the time and should be turned into agricultural lands to make them more productive. This

³³ Ottaviano Targioni-Tozzetti, *Relazioni d'alcuni Viaggi Fatti in Diverse Parti Della Toscana per Osservare Le Produzioni Naturali, e Gli Antichi Monumenti Di Essa*, Edizione seconda con copiose giunte, XII vols (Stamperia Granducale, 1768); Ottaviano Targioni-Tozzetti, *Ragionamenti Del Dottor Giovanni Targioni Tozzetti Sull'Agricoltura Toscana* (Lucca: Jacopo Giusti, 1759).

³⁴ Charles W. J. Withers, 'A Neglected Scottish Agriculturalist: The "Georgical Lectures" and Agricultural Writings of the Rev Dr John Walker (1731-1803)', *The Agricultural History Review* 33, no. 2 (1985): 132–46.

³⁵ On the Annexed Estates see Annette M. Smith, 'The Forfeited Estates Papers, 1745: A Study of the Work of the Commissioners for the Forfeited Annexed Estates, 1755-1784, with Particular Reference to Their Contribution to the Development of Communications in Scotland in the Eighteenth Century' (Doctoral Thesis, University of St Andrews, 1975); On Robertson and his travels see the edition of his journals Robertson, Henderson, and Dickson, *A Naturalist in the Highlands*.

³⁶ Jonsson, *Enlightenment's frontier*.

would increase their value and the role they played in the general Scottish economy. It would also help civilize their inhabitants.

In Scotland the conception of this process was extremely close to what was happening around the globe with European colonisation. This is also illustrated by the example of Robertson's travels. Robertson was not only collecting specimens and drawing plants, but also interviewing local populations everywhere he went to ask about what practical uses they had of local flora and fauna. The colonizers – here the Lowlanders – were using indigenous populations' knowledge of their resources to build their own knowledge. This knowledge was then processed in a centre of calculation that labelled it with terms fitting the colonizers' world definition.³⁷

This exploration of the Highlands' resources was also linked to the plan to “improve” the region, the second branch of this colonising enterprise. The Lowlanders used the new knowledge to determine theoretically what the best use for those resources was and tried to impose it to the Highland populations. For example, Robertson's journals from his expedition contain many notes on how the productivity of some regions could be increased by destoning fields, building walls, or transplanting different vegetable species from other part of Britain. This was done on a different scale than the colonization of native peoples in the Americas, Asia, or Africa, but the mechanics of the use of science to justify imposing changes on populations for the ultimate benefit of the metropolis – in this case the Lowlands, which would benefit from a stronger agricultural production both in terms of feeding themselves and for commerce – were very similar.

Both these aspects of the colonial enterprise are why Jonsson referred to the Highlands as “Enlightenment's Frontier”, a space to be colonised to spread the perceived superior civilization.³⁸ This was done with the help of scientific knowledge accumulated by and in institutions such as the botanic garden. It meant that the garden's purpose was also to serve public utility by helping this process.

Hope's idea of studying the local flora to help the improvement of Scotland was the same defended by Micheli in Tuscany a few decades before, with less of the colonizing undertones. In Tuscany, there was a will to educate peasants, but not necessarily a conception of them as “others” as strong as the distinction between High- and Lowlands in Scotland. Tuscan gardens did not

³⁷ On this complex phenomenon see Latour, *La Science En Action*; on the colonial context and the imperialism of science in particular see Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (Routledge, 1992).

³⁸ Jonsson, *Enlightenment's frontier*.

coordinate such formal exploration voyages as Robertson's in their own country as institutions. Many of the people who did write about the Tuscan countryside and improvements for it were associated with the gardens, but they usually travelled and wrote as individuals rather than agents of the gardens. This is a rare example of the Scottish garden being more directly involved in state affairs than its Tuscan counterparts.

The garden of San Marco did, however, take on an important and formal institutional role for the improvement of Tuscany when it was given to the *Accademia dei Georgofili*. The *Orto Sperimentale* of the academy had a mission to serve public utility by experimenting on agriculture and determining the most efficient methods to develop it. This mission had been the *Georgofili's* since their creation in the 1760s. It was immediately relevant to public utility as Tuscany had gone through three years of famine in a row between 1764 and 1766 due to the agricultural organisation.³⁹ The country produced enough to feed itself and sometimes export some surplus, but not enough to guarantee surplus every year. Any dip in production would immediately cause famine. A problem that the Academy was dedicated to study and fix.

This mission led the *Georgofili* to study mostly species that already existed in Tuscany: the legend of the map of the garden lists wild forest plants, legumes, peas, salads, or asparagus, for example, none of which were new to Tuscany.⁴⁰ Chapter 3 has already discussed some different types of experimentations that took place on plants in the garden, but a good example of the garden's role for public utility comes from looking at the work on how to best use plants that could grow easily in Italy. In 1794, Andrea Zucchini wrote a report on experiments conducted in the garden – and, I have to assume, his house – on potatoes.⁴¹

Seeing himself, that the Peasants mostly do not like the Potatoes when they are boiled, so as to encourage them to cultivate them, he has reduced them with Spinach into dough with very little flour, and a little salt; and then made them into *Schiacciate*, and baked in the oven, or more economically on trays in the domestic fireplace, he found that they become tasty, as he demonstrated alongside his essay with some of these resulting *Schiacciatine* at the Academic Meeting.

The potato had been discovered, brought back to Europe, and grown there since the sixteenth century. Botanists and governments alike knew that it was edible and useful because easy

³⁹ Cochrane, *Tradition and Enlightenment*, 151–52.

⁴⁰ ADG, Carte Bartolozzi, Busta 178, 28, Plan of the Garden.

⁴¹ ADG, Registro delle Adunanze dell'Accademia, 6 March 1799.

to grow and very nourishing.⁴² Despite these qualities, the potato was not very popular amongst Italian peasants, a situation that Zucchini set out to change. Zucchini was not an outlier either, in the same time period, Antoine-Augustin Parmentier in France and Frederik the Great in Prussia were organizing campaigns to popularise the potato.⁴³ That San Marco's garden and its productions were used for such experiments shows the role that the institution's research was given for public utility.

Experiments in the garden of the *Georgofili* also included research on which plants were more easily produced and how to cure or stop plant illnesses. The reports made by Ottaviano Targioni-Tozzetti on his work in the garden in the early nineteenth century show notes on degeneration of species, such as the genus *Triticum compositum*, which he concluded degenerates too easily and should be replaced by other cereals.⁴⁴ In 1796, the director of the garden was also charged with verifying a theory on the cure for a disease affecting olive trees referred to as the "*lupa degli ulivi*".⁴⁵ As these examples demonstrate, the *Georgofili* were involved in research on methods and productivity, not collection of the diversity of flora. The garden's role was not to display fantastic specimens that would capture the imagination of the visitors by their evocation of distant places. It was to serve very concrete and practical goals, which sometimes meant writing lab reports on boiled potato.

The botanic gardens were centres of study of their own countries, their resources, and how to best exploit them. In places like Tuscany and Scotland, which did not benefit from a direct and easy access to colonies as central imperial capitals, indigenous plants had a very important role to play. The value attached to the practical use of plants was most visible in indigenous, local, and ordinary plants, but it also applied to exotics.

Experimentations in acclimatization

Chapter 4 mentioned that botanic gardens were ideal places to conduct experiments of acclimatization. Those experiments did not just satisfy the immediate scientific curiosity of the botanists carrying them out, they had an economic and public utility function too. This was illustrated in Targioni-Tozzetti description of the *Georgofili* garden's functions in 1801: "The

⁴² Jean Georgelin, *L'Italie à la fin du XVIIIe siècle* (Paris: SEDES, 1989), 90–91.

⁴³ Rebecca Earle, 'Promoting Potatoes in Eighteenth-Century Europe', *Eighteenth-Century Studies* 51, no. 2 (2017): 147–62.

⁴⁴ ADG, Ottaviano Targioni-Tozzetti, "Rapporti sulle osservazioni ed esperienze fatte nell'orto agrario dell'Accademia" In *Atti della Real Società Economica di Firenze ossia de'Georgofili*, VI (Florence, 1810).

⁴⁵ ADG, Registro delle Adunanze dell'Accademia, pp 50-51, 6 July 1796.

Experimental garden ... [is destined] to establish the evidence, and the experiments of Agriculture, that could lead to a more advantageous production of the plants already known in Tuscany, and to introduce new ones for Agriculture, and for public and private economy".⁴⁶ Experiments in acclimatization were common in eighteenth-century Europe and, because they aimed to create new resources for the country, they served public utility. The choice of species to try and acclimatize was more often than not based on the perceived usefulness of the plant. The plants chosen could serve an economic purpose for domestic consumption to the country, to develop trade and commerce, or both.

Examples of acclimatization experiments for domestic consumption are easy to find in the *Georgofili's* garden, but often less showy than in other gardens. To fight the famine issues, the academy conducted experiments not only on indigenous plants but also on the diversification of crops. In the mid-eighteenth century, the two biggest crops in Tuscany were wheat and grapes.⁴⁷ The academy worked on proposing substitutes like barley, oats, and others that sometimes came from other countries, close or far. For example, Attilio Zuccagni, before going to work for *la Specola*, was also a member of the *Georgofili* and proposed to grow a new type of beans in the garden.⁴⁸ Often this type of domestic consumption experiments were not on very exotic species – except maybe the potato – but on European species close to the habits and diets of the local people.

In Edinburgh, there is little evidence of acclimatization experiments motivated by a desire to improve the diet of the local population, perhaps because the garden was not large enough for substantial agricultural experiments. But Edinburgh was certainly involved in trials of foreign plants with potential commercial value, notably rhubarb and tea. Hope's efforts to acclimatize exotic species stemmed from cameralist economic theories, an economic doctrine based on the idea – common in the eighteenth century – that all wealth and resources in the world was finite. Cameralism encouraged self-sufficiency on a national level to avoid giving away a country's resources, in particular gold and silver, which were the basis of currency value.⁴⁹ Cameralism strongly disapproved of the trade with Asia, China in particular, because it was very unbalanced. Europeans imported a lot of goods from China, such as tea, but China was not interested in

⁴⁶ ADG, Ottaviano Targioni-Tozzetti, "Rapporti sulle osservazioni" In *Atti*, VI (Florence, 1810).

⁴⁷ Cochrane, *Tradition and Enlightenment*, 151–52.

⁴⁸ Cochrane, 153.

⁴⁹ For examples of scholarship dealing with cameralism, in particular in link with botany see Koerner, *Linnaeus*; Jonsson, 'Scottish Tobacco and Rhubarb'; Marcus Popplow, 'Knowledge Management to Exploit Agrarian Resources as Part of Late-Eighteenth-Century Cultures of Innovation: Friedrich Casimir Medicus and Franz von Paula Schrank', *Annals of Science* 69, no. 3 (1 July 2012): 413–33.

European goods to trade so imports had to be paid in precious metals, which cameralists worried would lead to a decline in European wealth. John Hope seems to have embraced a cameralist approach like many of his botanist peers, including Carl Linnaeus.⁵⁰

To fix the problem of lack of certain resources in Europe, cameralism – and many other movements close to it such as physiocracy – often proposed to either replace the imported product by a European equivalent or organise production of the original product in Europe. In the case of plants, this meant acclimatizing them. The acclimatization would be of public utility since it was trying to fix what was perceived as a national economic problem. In Edinburgh, John Hope did several experiments of acclimatization for this very purpose.

The most successful of those was his growing of rhubarb, a very popular medicinal plant in the eighteenth century.⁵¹ Rhubarb's roots were dried and made into powder used as a cure-all treatment thanks to its laxative properties. The rhubarb's genus *rheum* contains several species, some of which were a more efficient laxative than others.⁵² The most prized and efficient species were the Russian and the Chinese rhubarbs. Western Europeans were trying to find and bring back specimens of what they called the “true rhubarb” throughout the eighteenth century. At least three different species of rhubarb had arrived in Europe before the opening of Leith Walk.

John Hope also participated in the rhubarb craze.⁵³ In 1762, the physician James “Rhubarb” Mounsey brought back seeds of Siberian rhubarb, collected in the botanic garden of St Petersburg, when he came back to Scotland after working in Russia for several years.⁵⁴ In 1765, Mounsey wrote to Hope and offers him seeds from his own rhubarb plants, started after his return. This species of rhubarb, named *Rheum palmatum*, was planted in the garden and its cultivation was so successful that in 1779, Hugo Arnot's guide of Edinburgh described a field of 3 000 rhubarb plants just next to the garden. This field was Hope's personal property but could only have been planted with seeds from the rhubarb grown in the garden. Thanks to this field, Hope became the main supplier of rhubarb for Edinburgh's Royal Infirmary, presumably a very lucrative position.⁵⁵

⁵⁰ Koerner, *Linnaeus*.

⁵¹ Foust, *Rhubarb*.

⁵² For more details on experimentation on medicinal rhubarb see chapter 3.

⁵³ All the documents on this subject are conveniently kept together in RBGE, HOP, GD253/144/5-7, section “Rhubarb”.

⁵⁴ Appleby, “‘Rhubarb’ Mounsey and the Surinam Toad—a Scottish Physician—Naturalist in Russia”; Clifford M. Foust, ‘Studies in the Society's History and Archives: The Society of Arts and Rhubarbs’, *RSA Journal* 136, no. 5380 (1 March 1988): 275–78.

⁵⁵ According to Hope himself, as quoted in Foust, *Rhubarb*, 124.

Jonsson writes that Hope's main goal when experimenting on acclimatization was to create a local culture of plants – in particular medicinal plants – that could be commercialised.⁵⁶ In the case of the rhubarb, this objective was met. Hope was serving the public good both as director and as individual. As director of the garden, Hope managed to bring a coveted new species⁵⁷ to an official royal institution, grow it and spread its culture by sending seeds to other gardens, like Kew, and members of learned societies.⁵⁸ As an individual, Hope benefitted from this successful experiment – one might say he had abused his position, but there seem to have been no rules about taking seeds for personal projects – and started a successful rhubarb business, supplying his local institutions with locally produced drugs. This was symbolically a cameralist success, and the public utility purpose of this type of experiment is only reinforced by the medicinal nature of the new crop, which was also a contribution to public health.

The acclimatization of rhubarb in Scotland was not an isolated example. Edinburgh itself carried out other projects of acclimatization, such as tea and *asa foetida*. Other gardens around Europe followed the same trend. In Tuscany, the *Georgofili* kept records of experiments on tobacco in 1789⁵⁹, rhubarb in 1796⁶⁰, and cotton in 1803.⁶¹

Limited effects

The experiments in acclimatization of economic plants that took place in botanic gardens like Edinburgh or San Marco shows the purpose of the gardens as institutions in regard to public utility. This was part of their mission and the staff endeavoured to fulfil it, but the question remains of the impact that their work had on the actual economy at the time.

In the case of rhubarb, Jonsson showed that its culture developed quite well, mostly in the Lowlands. It was considered an easy plant to grow and did not take too much space, so landowners did not have to reorganise the social organisation of their dependants. It was a way of making money without upsetting the population. The leaders of the movement thought that it would allow the very highly priced and praised drug to be affordable for everyone. Since the botanic garden was one of the first places to grow rhubarb in Scotland, it seems that it did have an impact. Jonsson

⁵⁶ Jonsson, *Enlightenment's frontier*, 61–64.

⁵⁷ Although it would later turn out not to have been the one true rhubarb either, which came to Europe in the nineteenth century.

⁵⁸ Quoted by Foust, *Rhubarb*, 116.

⁵⁹ ADG, *Atti*, II (Florence, 1791), p5.

⁶⁰ ADG, *Registro delle Adunanze dell'Accademia*, p 48.

⁶¹ ADG, "Osservazioni ed esperienze dal 1801 al 1807, dott. Ottaviano Targioni-Tozzetti" in *Atti*, VI (Florence, 1810).

does note, however, that the rhubarb craze ended in Scotland just as it started in England, so it was not necessarily a long-term development for the economy.⁶²

Rhubarb may be a positive example, but not all acclimatization experiments were successful. Hope's administration also saw the failure to start the culture of the tea bush in Scotland. In the eighteenth century, tea was fiercely protected monopoly of China. Tea was only sold to European as a finished product, leaves dried and in pieces. This did not stop Europeans from pursuing tea, on the contrary. Tea was an extremely important and ever-growing market there as documented by contemporary sources like John Lettsom.⁶³ In 1786, England alone sent fifteen ships a year to buy tea in China, ten more than they had done in 1776, and those numbers only went up. In 1791 even Tuscany, who had a more limited international, reach sent merchant ships for tea. With this new craze for tea, the tea bush was the ideal candidate for an acclimatization trial. Linnaeus himself tried his hand at it in the 1740s. As we saw in chapter 4, Hope's attempt at acclimatizing tea in the 1770s failed.

It failed on two levels. First, the tea-bush did not survive long enough to reproduce, so the species was obviously unfit for the Scottish climate. Secondly, as a consequence, it failed to change anything in the long-term development of agriculture in Scotland. In this sense, rhubarb was also not a big win. None of those species accomplished the goal of creating an agricultural renewal in the Highlands.

It is difficult to establish clear criteria to judge the impact of economic experimentation in botanic gardens could have on actual agricultural developments. One way to discuss this is to look at the gardens' economic experimentations as a part of the "agricultural Enlightenment".⁶⁴ The subject of economy and agriculture became extremely popular among the European educated classes in the second half of the eighteenth century. This sudden interest of the elites for agriculture and the cultural production that resulted from it constituted the "agricultural enlightenment" described by Peter Jones. Economic experiments in botanic gardens fit perfectly in this movement.

The theoretical side of the agricultural Enlightenment is well studied and established. The eighteenth century saw an exponential increase of the number of publications on the topic of economy, agriculture, and improvement. The extent to which these publications – and other

⁶² Jonsson, 'Scottish Tobacco and Rhubarb'.

⁶³ John Coakley Lettsom, *The natural history of the tea-tree: with observations on the medical qualities of tea, and effects of tea-drinking* (London: Printed for E. and C. Dilly, 1772), 24.

⁶⁴ Jones, *Agricultural Enlightenment*.

experiments conducted by the elites – affected the actual practice of agriculture is much more debated. Though there does seem to have been some evolution in agricultural practices between the eighteenth and nineteenth century, some historians argue that the development would have happened anyway and was not linked to the knowledge economy.⁶⁵ There are also arguments made that whatever progress or evolution that happened at the time was not due to knowledge coming from high up and being handed down to peasants, but came from empirical and oral knowledge transmitted between agricultural practitioners. As a small contribution to this debate, I have to observe that the botanic garden of Edinburgh had only a limited effect on the agriculture – if we consider that it helped spread the culture of rhubarb. The *Georgofili*'s inability to bring farmers in their gardens to teach them speaks to the same dynamic: development of theoretical knowledge from the elites – in these cases the official institutions of science – but no direct effect on the main agricultural practitioners. As institutions, the gardens were supposed to participate in the building of scientific knowledge that could improve the productivity and economy of their countries. I have shown that they did host activities that were trying to accomplish just that, but their immediate effect on agriculture was very limited.

Although the literature on agricultural Enlightenment tends to show that the movement was not very efficient in implementing actual change, it has also been suggested that all that research may have had an impact that is only visible in the long term.⁶⁶ It encouraged the development of “cultures of innovation”, which would be responsible for further developments of agriculture and other activities down the line. The institutionalisation of agricultural research in botanic gardens did reinforce this new culture as the public authorities showed interest and support.

Centres of expertise?

The establishment of botanic gardens as public institutions, and the professionalization of their staff discussed in Part II, also gave them another role to play for public utility: that of intellectual resource. Like the Royal Society and the French *Académie des Sciences*, botanic gardens were centres of expertise and the staff's expertise was available to public authorities for consultation.⁶⁷

⁶⁵ For a summary of the historiographical debate see Jones, 1–4.

⁶⁶ Popplow, ‘Knowledge Management’, sec. 4.

⁶⁷ Gascoigne, ‘The Royal Society and the Emergence of Science as an Instrument of State Policy’.

The pronounced interest of botanic garden institutions and their staff for plants indigenous to their own countries was part of their role as scientific expertise resource. They were helping collect information about the territory for the political powers. This was supposed to allow the latter to govern more efficiently. In Scotland, public authorities funded the trips of John Robertson around the country to explore and collect in the Highlands and the islands. The scheme was financed by the Board of Annexed Estates with the idea of using the data to more efficiently exploit the territories. Robertson's role was as much an emanation of the Board of Annexed Estate that it was of the Royal Botanic Garden. The information he collected was processed by both. The garden – here through the person of Robertson, but also the rest of its expert staff – was acting as an intermediary between governing bodies and the country – both the people, who were being interviewed by Robertson, and the actual physical land and nature of the country.

Cochrane argued that Tuscan academies were supposed to be intermediaries between the people and the sovereign, bringing up the problems of the people to the sovereign and explaining the sovereign's policies to the people.⁶⁸ This was also what botanic gardens as institutions were used for. They had information on the state of things and fed it back to the public authorities. The link with people was weaker than in usual learned societies, because, with the exception of the *Georgofili* who were supposedly in contact with farmers and peasants, the botanic gardens were mostly working with nature and plants.

In the case of Robertson's expeditions, his status as a gardener from the botanic garden was not a coincidence. In 1767, *Scots Magazine* wrote that "these parts of the country have never been regularly researched, by any person skilled in botany".⁶⁹ To achieve its goal, the expedition needed to be done by someone with a particular set of skills. James Robertson had been personally trained by Hope for those expeditions. In 1769 – after already several expeditions – Hope wrote to Lord Bute:

James Robertson now draws well, he is perfectly acquainted with the indigenous plants of Scotland and by having attended two courses of chemistry and received some private instruction from Dr Black he is no contemptible minerologist, he has for some time collected & paid attention to Zoology in a word is not now unqualified for collecting the materials on which the Natural History of the Country must be pounded, which makes me define them may be still employed at

⁶⁸ Cochrane, *Tradition and Enlightenment*, 55.

⁶⁹ RBGE, HOP, "Various", "James Robertson Papers".

the expence of the Annexed Estates in researching the distant parts of Scotland

...⁷⁰

Because of its link to the University, teaching, and its resources, the botanic garden was the perfect place to form someone like Robertson for this mission. Where else would public authorities find an expert in all those subjects, with practical skills of handling plant samples, and already working for a public institution, but in a botanic garden? Hope himself could not go on a half year expedition away from Edinburgh, but he was the ideal person to find and train someone to do it. The skills and the knowledge of the country and nature that botanic gardens hosted as institutions was probably the most important part of what made them assets to the public authorities. They were centres of expertise. The training of expert gardeners continued to be useful when Hope recommended Archibald Menzies to serve as surgeon and science collector on Navy ships in 1782.

The expertise of botanic gardens could be called upon easily for science-based advice for public authorities. The *Georgofili* in particular were often ordered to help the government with evaluations or reviews. In September 1791, the *Segreteria* asked them to review a manuscript entitled “*Carbon Fossile*” whose publication might have been sponsored by the grandducal funds.⁷¹ They were also asked to provide opinions on certain people’s plantations and the quality of their crops. For example, on the 2 March 1796, the *Segreteria* sent an order to conduct “the examination of a new culture of rhubarb in the region of Siena, made by Sig. Biago Barbalini, and for which he asked for a reward from HRH”.⁷² Tasks that were more directly linked to the garden included verifying the results of experiments made by other people in San Marco to assess the validity of their results. In those ways, the academy was providing an expertise service to the grandducal authorities. Their expertise was called upon to take political decisions to do with agriculture and the countryside. The academy was said to be the third pillar of the scientific reform of Peter-Leopold with the museum of *la Specola* and the Chamber of Commerce, but like the latter, its scientific role was linked to the economy.⁷³ This was why the *Georgofili* were so close to the government, as shown in the previous chapter.

In Edinburgh, the government was too far away for the garden to be directly invested in matters of national interest. But the use of the garden institution as a resource for scientifically informed opinion can be seen, once again in the organisation of Robertson’s travels. Seating on

⁷⁰ Mountstuart, BU/118/3, John Hope to Lord Bute, Edinburgh, 1769.

⁷¹ AdG, Registro delle Adunanze dell'Accademia, p13, 23 September 1791.

⁷² AdG, Registro delle Adunanze dell'Accademia, p48, 2 March 1796.

⁷³ Contardi, *La Casa Di Salomone*, XIII.

the Board of Annexed Estates was Dr John Hope, director of the botanic garden, whose expertise was relevant and useful for discussion on improvement. Despite differences in scale, the experts of the botanic garden of Edinburgh were also playing a role in state government, like their Tuscan counterparts.

The role of centre of expertise seems to have been less strong in Pisa and in *la Specola*. In the first, the lack of documentation may give the wrong impression and it is possible that Pisan experts did contribute advice to political bodies, but if they did, it was much more discreet than their Florentine colleagues.

As institutions, botanic gardens could be intellectual resources for public authorities. Their staff, no matter which individuals it was made of, was highly trained and possessed scientific skills that allowed the gardens to be efficient centres of calculation. Interaction with the gardens and their staff helped officials to take political decision, thus serving public utility.

Conclusion

The botanic gardens, and their collections, did have a symbolic and representation role for power, but for smaller gardens like Edinburgh, Florence, and Pisa, this was not the primary reason that public authorities supported them. Instead, gardens with less influence and less reach than Kew or Paris, focused more heavily on the public utility mission of gardens, be it for health or economic reasons.

Eric Cochrane wrote that Tuscan academies were bringing together those who know the issues and those who have the technical skills to fix them.⁷⁴ This was also the role of the gardens— even for gardens that were not administered by learned societies – for the public authorities: they were a source of people who understood specific problems and had the skills or the means to fix them. Though it is difficult to gauge the impact that botanic gardens directly had on agriculture, or even medicine, it is obvious that public authorities believed they could have one and define it as their primary mission. This defined the gardens as public institutions in the sense of serving the public good. The gardens' economic research in particular shaped this perception of their role in society. However, considering its relatively low impact on actual agricultural development, I would argue that the most efficient resource that the gardens as institutions offered to public authorities were

⁷⁴ Cochrane, *Tradition and Enlightenment*, 54.

their expertise. Knowledge was the most useful contribution that the gardens made to public life, a knowledge that was used in practical ways by the authorities.

CONCLUSION

The political, economic and ecological differences between Scotland and Tuscany in the eighteenth century affected the development of their publicly funded botanic gardens. The Tuscan Grand-Duke lived near and visited the gardens of Florence and Pisa. He was directly involved in their management. As a Grand-Duke, Peter-Leopold also had a defined vision and plan for the institutions of science and knowledge under his care and worked towards it by increasing his control and their public funding for them. In Britain, George III was physically far away from Edinburgh and never personally involved in its administration. The garden was granted royal protection mostly thanks to the patronage of Lord Bute and was not part of a larger plan for sciences on a national level. Britain often favoured private initiative rather than state intervention. The two countries also had widely different resources, both financial and natural. Britain was obviously richer than Tuscany, it was also bigger, and its institutions had access to vast trade and colonial resources. The Italian Grand-Duchy, on the other hand, had more limited trade relations and no colonies or imperial outposts, which meant a less steady influx of exotic species in its botanic gardens. On a purely material level, Scotland and Tuscany also had quite different climates, which had a big impact on the growing of botanical collections.

Despite these differences in their political, economic, and climatic situations, the comparison of the botanic gardens of Edinburgh, Florence, and Pisa reveals many similarities in their development as institutions in the second half of the eighteenth century. Though they sometimes responded to the same issues in different way, it is evident that they grappled with the same questions and followed similar trends in terms of management of space, status of people, and place in the public system. These trends all point towards a reinforced institutionalisation of the plant sciences in the late eighteenth century.

The particularity of botanic gardens compared to many other groups or structure involved in scientific activities, was their materiality. This dissertation's examination of these gardens as physical spaces has shown that they were spaces modelled by shifting ideas about what science was. The internal organization of the gardens reflected their teaching function, but also their increasing role in research. The latter became progressively more important and its growing impact on the space of the gardens shows that the research was becoming part of the official and expected role of the gardens. The gardens' role as sites of knowledge production was acknowledged and encouraged by the authorities in charge of them. The type of knowledge that the space was dedicated to was also increasingly specialised. Botany's increasing independence from medicine

was reflected in the management of garden spaces. So were the new sub-specialities of plant science such as agriculture.

Scientific thought not only had a big impact on the physical conception of the gardens' space, but also on how it was perceived mentally. Restrictive policies of access based on knowledge status show that gardens were defined as scientific spaces and enforced a defined vision of scientific knowledge and attitudes. In their perception of visitors, the staff of botanic gardens showed that the gardens as institutions were authorities on science. They could enforce the distinction between institutional science and other forms of knowledge.

The authority of the gardens in matter of defining science came in great part from their staff. The manual workers caring for the collections may often have been only practically trained in gardening methods, but the directors managing them had to prove their scientific credentials to be considered for their job. The profiles of the botanic garden directors discussed here show that they were selected on similar criteria in the various gardens. Though rarely officially spelled out, these criteria show an increasing requirement of formal education in the sciences. The directors were picked based on their ability to fit those requirements, particularly the need for a university degree, but did not need to prove extraordinary accomplishments in scientific research. These positions were jobs, not titles to reward exceptionally skilled amateurs. The responsibilities and pay that came with the position for those who passed the selection meant that the role of director was an active job – if not always a full-time one – and that those who did it were as close to professional scientists as there could be in that time period. The professionalisation of the directors reinforced the institutionalisation of botanic gardens. By having the directorship be a job with hiring requirements, a salary, and defined responsibilities, the fate of the gardens were detached from individual fancy. Instead the directors were accountable for their work to bigger structures.

These bigger structures were ultimately controlled by public authorities, making gardens part of the apparatus of a broader public administration. We have seen that public authorities increased their support and their control over the gardens during the period examined. The management of science institutions was increasingly taken over by national authorities: in the case of Edinburgh, control of the botanic garden by local structures like the City Council was overtaken by royal institutions. The interest of public authorities in botanic gardens grew with the idea of utility, pushing gardens to take on functions of teaching to wider audiences and researching useful plants such as agricultural crops. Public authorities defined botanic gardens' mission as serving the public good, assigning them a role in society.

The development of the botanic gardens in terms of space management, staff status, and public supervision were all different facets of the same general process of institutionalisation. Botanic gardens becoming more organised and more defined was a response to the combination of specialisation of plant-knowledge and public authorities' interest in the useful potential of science. The professionalisation of staff was also part of the institutionalisation as the organization of the gardens as permanent structures with clear objectives required the clear setting of expectations for directors. This led to the homogenisation of the role of director across the different gardens.

In fact, there was a homogenisation of the botanic gardens in general. Apart from *la Specola*, which clearly stands out because of its very different role in public life, the botanic gardens of Edinburgh, San Marco, and Pisa came to share more similarities by the end of the eighteenth century than they had at its start. The fact that the five gardens studied in this thesis – including *la Specola* – follow the same trends of specialisation, professionalisation, and institutionalisation is an important finding and shows that the concept of a botanic garden was becoming more defined and more standardized.

The story they tell collectively is also different from the stories that studies of individual gardens, which have been the most common form, can tell.¹ The comparative framing of this thesis shows that this story was a European one. Despite many local differences, the similarities in the evolution of the gardens of Edinburgh, Florence, and Pisa, are proofs that institutionalisation was a transnational European trend. None of the Tuscan gardens were directly influenced by the Scottish garden, and vice versa. Instead they were all responding to wider trends that obviously existed in two very different contexts. Though there is space for more studies focused on individual institutions and national contexts, I argue, as John Robertson has done for Enlightenment thinking, that the conceptualisation and institutionalisation of science followed common patterns across the continent.² These patterns transcended not only borders but also some of the specificities of national contexts that the historiography has long considered very significant in the shaping of the history of science, such as the emphasis of private initiative as a main drive of

¹ Richard Drayton, 'Henri IV et la Fondation de l'Hortus regius monspeliensis', in *Le Jardin des Plantes de Montpellier, Quatre Siècles d'Histoire*, ed. Jean-Antoine Rioux (Montpellier: Sauramps Médical, 1994); Giuseppe Catalano, *Storia dell'Orto botanico di Napoli*, 1958; Garbari, Tongiorgi Tomasi, and Tosi, *Giardino Dei Semplici*; Ferri and Vannozi, *Giardini Dei Semplici*.

² Robertson, *The Case for the Enlightenment*.

British science.³ The overall narrative has hidden some of the nuances to be found in the stories of individual institutions.

It is also true that those individual institutions have been neglected in the history of institutions of science itself. When it comes to the eighteenth century, that history is too often limited to the study of the numerous learned societies and academies which flourished in the period.⁴ The institutionalisation of science outside of those societies is too often associated with the nineteenth century, the French Revolution being sometimes perceived as a major influence in the start of the process as it exported the models of the *Institut des sciences* and the *Museum National d'Histoire Naturelle* across Europe. The examples of the botanic gardens of Edinburgh, Florence, and Pisa show that the process of public institutionalisation not only started before the French Revolution but was also not necessarily based on the exportation of a central French model such as the *Academie des Sciences*. There were different types and waves of institutionalisation of science. The Revolution undoubtedly accelerated and standardized the process, but institutions of science had already been growing in different ways across Europe. I have shown that through their management of space, people, and their officially assigned role in society, botanic gardens were shaped into public institutions of science. They became permanent structures working a part of a wider system of public services to develop knowledge in a defined methodological frame, which was established as the right way to know nature.

Finally, this study of botanic gardens, though it is focused on plant-related knowledge, should be used to challenge our understanding of the institutionalisation of sciences and science in general. I have demonstrated that the public institutionalisation and professionalisation of botany started earlier than it did for other disciplines, but this should not be considered an isolated case. Botanic gardens were not the only early modern institutions of science neglected by current historiography of these topics and their example should encourage scholars to reconsider the status of observatories in particular, which share many similarities with botanic gardens as fixed spaces of study, managed by scholars, and producing knowledge useful to society, for example in the form of navigation instruments and data. Botanic gardens and other institutions such as laboratories highlight a missing step in the long history of the institutionalisation of science.

³ Shapin, 'Property, Patronage, and the Politics of Science'; Gascoigne, 'The Royal Society and the Emergence of Science as an Instrument of State Policy'.

⁴ McClellan, 'Scientific Institutions and the Organization of Science'; Hahn, *The Anatomy of a Scientific Institution*; Moran, *Patronage and Institutions*; Teich, 'Institutionalisation of Science'.

ARCHIVAL SOURCES

Accademia dei Georgofili

The archives of the academy contain very various sources and documents that were consulted for this thesis. The most often referenced were part of the “*Statuti e Regolamenti*”, “*Registro delle Adunanze*”, and the accounts in *Busta 148*. I also consulted the correspondence in “*Carteggio*” and “*Carteggio amministrativo*” and the “*Documenti Vari*” which also contain documents of the *Società Botanica*, after it was absorbed by the *Georgofili* in the 1780s.

Archivio di Stato di Pisa

The Pisan archives are the repository for the University archives, catalogued under *Università di Pisa 13* and *13bis - II° Versamento*. Most of the documents relating to the garden in the eighteenth century are the accounts which can be found in 13/515 and 13bis/Sezione F.VIII.1.

I also consulted the University administrative records to find notes on salaries, raises and hirings which can be found in 13bis/Sezione G3-6, G8, G11, and G14.

Biblioteca Centrale Nazionale di Firenze

The BCNF keeps the record of several generations of the Targioni-Tozzetti family. I mostly consulted Targioni-Tozzetti 242, 249, 250 I and II, and 259 to find Ottaviano’s classnotes, his correspondence, and his notes on the garden of San Marco and *la Specola*.

Biblioteca Universitaria di Botanica, Università degli Studi di Firenze

The Botany Library of the University of Florence holds most of the archives for the *Società Botanica*. The documents are bound in two big volumes: numbers 97 and 98 on the *Scaffale Msi*. The volumes contain everything from notes on the garden to correspondence, minutes of meetings to accounting documents.

Bute Archive at Mounstuart, Rothesay

Though these archives did not contain much relevant material, I did find some correspondence and a report of James Robertson on the isle of Bute.

Museo Galileo

The museum inherited the archival collection of *la Specola*. These archival collections are extremely wide. They have recently been recatalogued as the ARMU documents, of which I

consulted ARMU.Affari 001, 004, and 007, following advice and references from Dr Simone Contardi who knows the fund much better than I could. Unfortunately, the documents on the garden itself are few and far between.

National Records of Scotland

Though most of the NRS material on the garden is copied and available in the RBGE archives, some extra documents only exist in the NRS, for example records of interactions between Hope and the Exchequer in E201, E418 and E350, or correspondence regarding Robertson's expeditions in E727/47. Other documents are found under GD253/146.

Royal Botanic Garden of Edinburgh

The RBGE keeps records organised in collections relating to individuals.

The HOP collection (for John Hope) is the most widely cited one in this thesis. It includes original correspondence, research notes by Isaac Bailey Balfour, as well as copies from documents held in the National Records of Scotland under the quote GD253 which concern the garden under Hope's administration. Boxes E414 also contain copies of financial documents of the time. The research notes by Balfour also quote and gave me references to look into the Town Council minutes and the Registry of the Privy Seal.

I also consulted the collections of papers of Dr Charles Alston, Malcom M'Coig, Archibald Menzies, and Daniel Rutherford, although few direct quotes made it into the thesis.

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Appendices

ORIGINAL QUOTES

Introduction

1. "aucun botaniste ne peut le voir sans cette espèce de respect qu'inspirent les lieux où les hommes ont commencé à s'élever a des idées d'utilité générale"

Part I

Chapter 1

1. "Di Bottanica, e d'Istoria Naturale."
2. "Professore di Bottanica"
3. "ostensore del Giardino Bottanico, e del Museo d'Istoria Naturale. " Emphasis mine.
4. "[..] In quello spazio poi di terreno, come sopra acquistato, e riunito al Giardino Bottanico, dal Direttore del medesimo vi fu stabilito un Giardino Economico per comodo della Studiosa Gioventù."
5. "les deux systèmes principaux des plantes. "
6. "la situazione o cultura che le medesime richiedono, come sarebbe nel I° le annue, nel II° le perenni, nel III° le palustri etc. "
7. "le piante non devano srvire per apprendere il sistema, ma bensì il sistema deve servire per imparare le piante; ed il sistema intiero deve esaminarsi e porre in mente sopra i libri e a tavolino, e non nel Giardino. "

Chapter 2

1. "[...] il celebre Giardino de' Semplici, così detto per le rarissime Piante, ed infinite qualità di Fiori, e di Erbe rarissime, che quivi si custodiscono sotto la direzione di un virtuoso Lettore, per renderne la cognizione alli Giovani Studiosi nell'Arte Medica, quale è degno di essere veduto, per le varie qualità dell'Erbe, e Piante Medicinali, cognite alli Naturalisti; et altresì per le differenti Piante straniere, delle quali prima di adesso non se ne aveva la cognizione, fatte venire dall'America, e dalle Indie Orientali per adornamento, ed assortimento di questo Giardino. "
2. "sul progetto di formare nelle campagne delle pubbliche scuole d'Agricoltura senza sgravio dello Stato."
3. "On écrit des choses utiles sur l'agriculture, tout le monde les lit, excepté les laboureurs".
4. "le lezioni più utile del Professor d'Istoria Naturale e di Chimica sono quelle nelle quali deve unire alle medesime le Dimostrazioni, e le Osservazioni" ; "sia dispensato dal fare tutte le lezioni di Obbligo in Sapienza, e vene faccia forlo quel numero che crederà sufficiente alla scienza che tratta."
5. "che possono avere più erudizione", "tutta la pratica delle materie agrarie, talento, genio, e passione per applicarsi a soggetti di pubblico vantaggio".
6. "delle piante in generale, delle loro parti, nutrizione, e accrescimento"; " della Zafferano, del Tabacco, del Rabarbaro, del Papavero, e di alcune altre, la coltivazione delle quali interessa come ramo di commercio."

7. "le piante non devano svire per apprendere il sistema, ma bensì il sistema deve servire per imparare le piante; ed il sistema intiero deve esaminarsi e porre in mente sopra i libri e a tavolino, e non nel Giardino. "
8. "teatro della natura ma anche inventario di un sapere che doveva trovare nella pratica la sua vocazione piu significatica"

Chapter 3

1. "farèbbero migliore ornamento a qualc'altro dei Reali Giardini. "
2. "desiderio di risprendere come il filo de filosofici sperimenti riafiunto da questa societa medesima, gia sono molt'anni ma non proseguiti per difetto di Protettore"
3. "Argomenti botanici sopra I quail si puo ragionare, e fare dell'Esperienze".
4. "si verifichino le pretese virtue della Lobellia Siphilitica del Linneo, stimata oggiorno nel Nort Specifico della Lue Celtica"
5. "Plantis Palustribus."

Chapter 4

1. "Le soin, la propreté, l'ordre, y président et [rendent la collection] aussi commode pour l'instruction des élèves qu'agréable aux yeux des personnes mêmes qui n'ont aucune idée des méthodes."
2. "L'uso da alcuni anni introdotto di tener aperto a chiunque l'ingresso dell'Orto Agrario Sperimentale nei giorni festive dei mesi della buona stagione".
3. "come lo sono le pubbliche biblioteche".
4. "un spazio pubblico destinato allo scienza".
5. " Finalmente resti a carico del Giardiniere, che non siano ammesse nel Giardino truppe di persone ordinarie ne ragazzi, e solo alle persone Civili sarà permersso il condurvi servitori, e serve. Le serve poi, senza le Padrone, e le Donne del volgo non potranno esservi ammesse poichè queste bene spesso tirate dalla superstizione, e ridicola credenza di alcune virtu delle piante, svelgono le medemi, e le rubano. Dovrà inoltre negare ad ogni altra persona, quando pero non fusse Accademico, o ne avesse ottenuta la previ permissione dalla società, l'andare nel Giardino a Caccia , il condurvi Cani per correre, ed il pescare nell'Isola, non potendo farsi tali cose, senza un danno ben grande delle piante. E per l'istessa ragione non potra tenere nel Giardino Agnelli, polli, o altri simili animali a pascere, ed'ingrassare, e nemmeno il Cavallo, se non che per breve tempo."
6. "si proibisca dentro al Giardino sparar Armi da Fuoco, far Risse, giuocare a qualsivoglia giuco, far de i Raddotti, Merende, cene etc"
7. "tener chiuso costantemente il detto Orto, e di dar solo l'accesso (picchianda alla piccola porta) agli Academici Georgofili, ed ad ogna altra persona pronta, da cui non si potesse temere una insolenza."

Part II

Introduction

1. "Dirimpetto [alla Specola] è situato il Giardino dei Semplici, ove si conservano rarissime Piante, ed infinite qualita di erbe, Fiori, e Piante medicinali fatte venire fino dall'America, e dall'Indie Orientali, ed inoltre il raro e celebre Museo di cose Naturali. Ci presiede il Professor di Bottonica, che attualmente gode una tal carica il Dottore Angiolo Tilli."

Chapter 5

2. "professore straordinario di Botanica"
3. "Alla lettura dei Semplici, e custodia del giardino"
4. "Un Presidente, Un custode dei semci; Un Dirretore del Giardino quanto ai semplici. Due Provveditorri. Un camarlingo. Un Segretario Generale. Une Custode del Giardino quanto ai fiori, Pomi, agrumi, loro cultura, Boschetto di Cedrati, Cerchiate, saluatichi"
5. "tutto quello, che appartiene alla Botanica, cisei, provvisione, Coltura e mantenimento dei semplici"
6. "persone di fuori".
7. "Direttore delle Piante dei Semplici"
8. "Un campaccio mal tenuto"
9. "Il Direttore parteciperà ai Deputati il piano delle sue Lezioni annuali, e converrà con i medesimi, per quanto sarà possibile, in tutto cio che riguarda a conservazione dell'orto, ed il regolamento economico del medesimo; sicome ancora abbia la cura delle esperienze affidategli dai Deputati istessi, e dagli Academici Ordinari, e Onorari, ed'abbia la facoltà di eleggere le persone dei Lavoranti temporari, secondo il numero che gli sarà dai Deputati accordato, con dirigere tanto i lavori di questi; che di quello permanente nella Casa dell'Orto medesimo, il tutto con la partecipazione al Presidente, a cui spetta l'Economica parte della Società."
10. "Argomenti botanici sopra I quail si puo ragionare, e fare dell'Esperienze".
11. "si verifichino le pretese virtue della Lobellia Siphilitica del Linneo, stimata oggiorno nel Nort Specifico della Lue Celtica"

Chapter 6

1. "suo abile Maeestro Abate Lapi"
2. "[...] non abbiamo saputo rinvenire soggetto piu capace a supplire alle incombenze de questo Direttorato con la maggiore utilita dell'Accademia e del Pubblico del Canonico Andrea Zucchini di Cortona, che ha tutta la pratica delle materie agrarie, talento, genio, e passione per applicarsi a soggetti di pubblico vantaggio, e sopra dei quali ha dato ancora con le Stampe qualche saggio della sua applicazione. Questo soggetto per la pratica, che ha fin da la sua infanzia della campagna per li studi ed esperienze che ha fatto sopra la medesima si è creduto il piu proprio in preferenza di altri che possono avere piu erudizione di lui, per esercitare con vera utilita, e non con pomposa apparenza il Direttorato del Giardino, e per supplire a quelle Lezioni che sono ingiunte a questo impiego."
3. "[Giovanni Lorenzo Tilli] avendo fino nell'anno 1772 per cagione delle indisposizioni di salute del Dott. Angelo Attilio Tilli di lui padre [...] ottenuto di fare le veci del medesimo nell'Ostensione delle Piante nel Giardino Botanico a beneficio delli Scolari [...]. Rappresenta ancora come sono già anni cinque, che per altro benigno rescritto venne l'oratore autorizzato a fare le Pubbliche Lezioni d'Istoria Naturale, e le Ostentazioni dei Corpi Naturali esistenti nel Museo della stessa Università a vantaggio dei suddetti Scolari [...]. Parimenti espone, come attesa la lungha e quasi continua malattia del Padre l'oratore si è sempre impiegato in suo luogo, non solo nella custodia dell'Orto Botanico, e Museo, quanto anche nella disposizione delle Classi delle materie di quello, con avervi collocate molti Uccelli, Pesci, e vari Quadrupedi preparati da sè in maniera da conservarsi, ed inoltre ha procurato di soddisfare chiunque è venuto ad osservarlo, mostrando personalmente le Piante Medicinali del Giardino, ed i corpi di ditto Museo agli Studenti, ed ai moltissimi Forestieri eruditi, che frequentemente passano da Pisa [...]."

4. *“Riflessioni sopra le incumbenze da assegnarsi al giardiniere”.*

Part III

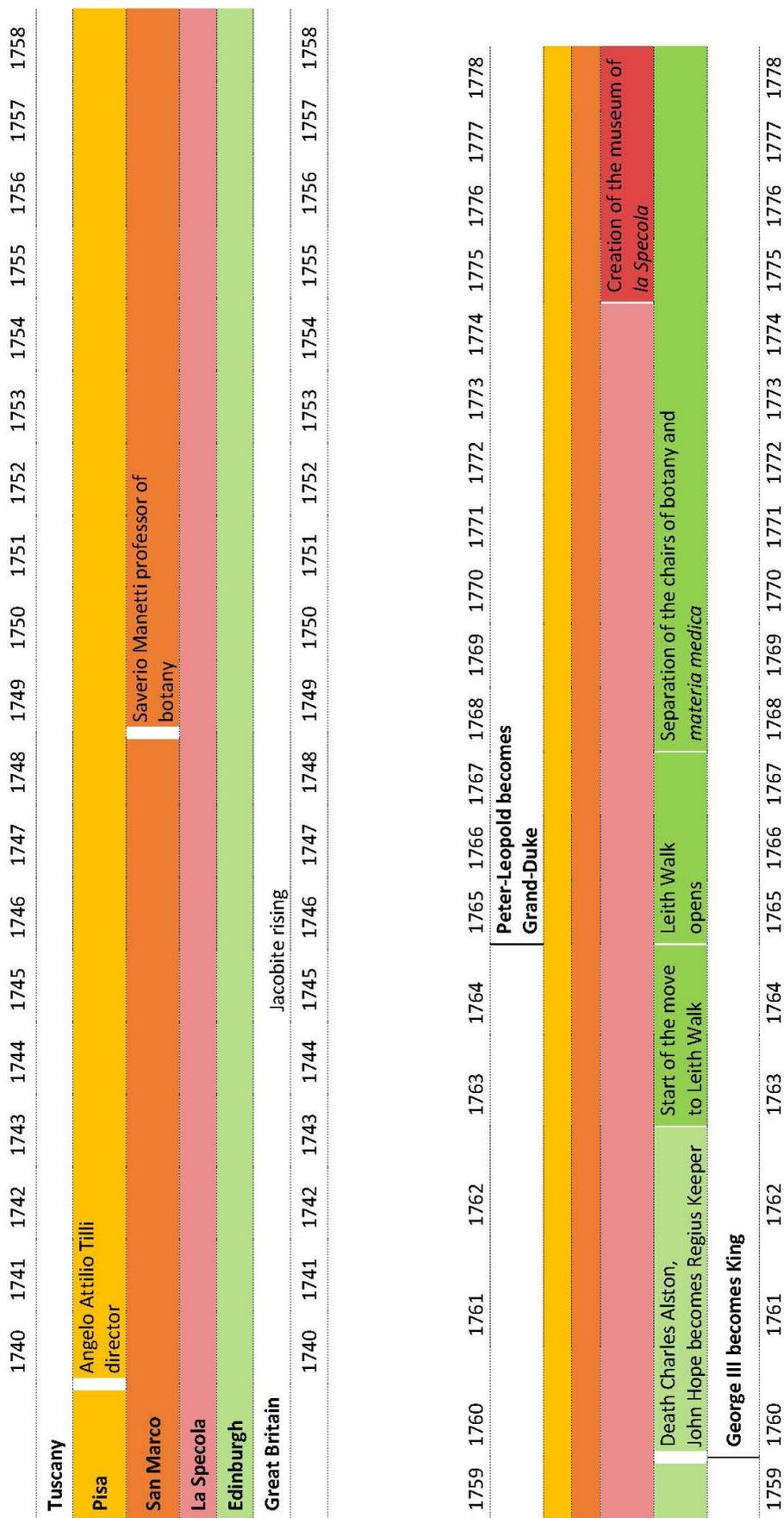
Chapter 8

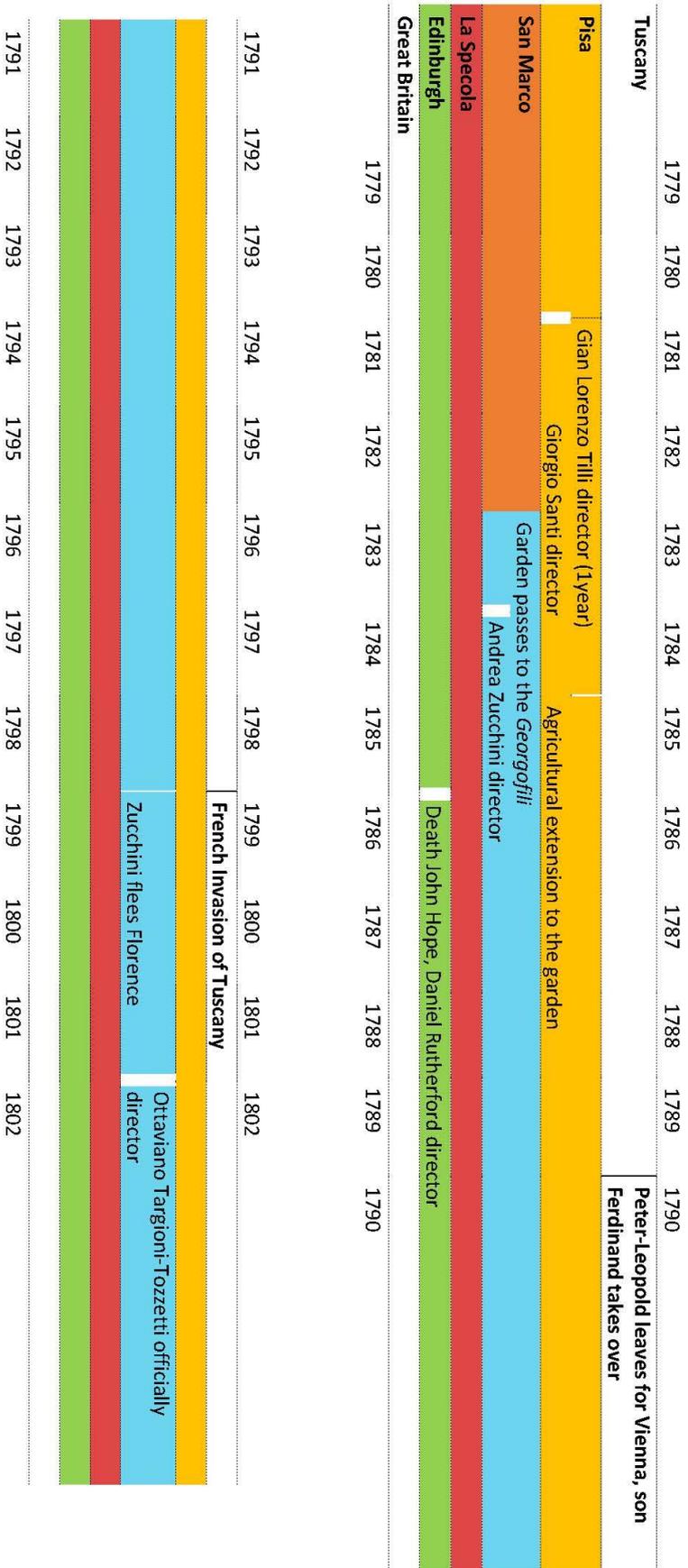
1. *“a tutto il Corpo de Soci Adunati”*
2. *“Che sia ispezzione del Soprintendente Generale de i Reali Giardini di farsi render buon conto dalla Societa Botanica dell'amministrato da lei, e riconoscere in che stato si trovi il Giardino con dar parte a S.A.R. quando essa avesse mancato nel suo buon servizio”.*
3. *“Con Approvazione”.*
4. *“Il primo non fu approvato da S. Ecc. Schmidveiller Direttore delle R. Finanze, a qual Dipartimento appartiene la nostra Accademia”*
5. *“Imperiale e reale museo di fisica e storia naturale”.*

Chapter 9

1. *“necessari”and of “utilita può arrecare a i fedelissimi sudditi di S.A.R.”.*
2. *“rendersi utile in generale a tutti i ceti degl'Abitatori della Toscana”.*
3. *“al maggior vantaggio del pubblico”.*
4. *“deputerade från hela vida verlden”*
5. *“il ben conoscere l'Erbe per eseguire con tutta esattezza le Ordinazioni dei Medici, e per non cacciar in corpo a i Galantuomini erbe nocive, o velenose in vece delle salubri.”*
6. *“qualche scoperta, o osservazione utile all'avanzamento dell'agricoltura”*
7. *“porgetto di formare nelle campagne delle pubbliche scuole d'Agricoltura”*
8. *“Vedendo egli, che ai Contadini non piacciono per lo piu le Patate tali quali son cotte lesse, affin d'invogliargi a coltivarle le ha fatte ridurre in pasta collo Spinattoio unendorvi pochissima farina, e un poco di sale; e poi fattene Schiacciate, e cotte in forno, o piu economicamente in delle Teglie al domestico Foscolare, ha trovato che riescono saporitte, com'ei fece riscontrare col Saggio di alcune di tali Schiacciatine esitite all'Adunanza Accademica.”*
9. *“L'orto Sperimentale ... essendo destinato per istituirvi quelle prove, e quelle esperienze di Agricoltura, che possono condurre ad un più vantaggioso prodotto delle piante di già conosciute in Toscana, e ad introdurne delle nuove per l'Agricoltura, e per la pubblica e privata economia”.*
10. *“li esame di una nuova cultura di Rabararo nel Senese, fatta dal Sig Biago Barbalini, e per cui chiedeva d'esser gratificato da SAR”.*

Timeline





PLANS OF THE GARDENS

Edinburgh

Images: personal photographs, reproduction courtesy of HES

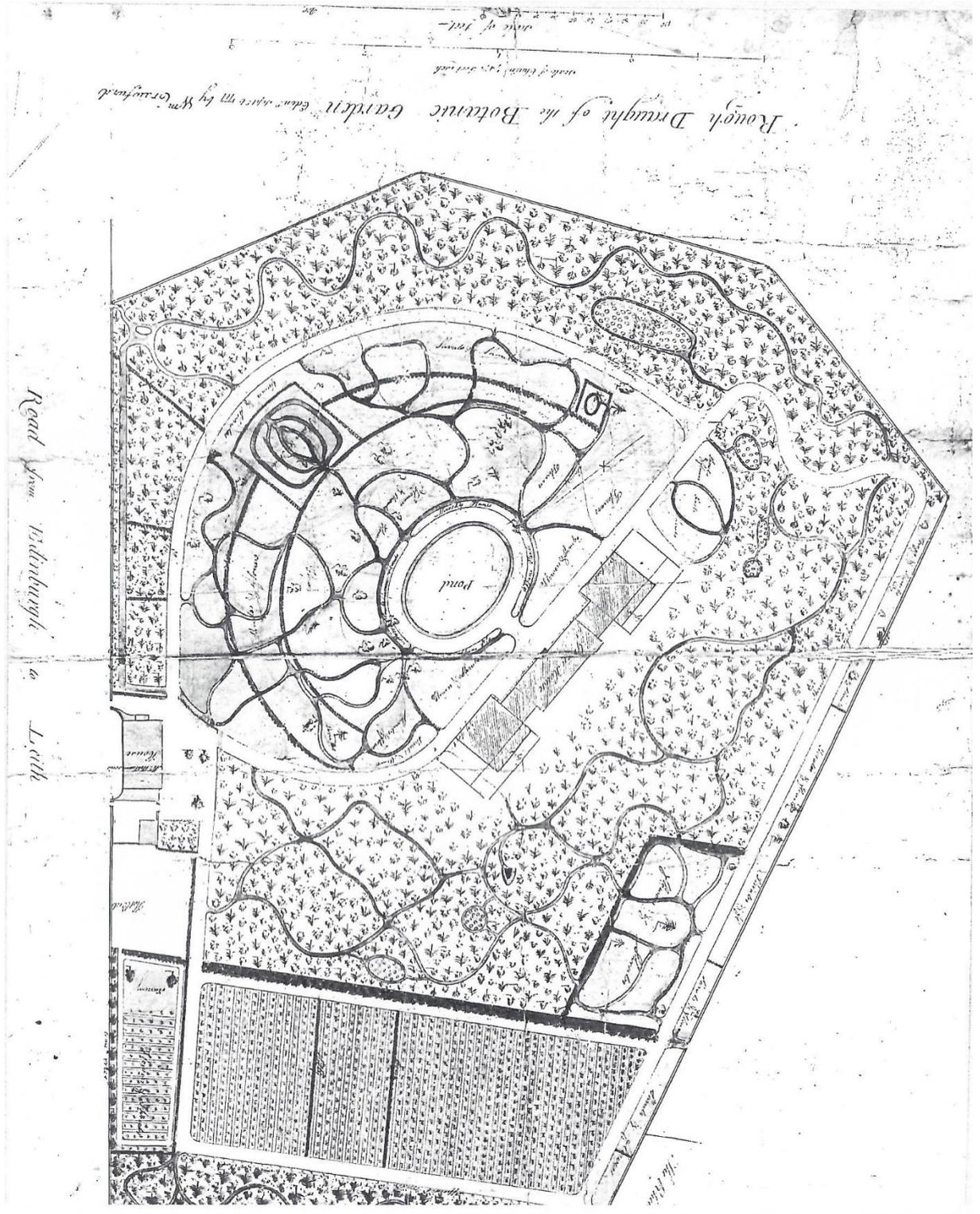


Figure 7 - Rough draft of the Botanic Garden, William Crawford, 1777, RCAHMS EDD/275.

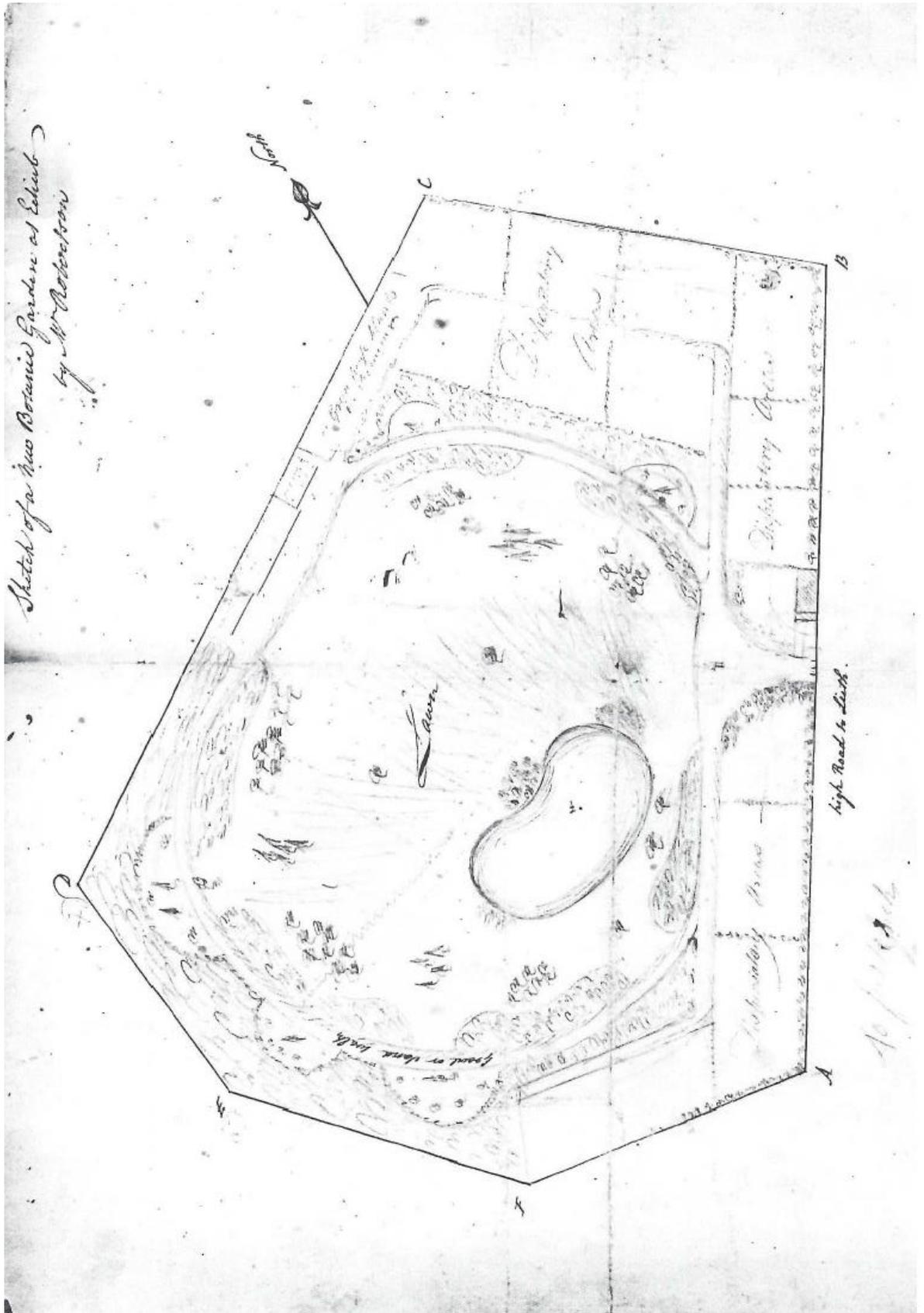


Figure 8 - Sketch of a New Botanic Garden at Edinburgh, R. Robindon/Robertson, 1763, RCAHMS EDD/275.

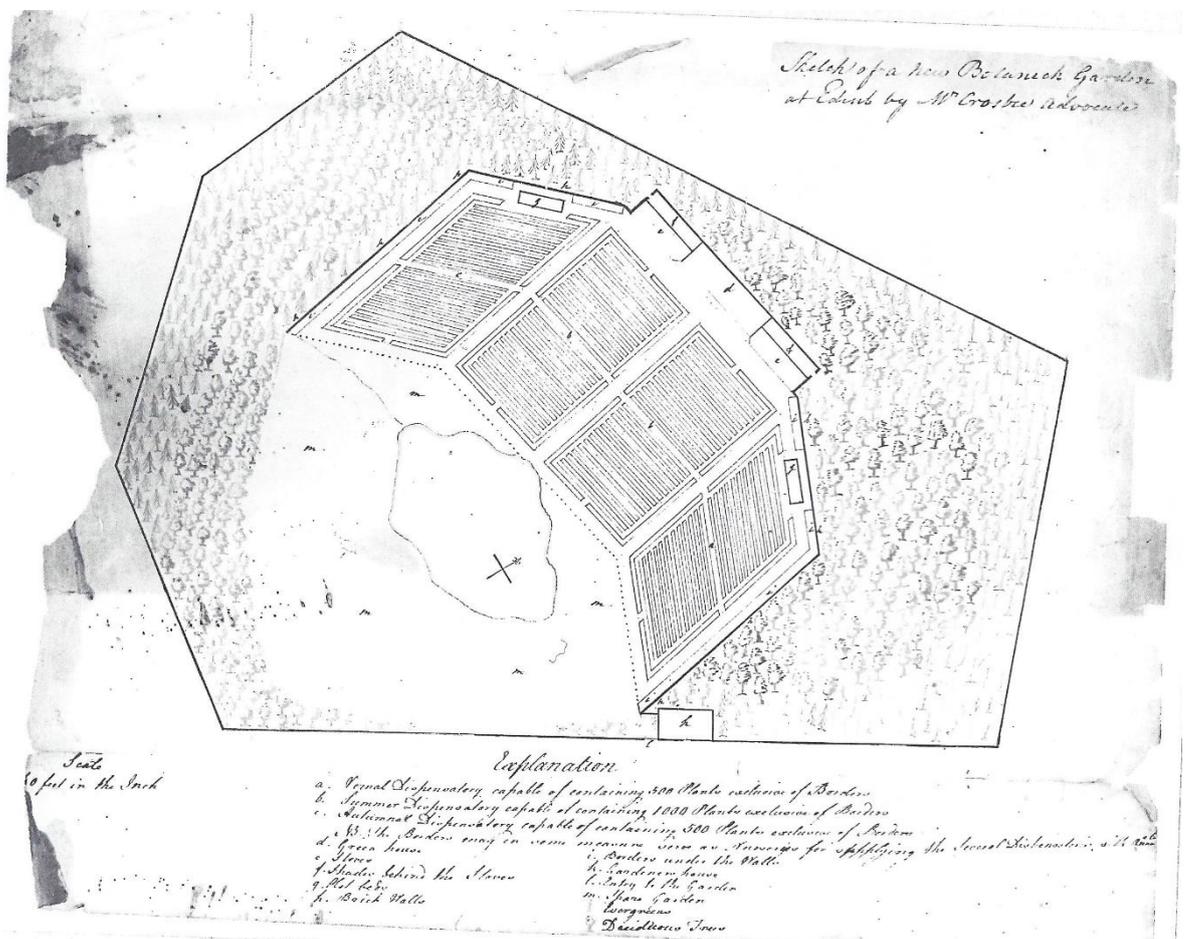


Figure 9 - Project for the new botanic garden. Andrew Croshie. 1763. RCAHMS EDD/275/23/P

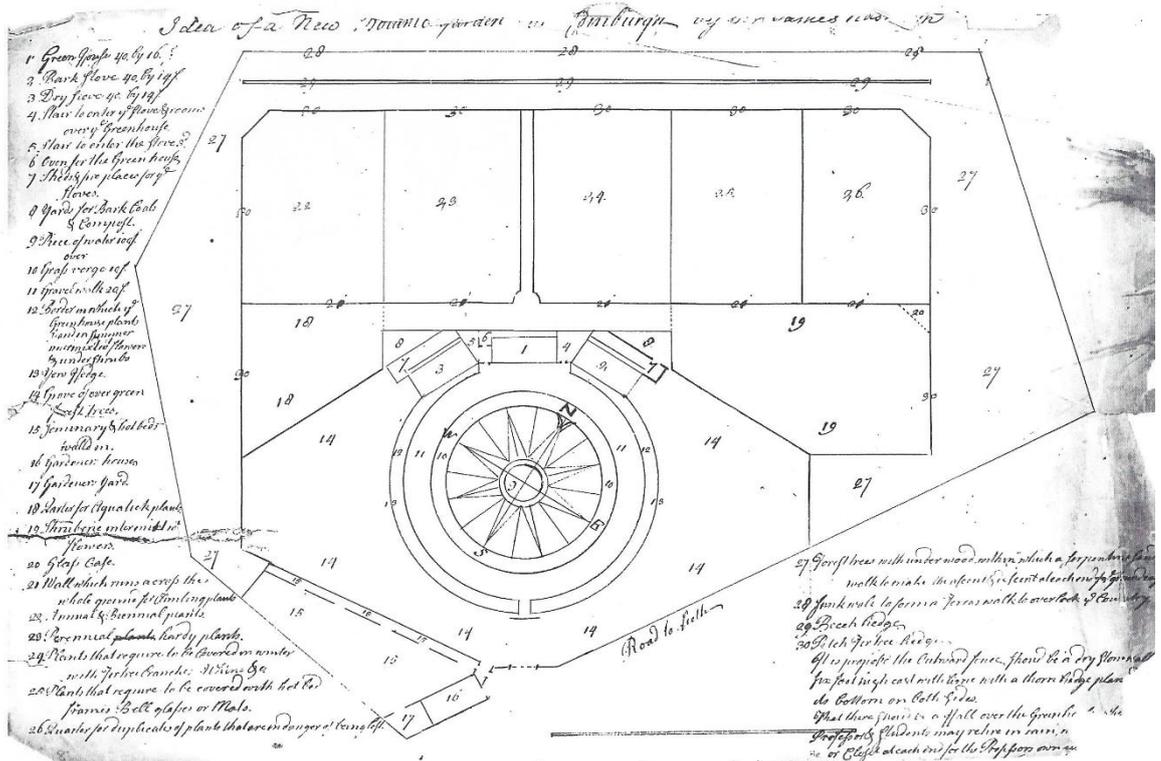


Figure 10 - Project for the new botanic garden, Sir James Nasmyth of Dawyck, 1763, RCAHMS EDD/275/22/P.

Pisa

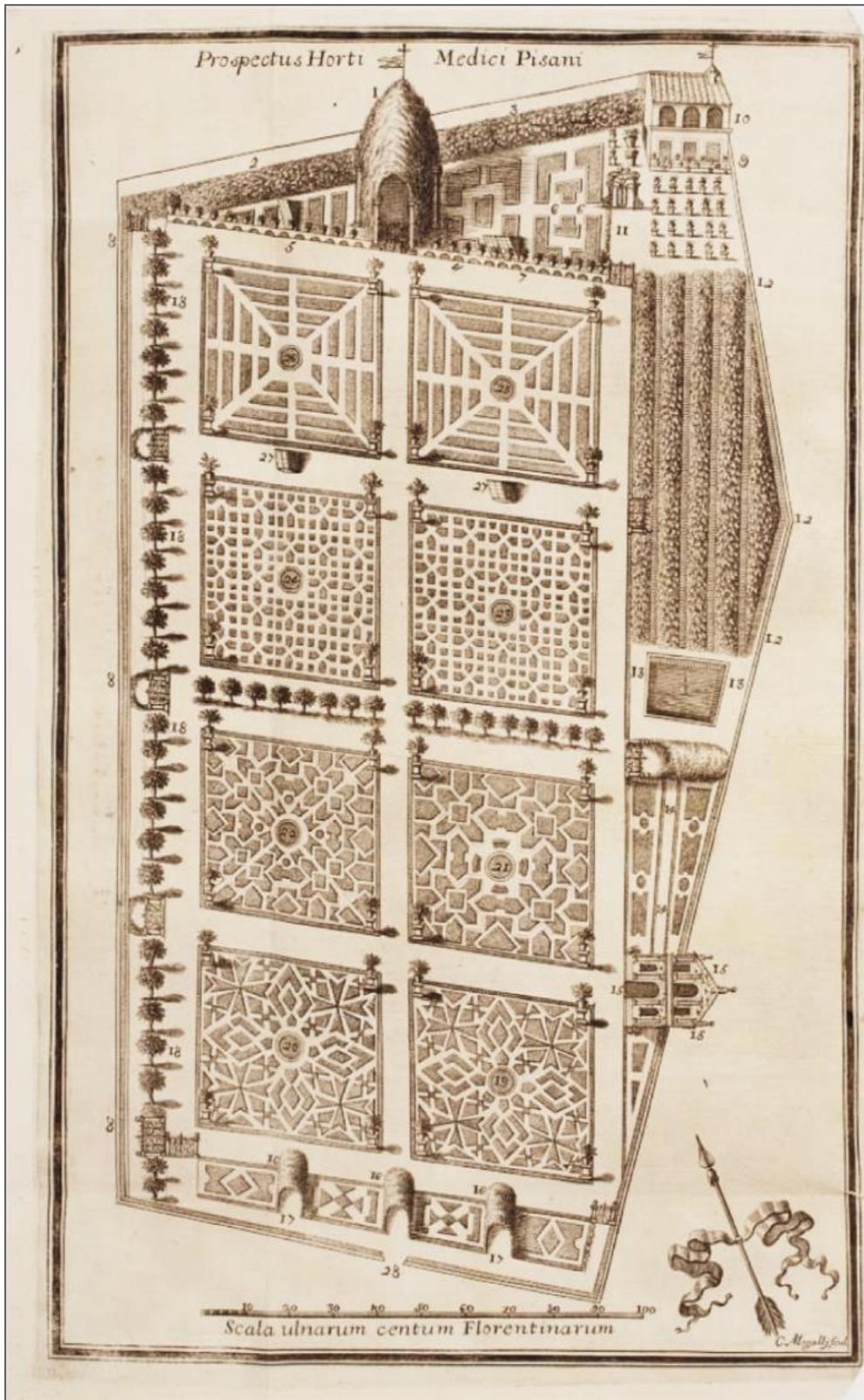


Figure 12 - Plan of the Botanic garden of Pisa, Michelangelo Tilli, *Catalogus plantarum horti Pisani*, 1723.

CC BY-NC-SA Digital Library Royal Botanic Garden Madrid (Spain)

Florence

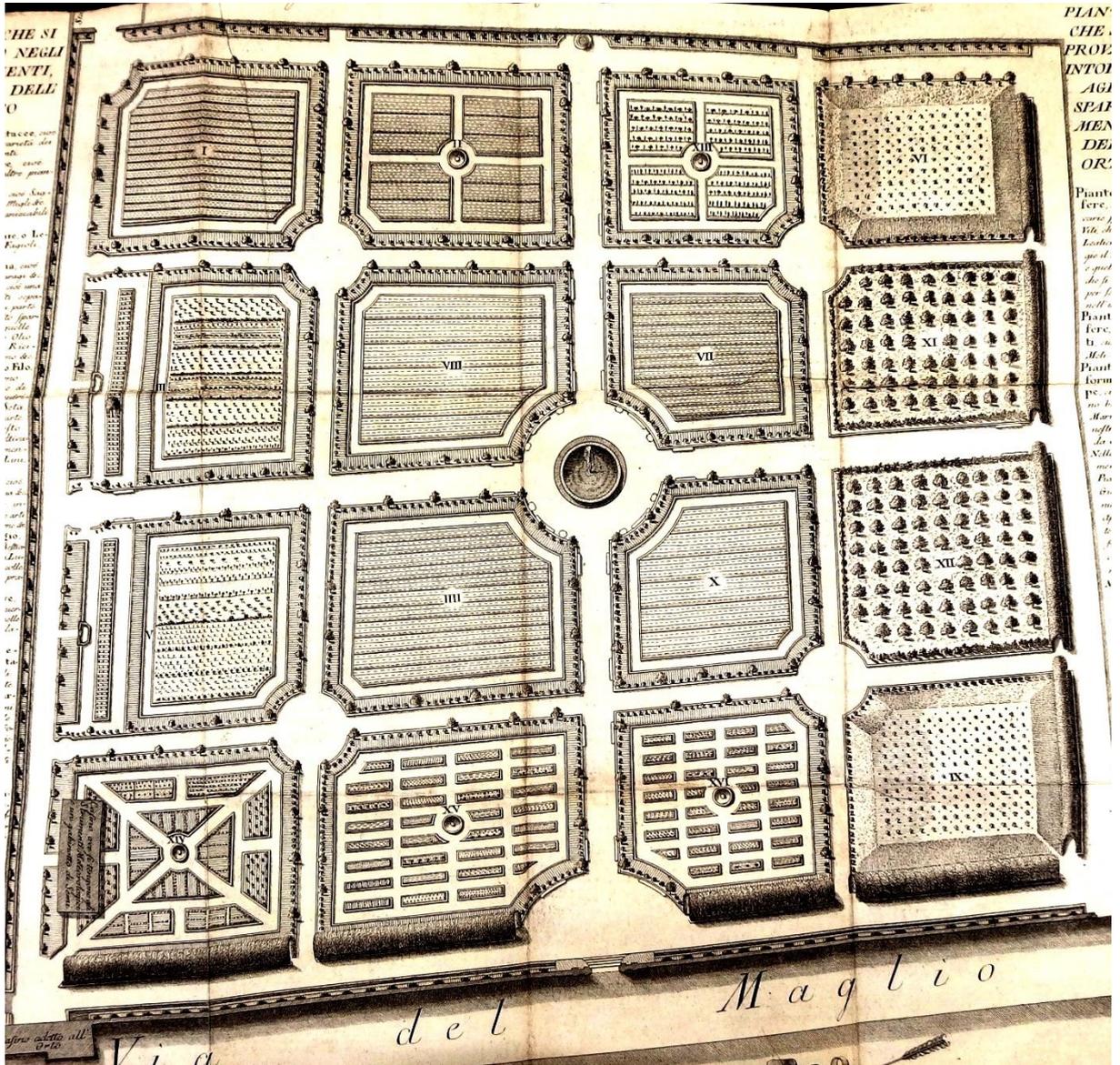


Figure 13 - Plan of the Orto Agrario dell'Accademia dei Georgofili, personal photography reproduction courtesy of the Accademia dei Georgofili.

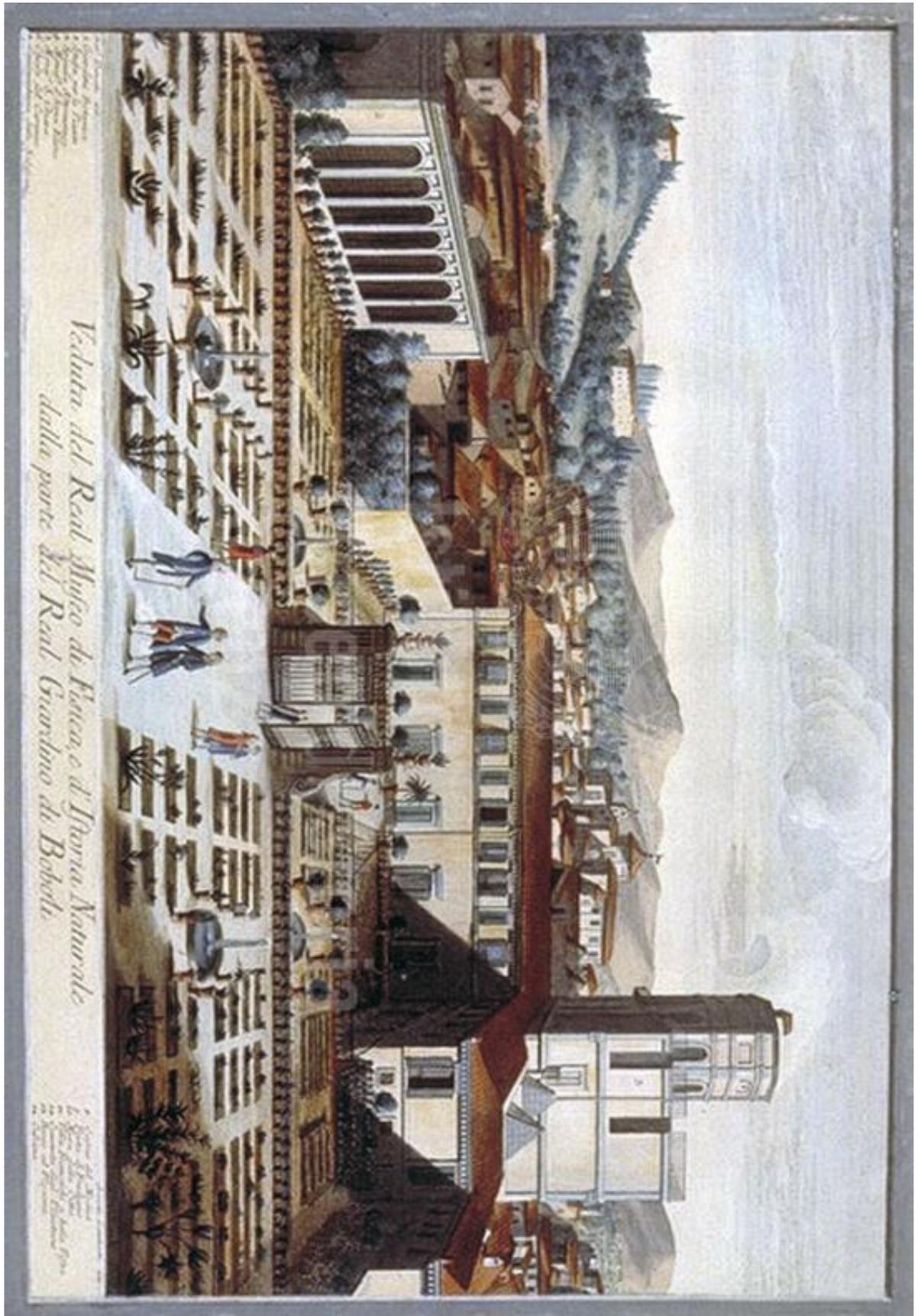


Figure 14 - Aniello Lamberti, View of Palazzo Torrigiani, seat of the Museo di Fisica e Storia Naturale (la Specola), late 18th century, property of BNCF.

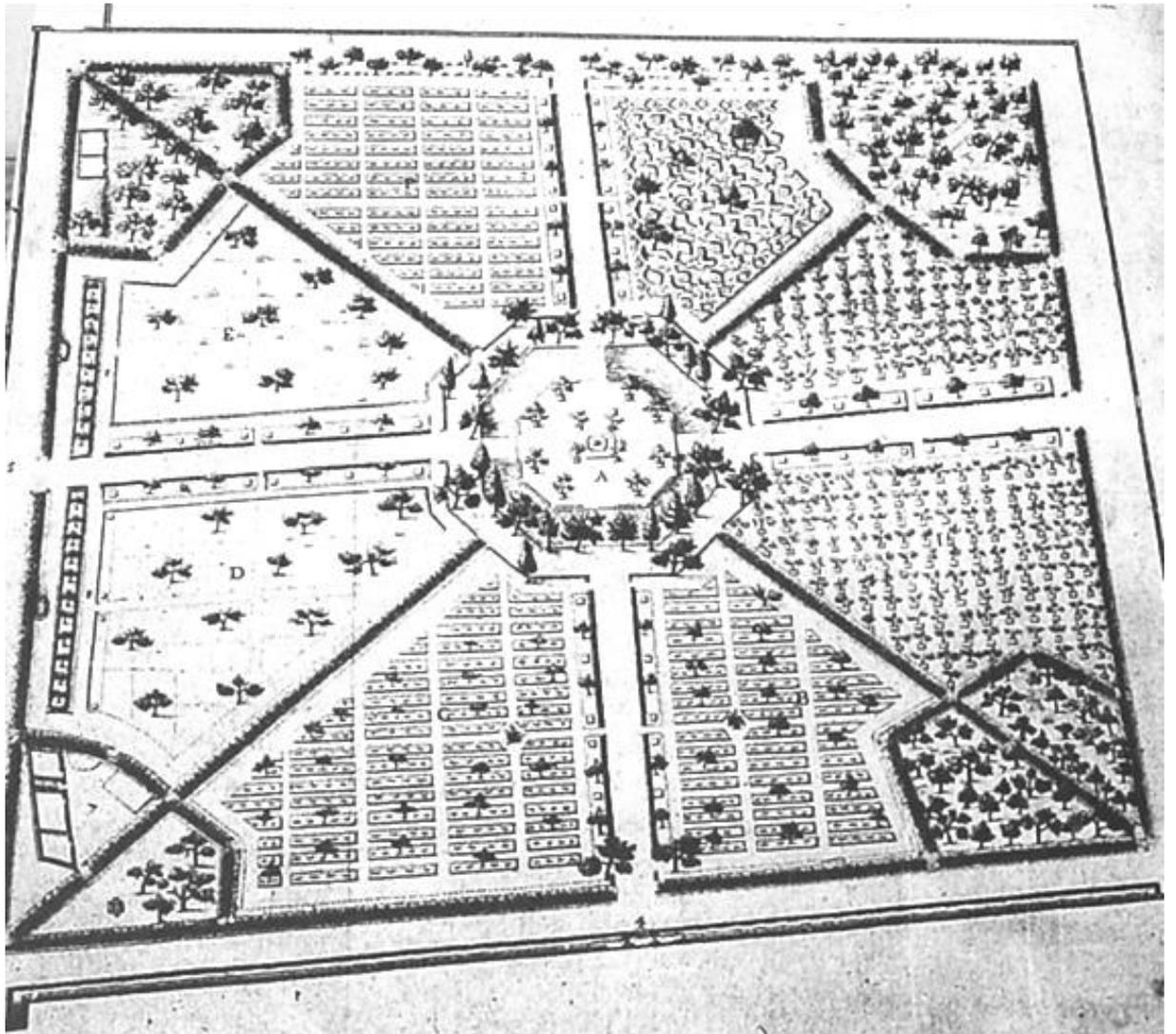


Figure 15 - Plan of the garden of San Marco under the Societa Botanica, wikipedia.