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Placing plants on paper: Lists, herbaria, and tables as experiments with territorial inventory at the mid-seventeenth-century Gotha court

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Abstract

Over the past several decades, historians of science have come increasingly to focus on the role of so-called "paper technologies," reorganizing and transforming information through the use of paper and pen, in the emergence of modern science. Taking as a case study an effort by administrators in the seventeenth-century German princely state of Saxe-Gotha to enlist foresters and herb-women to catalog the medicinal plants of the territory, this article analyzes the varied forms of paperwork produced in the process, including an extremely unusual table, and argues that the table represented an effort to produce a synoptic visualization, akin to but not identical to a map, of the location of the territory's herbs. While this table may not have ultimately succeeded as a viable paper technology, due to problems of incommensurability, it demonstrates the role of administrative practices and state actors in experimenting with information about the natural world during the early modern period.

Keywords

Paper technology, natural history, botany, physicians, foresters, herb-women, territorial surveys, incommensurability, early modern, Holy Roman Empire

The summer of 1655 saw foresters in Saxe-Gotha, a princely territory currently in its fifteenth year of existence under ruler Duke Ernst the Pious, scratching their heads. Ernst had sent each of the roughly twenty forest districts in his territory a rather strange order. Rather than focusing on trees or timber, this order had asked forestry officials to enlist their

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employees (*Forstknechte*, literally "forest-servants") in a quest to determine which, in a long list of healing herbs, grew in each district, and where. Many of the foresters had found this difficult. In their letters back to Ernst, some officials complained that their men had had difficulty identifying, or even finding, the plants in question. Nor had they always been able to find the herb-women whom they had been told to ask for help. Still, over the next two months forestry officials sent in lists of what their men had found (with the assistance of the herb-women). Some lists were short, others fuller. In Gotha itself, where the large Baroque palace of Schloss Friedenstein, home to the princely court, loomed over the town, a man (almost certainly a physician, as this article will show) sat at a desk and sorted through all the lists. Wielding his pen, he checked off names of medicinal plants and entered them onto a chart or table he was creating, one that would create a sort of bird's-eye view of the territory's forests and herbs, that would let any viewer see at a glance where each herb could be found – and how widespread it was in the areas under Ernst's rule.

Shortly after compiling the bulk of the multi-page table, the man died. It was left to another of Ernst's administrators to write up a memorandum commenting on the table and suggesting further modifications. He came up with several ideas. It is not clear whether any of these ideas were carried out, though, because at some point, somebody gathered together the multi-page table and all the correspondence, and put them in storage, possibly in Ernst's custom-built archive or in his library, facing each other across the wide courtyard of Schloss Friedenstein. Eventually, all the pieces of paper – including two herbaria, sets of pages with plants glued to them and labeled in a variety of ways – were bound, together with manuscripts on a wide range of topics from the anatomical to the metaphysical, in a single volume. This volume received a call number and was shelved amidst the other manuscript volumes of the ducal library. It was placed on exhibition at least once, during the earliest years of the twentieth century, so that members of the local botanical society could pore over the herbaria. Then it went back into storage.

Over the past several decades, historians of science and medicine have begun to devote increasing attention to how it was that paperwork like that described above was created. In particular, they have come to focus on the epistemological questions raised by this paperwork. How was it, they have asked, that, during the early modern period and on into the modern one, natural particulars scribbled down by doctors, philosophers, and other natural enquirers ended up being transformed into universalizing systems of natural knowledge? How did notes on plants, stars, and patients, to name just a few objects of study, change over time, and in what ways, if any, did they help to lead to the productive generalizations that ultimately created the modern natural sciences in their current forms? How, most especially, were notes on individual cases, species, and phenomena, often in list form, ultimately synthesized into the kinds of synoptic views, whether in the form of charts/tables, diagrams, or maps, that helped to enable this transformation? Questions about universals and particulars, of course, go back to the ancient Greeks, if not earlier. But the answers that historians of science and medicine have been coming up with, in response to the kinds of questions presented above, show how key these issues were during the transition to modern forms of scientific knowledge.[1]

1. For just a tiny sampling of recent literature on the move from the individual case to broader generalization, see for example Volker Hess and J. Andrew Mendelsohn, "Case and Series: Medical Knowledge and Paper Technology, 1600–1900," *History of Science*, 48 (2010):

One site that seems to have led to the proliferation of charts, tables, diagrams, and maps during the early modern period was the princely court. Kings, dukes, electors, and all sorts of other princes, as well as their ministers, all seem to have had a high level of interest in finding ways to survey their states in their entirety – whether focusing on their geography, economic activities, human populations, and/or the administrative systems increasingly intended to optimize these territorial attributes – at a glance, in the hope that this information might make them better able to govern.[2] For this reason, princely courts were an important site not only for the emergence of bureaucracy but also for experimentation with, to use a more recently developed term, "paper technologies."[3] Indeed, as is well known, practices of surveying the early modern state were ultimately to play a major role in the emergence of the field now known as statistics, a word whose etymology clearly shows its indebtedness to concepts of the state.[4]

By investigating the set of writing acts briefly narrated above, which took place in one particular early modern German princely state, this paper aims to examine the role of several kinds of paper technologies – in particular, lists, herbaria, and tables – in the creation of both natural and medical knowledge at court. The princely state in question, namely Saxe-Gotha, offers an especially interesting setting to explore due to its status as one of the earliest states to embrace the political and economic philosophy that would

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287–314, and the essays in Lorraine Daston and Elizabeth Lunbeck, (eds.), *Histories of Scientific Observation* (Chicago: University of Chicago Press, 2011). On the issue of the universality versus locality of science more generally, see David N. Livingstone, *Putting Science in its Place: Geographies of Scientific Knowledge* (Chicago: University of Chicago Press, 2003).

2. This was, of course, not a completely new development; written records survive from ancient Near Eastern and other administrations, while within medieval Europe, the Domesday Book compiled after the Norman conquest of England represented a new level of state information-gathering; see M. T. Clanchy, *From Memory to Written Record: England, 1066-1307*, 3rd ed. (Chichester, UK: John Wiley & Sons, 2013). Early modern rulers, however, seem to have developed new appetites for gathering information about their territories; for an introduction to the burgeoning literature on this topic, see Arndt Brendecke, Markus Friedrich, and Susanne Friedrich (eds.), *Information in der frühen Neuzeit* (Berlin: LIT Verlag, 2008), most of the essays in which refer to the gathering of information in state contexts, especially those of the princely court.
3. On "paper technology" and related terms, see Anke te Heesen, "The Notebook. A Paper-Technology," in Bruno Latour and Peter Weibel (eds.), *Making Things Public: Atmospheres of Democracy* (Cambridge, MA: MIT Press, 2005), pp. 582–9, and Volker Hess and J. Andrew Mendelsohn, "Paper Technology und Wissensgeschichte," *NTM: Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, 21 (2013): 1–10.
4. See for example Mohammed Rassem, "Stichproben aus dem Wortfeld der alten Statistik," in *Statistik und Staatsbeschreibung in der Neuzeit, vornehmlich im 16.-18. Jahrhundert*, ed. Mohammed Rassem and Justin Stagl (Paderborn: Schöningh, 1980), pp. 17–36; Hans Erich Bödeker, "On the Origins of the 'Statistical Gaze': Modes of Perception, Forms of Knowledge and Ways of Writing in the Early Social Sciences," in Peter Becker and William Clark (eds.), *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices* (Ann Arbor: University of Michigan Press, 2001), pp. 95–140.

later come to be called "cameralism." A system of thought as well as administration focused on ensuring the self-sufficiency of territories, cameralism was to gain a significant foothold during the eighteenth century in many of the scattered German-speaking territories of the Holy Roman Empire (as well as in Scandinavia) as a sort of Central European counterpart to the philosophy of mercantilism most popular in the colonial powers of England, the Netherlands, France, and Spain.[5] At his princely seat in the town of Gotha, ruler Duke Ernst the Pious (ruled 1640–1675) mentored a young librarian called Veit Ludwig von Seckendorff, who then went on to serve in Ernst's administration and to write a book called *Teutscher Fürsten Stat* (first published in 1656), now regarded as a key early cameralist work.[6] Furthermore, Ernst is known to have attempted to put many of Seckendorff's ideas about territorial inventory into practice.[7]

For all of these reasons, this case is an especially interesting one to study. In Gotha, under the impetus of new administrative practices and goals, new kinds of collaborative paperwork ended up emerging at the intersection of multiple fields: in particular natural history, medicine, and statecraft.[8] An investigation of this paperwork shows that efforts at territorial inventory resulted, in Gotha, in a series of striking experiments with paperwork in an attempt to create a paper technology that would enable a new synoptic view of the

5. The literature on mercantilism is huge, but the articles in Philip J. Stern and Carl Wennerlind (eds.), *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire* (New York: Oxford University Press, 2014), which explores a wider geographical terrain than its title would suggest, provide up-to-date perspectives on this literature. The following works, which place the history of science in the context of cameralism, provide extremely helpful historiographical surveys of cameralism: Pamela H. Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton, NJ: Princeton University Press, 1994); Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999); and Andre Wakefield, *The Disordered Police State: German Cameralism as Science and Practice* (Chicago, IL: University of Chicago Press, 2009). On science and medicine at princely courts more generally, see Bruce T. Moran (ed.), *Patronage and Institutions: Science, Technology and Medicine at the European Court, 1500–1750* (Woodbridge: Boydell, 1991) and Vivian Nutton (ed.), *Medicine at the Courts of Europe, 1500–1837* (London: Routledge, 1990).
6. Veit Ludwig von Seckendorff, *Teutscher Fürsten Stat* (Frankfurt am Main, 1656); later editions, of which there were many, tended to modernize the title's format to *Teutscher Fürstenstaat*. Much has been written about the reign of Duke Ernst the Pious; two excellent recent works on the man and his activities, departing from the hagiography of nineteenth-century works which effectively described him as a sort of Lutheran saint, are Roswitha Jacobsen and Hans-Jörg Ruge (eds.), *Ernst der Fromme (1601–1675). Staatsmann und Reformer* (Bucha bei Jena: quartus-Verlag, 2002), a collection of essays, and Andreas Klinger, *Der Gothaer Fürstenstaat. Herrschaft, Konfession und Dynastie unter Herzog Ernst dem Frommen* (Husum: Matthiesen, 2002). On Seckendorff, see Roswitha Jacobsen, "Die Brüder Seckendorff und ihre Beziehungen zu Sachsen-Gotha," in Roswitha Jacobsen and Hans-Jörg Ruge, *Ernst der Fromme (1601–1675). Staatsmann und Reformer* (Bucha bei Jena: quartus-Verlag, 2002), pp. 95–116.
7. With relatively little practical success, according to Wakefield, p. 18 (note 5).
8. Vera Keller, *Knowledge and the Public Interest, 1575–1725* (Cambridge: Cambridge University Press, 2015) analyzes the intersections of the scientific and political with a focus on the origin of modern ideals of collaboration in science.

territory's herbal riches. As this article will argue, though, these experiments failed, for reasons that are revealing of broader tensions in the early modern pursuit of natural knowledge. For, as this case shows particularly clearly, the gap between the "particular" and the "general" often spanned not just one but multiple levels of knowledge, as well as of brokers of that knowledge. The result was multiple levels of incommensurability that ultimately defeated the effort to create meaningful new forms of knowledge.

Lists

In order to understand how the unusual plant-table encountered at the start of this paper first came to be created, it is necessary to start with lists, since the table, like many tables at the time and today, was essentially the result of a juxtaposition of lists. Here it is important to note, though, that lists were not merely a precursor to something else. As recent work has shown, lists could take many different forms, and could assist in many ways in the generation of natural and medical knowledge, whether by concretely enumerating a batch of specimens to examine, or proposing a set of projects that would further progress the arts and sciences (cf. desiderata lists), or (more generally) organizing information so that further physical and/or intellectual operations could be performed on it or any objects it represented.[9] The lists of herbs sent in by the foresters of Saxe-Gotha can be seen as a concrete example of this kind of process.

The foresters' lists can also, though, be seen as indicative of what was happening in the setting of the princely court at the time. During the mid-seventeenth century, the court of Gotha, like many other princely courts, was beginning to generate substantial amounts of paperwork, much of it in list form. Take, for example, the assorted collections that Duke Ernst was proud to display in his palace and its surrounding grounds. Ernst made sure that the cabinet of curiosities (or *Kunstkammer*) he carefully assembled over the years – lavish not only in the artwork it contained but also in the objects made of precious natural materials like ivory, ebony, the horns of exotic animals, and the like – regularly had inventories made of its contents.[10] Likewise, he regularly had his gardeners draw up manuscript catalogs of the numerous varieties of exotic plants he arranged to have grown in the fourteen beds of his pleasure garden, which demonstrated his keen

9. For recent work on the importance of the list in the pursuit of early modern science, see "Introduction" by James Delbourgo and Staffan Müller-Wille, "Specimen Lists: Artisanal Writing or Natural Historical Paperwork?" by Valentina Pugliano; "The 'New World of Sciences': The Temporality of the Research Agenda and the Unending Ambitions of Science," by Vera Keller; "Listing People," by James Delbourgo; and "Lists as Research Technologies," by Staffan Müller-Wille and Isabelle Charmantier, all in "Listmania," a special section in *Isis* 103, 4 (2012): 710–752, as well as the numerous works cited within.

10. Wolfgang Zimmermann, "Sammlungsgegenstände aus Natur und Technik der Kunstkammer Ernst I. von Sachsen-Fotha-Altenburg (1640–1675)," in Andreas Grote (ed.), *Macrocosmos in Microcosmo: Die Welt in der Stube. Zur Geschichte des Sammelns 1450 bis 1800* (Opladen: Leske & Budrich, 1994), pp. 629–42; Dominik Collet, "Die Gothaer Kunstkammer auf Schloss Friedenstein – Kuriositäten als Karriere," in *Die Welt in der Stube. Begegnungen mit Außereuropa in Kunstkammern der frühen Neuzeit* (Göttingen: Vandenhoeck & Ruprecht, 2007), pp. 35–160.

interest in the cultivation of citrus plants as well as of tulips, the latter seen at the time as exotic rarities capable of displaying natural diversity like no other species.[11] In addition to these two collections of his, which may in part be seen as at least partially "natural" in the species and materials assembled, Ernst was also an avid collector of coins and medals, and these collections too were regularly cataloged.[12] Based on all three of these collections, one might say that Ernst was the consummate collector: not only of objects but of the lists themselves that represented these objects.

The princely court at Gotha did not, however, limit itself to the production of lists itemizing only especially prestigious material collections. It took inventory of almost everything it was able to. The creating and maintaining of tax registers had, of course, long been a preoccupation of a wide range of governments. But Ernst took this further. One of Ernst's most significant accomplishments, according to his many biographers, was his introduction to Saxe-Gotha of a *Seelenregister* (literally, "index of souls"), a new and much more stringent form of record-keeping that, like other rulers during the Counter-Reformation period, Ernst instituted as part of his church reforms. Under this new system, reports were to be sent in to Ernst and his advisors in Schloss Friedenstein on a yearly basis, so that he could have a better sense not only of the spiritual status of his subjects, which the system of visitations inaugurated by previous Protestant rulers had already enabled, but also of population growth and/or decline. This was an important area of concern for cameralists and others at the time, who maintained that population growth was crucial to the prosperity of a state.[13]

The significance of lists as a paper technology at the Gotha court, however, can also be seen through a different source, namely a handwritten schedule recording the most important activities Ernst's sons were supposed to participate in as part of their princely education. Right after the listing of the first activity that the young princes were supposed to engage in on a daily basis (getting to know the "people" of the principality) were two other activities that explicitly involved lists: studying the list (*Verzeichnis*) of clergy members in the territory, and collecting from the pastor the "catalog" of youth being instructed in the catechism.[14] Following lists of many more activities during which Ernst's sons were also supposed to consult still further lists, the document closed with the injunction that once each year the young princes go through the inventories of the districts and the court itself so as to be able to tell at a glance whether key numbers had increased or declined.[15] Lists, then, were not only a key tool for practitioners of the sciences and medicine during the seventeenth century; the information gathering they made possible was also seen as essential for government officials and even princes themselves,

11. Marc Rohrmüller, "Ernst der Fromme und die höfische Pracht," in Roswitha Jacobsen and Hans-Jörg Ruge (eds.), *Ernst der Fromme (1601–1675). Staatsmann und Reformer* (Bucha bei Jena: quartus-Verlag, 2002), pp. 157–76, especially pp. 166–76.
12. Rolf-Günther Lucke, "Geschichte des Münzkabinette Gotha" (PhD dissertation, Halle, 1967).
13. Hermann Woldemar Böhne, *Das Informationswerk Ernst des Frommen von Gotha* (Leipzig: C. G. Naumann, 1885), p. 39.
14. Thüringisches Staatsarchiv Gotha (hereafter abbreviated as ThStA Gotha) Geheimes Archiv E III Nr. 2, fol. 44.
15. Ibid.

if they wished to be able to maintain a proper understanding of their territories and the subjects who lived in them.

With this in mind, let us now turn to the lists compiled by the foresters. Presumably, in the order he originally sent to Gotha forest officials, telling them to look for herbs in their forest districts, Duke Ernst may well have hoped for at least a certain degree of consistency of response; unfortunately, since no copy of this original order seems to have survived,[16] its elements must be inferred from forest officials' responses to it. From these we can learn that the order was dated June 5, 1655, though in at least one case it took a long time to arrive (10 days).[17] In the order, Ernst seems to have asked for information about "the herbs growing in the woods in this district," telling the foresters to consult herb-women (*Kräuterfrauen*) if they were not able to locate or identify the herbs themselves; to direct their efforts, Ernst seems to have included a list of the herbs he was especially interested in.[18]

The lists the foresters produced in response to Ernst's order were varied. One, which was written by a *Forstknecht* himself, rather than an official, contained only four herbs; the forester blamed these rather scanty results on a lack of knowledgeable women in the neighborhood (Figure 1).[19] Another submitted a lengthy list, only to repeatedly lament about many items, "Not plentiful," "Can't be found in these forests," "Hasn't been found yet," and so forth.[20] But others wrote lists demonstrating a greater degree of success.[21] The plant lists differed not only in their lengths, however, but also in the format in which they were written. Though all lists had in common that the vast majority of plant names used were German, rather than Latin ones, this was practically the only point in common. While some lists, for example, contained just names of herbs, others contained brief descriptions of their locations as well. Some lists were numbered; most, however, were not. Some lists were alphabetical; others were not. One list is especially noteworthy due to the fact that checkmarks appear, though only occasionally, to the left of plant names, suggesting that the list might actually represent not any kind of list of plants actually found, but rather the original list of plants to be searched for, and that only the plants with checkmarks next to their names had been successfully located. Nor do all of the lists seem to have been sent in letter form. Many lists were clearly folded up and sent with letters, as

16. I am extremely grateful to archivist Rosemarie Barthel at the Thüringisches Staatsarchiv Gotha for undertaking the tedious task of searching for Ernst's order; however, the document in question does not seem to be extant. That there was indeed such an order, though, is evident from the multiple references to Ernst's "order" (*Befehl* in most cases, *Begehren* in just one case) in the foresters' letters: Forschungsbibliothek Gotha Chart. A 707, fols. 106r, 108r, 118r, and 121r.
17. Forschungsbibliothek Gotha Chart. A 707, fol. 108r.
18. Ibid., fol. 106r; see also Gustav Zahn, "Zwei kleine Herbarien aus der Zeit Herzog Ernsts des Frommen (1601–1675) in der Handschriftensammlung der Herzoglichen Bibliothek zu Gotha," *Mittheilungen des Thüringischen Botanischen Vereins*, Neue Folge, 17 (1902): 22–32, 22.
19. Forschungsbibliothek Gotha Chart. A 707, fol. 121r. "There's no woman here who knows them [the herbs in "my appointed forest"]." He did find an "old woman" on the Hessian side of the district, but she fetched her herbs in a different district.
20. Forschungsbibliothek Gotha Chart. A 707, fol. 116r.
21. Ibid., fols. 112r-114v, 116r-117r, and 120r.

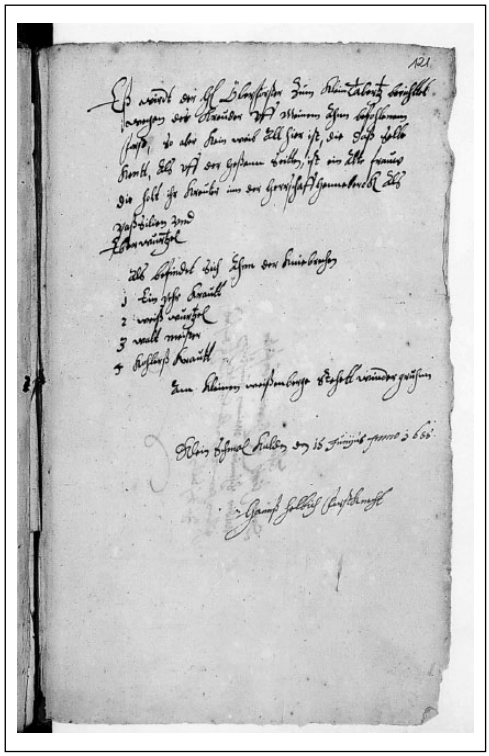

Figure 1. A brief list of medicinal herbs from a forester. Forschungsbibliothek Gotha der Universität Erfurt, Chart. A 707, fol. 121r.

the red sealing wax still adhering to the reverse of the page reveals; another list, though, appears on unfolded paper without any sort of accompanying letter, perhaps a sign that it may have been recopied from a messy original, perhaps the work of a less-literate *Forstknecht*, whose list was so illegible or confused as to need redrafting.[22]

The foresters' lists, then, seem to represent a diverse and fairly inconsistent set of local responses to Duke Ernst's centralized command for information. Duke Ernst and/or his officials may have hoped that the foresters, being men with, in most cases, apparently at least some education, would adequately transmit the information provided by the (presumably illiterate) herb-women or *Kräuterfrauen* they consulted, for whose knowledge they effectively served as go-betweens.[23] In directing the foresters to consult herb-women in the first place, though, Duke Ernst's original order showed an awareness that foresters would not necessarily have had any training in or aptitude for locating or

22. Ibid., fol. 108r.

23. On these concepts, see, albeit for a later period and in a less-local context, Simon Schaffer, Lissa Roberts, Kapil Raj, and James Delbourgo (eds.), *The Brokered World: Go-Betweens and Global Intelligence, 1770–1820* (Sagamore Beach, MA: Science History Publications, 2009).

identifying medicinal herbs, a task rather far beyond their ordinary duties. Local *Kräuterfrauen* who collected these herbs in their local fields and forests in order to supply them to apothecaries or sell them in the market would be much more suited to coming up with the actual information needed. In this awareness, whatever Gotha administrators may have been involved seem to have followed the example of many early modern botanists from such "fathers of German botany" as Brunfels and Cordus onwards, who from time to time mentioned their own consultation of local herb-women for information.[24] While positive sentiments about the knowledge of *Kräuterfrauen* were not uniformly shared, especially among university-educated physicians, conscious of their rivalry with potential competitors for their medical services – Leonhart Fuchs, for example, disparaged the knowledge of "foolish and superstitious old women," some other botanists made equally condemnatory remarks about them, and Ernst and his officials themselves condemned the medical activities of "herb-seekers" (*Kräutersucher*) and "females" (*Weibs-Personen*) in the medical ordinances they promulgated[25] – nonetheless their assistance seems to have been regarded as necessary and, when they were to be found, *Kräuterfrauen* do seem to have generated a substantial amount of information for Ernst and his staff.

Yet the recognition in Ernst's original order that foresters might not be the most knowledgeable source of information on medicinal herbs, and that they might at best be mere brokers of knowledge from people, like herb-women, who *did* actually possess this information, is telling, and may well account for many of the inconsistencies in the quality of the lists foresters produced and sent back to the palace. While it seems to have indeed been clear to each forester that his letter to Schloss Friedenstein should contain a list of some sort, the sheer variety of formats exhibited by the different lists, with the differing quantities and qualities of the information they contained, implies that there was no clearly agreed-upon idea as to what a list *ought* to look like. Far from following any kind of standardized format, the lists seem to diverge utterly from any such goal. They verge, rather, on the incommensurable. Many additional factors might also have played a role here; did, for example, the paperwork of those forest districts that reported finding relatively few herbs reflect a genuine lack of herbs in those districts, perhaps due

24. For examples, see Otto Brunfels, *Herbarium vivae eicones* (Strasbourg: apud Joannem Schottum, 1530–36), vol. 3, p. 13; Euricius Cordus, *Botanologicon* (Cologne: apud Joannem Gymnicum, 1534), pp. 26–7; Karen Meier Reeds, *Botany in Medieval and Renaissance Universities* (New York: Garland, 1991), p. 25; and B. Hryniewiecki, "Anton Schneeberger (1530–81): Ein Schüler Konrad Gesners in Polen," *Veröffentlichungen des Geobotanischen Instituts Rübel in Zürich*, 13 (1938): 1–64, 33. It is noteworthy, though, that willingness to credit the assistance of non-botanists, especially prominent in sixteenth-century sources, seems to have greatly decreased from the seventeenth century onwards, perhaps due to changing formats of botanical publication or social dynamics among botanists; on issues of credit-giving in natural history, see Alix Cooper, *Inventing the Indigenous: Local Knowledge and Natural History in Early Modern Europe* (Cambridge: Cambridge University Press, 2007), pp. 152–72.

25. Anna Pavord, *The Naming of Names: The Search for Order in the World of Plants* (London: Bloomsbury, 2005), p. 179; Brian Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2006), pp. 14, 15, and 55; and ThStA Gotha Geheimes Archiv KK 7 Vol 1 Nr 65, fol. 336.

to differences in soil, forest type, altitude, or climate? Or did the paperwork reflect insufficient staffing of the forest districts in question, resistance on the part of *Forstknechte* to an order they considered a waste of their time, or perhaps just different ways of going about the task assigned by the Duke, for example a confusion about how common a species had to be in order for it to be reported as present in a forest district? Most fundamentally, though, the difficulties inherent in the attempt to integrate the different kinds of knowledge possessed by somewhat-literate foresters and illiterate herb-women stands out as a likely cause for the problems that were already apparent in this stage of information gathering.

Herbaria

Here it is necessary to turn to another type of paperwork. For it seems quite likely that the two herbaria bound in the same volume as the foresters' lists may have been created in response to the same princely order that generated the lists. Several considerations support this hypothesis. First, both herbaria, with their plant specimens glued onto pages, reveal the same focus on medicinal herbs as the lists the foresters were instructed to compile: the title page of one describes it as showing "most of the herbs, that are useful for an apothecary shop, and can be found in the region of this princely district of Heldburg," while a list to be found within the other herbarium reports its contents as "the herbs useful in apothecary shops and elsewhere which can be found commonly and well-known throughout the princely Saxon district of Königsberg."[26] The similarity of the wording here is striking, implying a possible common response to a princely order. Second, several phrases in the foresters' letters suggest that they may have been expected to send in actual specimens of the herbs they found: one forester mentioned in his letter the expectation that he was to "break off from every kind [of herb] a little piece," while another wrote that he had told the *Forstknechte* in his district to "collect the prescribed plants, roots and trees… in various 4 books."[27] Might the latter phrase be referring to herbaria? Finally, the one author who has written on these two herbaria, albeit over a century ago, argues that the German names of the plants in both herbaria agree sufficiently closely with those in the foresters' lists that it is likely they had a common origin, presumably in the list sent out along with Duke Ernst's original order.[28]

Herbaria, despite or perhaps because of their inclusion of actual plant materials from stems and leaves to roots and flowers, all glued to the page, can, like lists, be seen as an important form of paper technology during this period. First invented in Italy around the mid-sixteenth century, they rapidly caught on among those who, introduced to botany as part of their medical studies or in some other way, wanted to

26. Forschungsbibliothek Gotha Chart. A 707, fol. 16r: "Herbarium vivum welches zeiget die meisten Kräuter, so zur Apothek vonnöthen, und in der Gegend dieses fürstl. Ambts Heldburgk zu finden sind"; f. 73r: "Verzeichniß derer in Apotheken und sonst, gebräuchlicher Kräuter so in fürstl. Sächs. Amt Königsbergk überall gemein, und bekannt finden."
27. Ibid., fols. 106r, 108r.
28. Zahn, p. 23 (note 18).

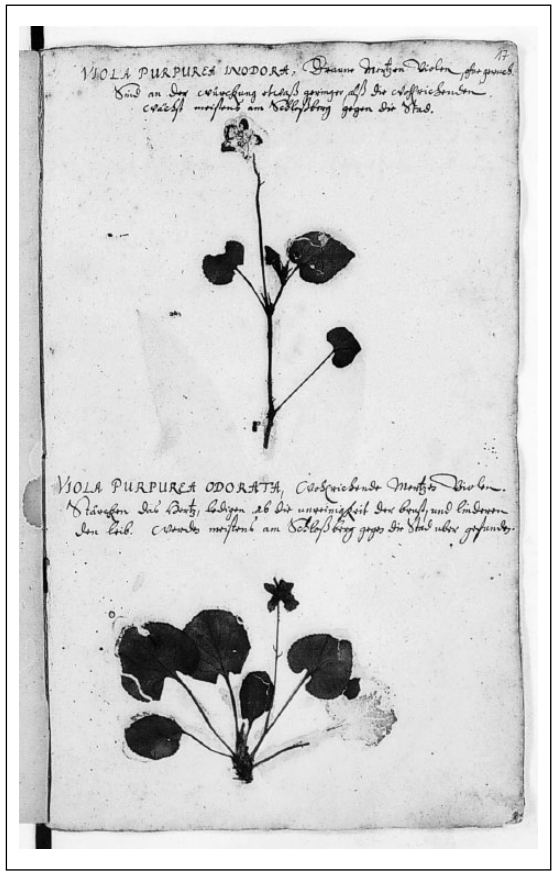

Figure 2. Herbarium page. Forschungsbibliothek Gotha der Universität Erfurt, Chart. A 707, fol. 17r.

find a method of preserving plant specimens to be studied at leisure.[29] The herbarium, a (usually bound) set of pieces of paper with dried plants between adjacent pages, made this possible. Often containing written notes on plant identification, and occasionally supplemented by comments on where specimens had been found and/or their

29. Despite the importance of herbaria-making in botany, and their role in medical education, surprisingly little has been written about them; see Kreutzer, "Zur Geschichte der Herbare," in *Das Herbar: Anweisung zum Sammeln, Trocknen und Aufbewahren der Gewächse nebst geschichtlicher Bemerkungen über Herbare* (Vienna: Carl Helf, 1864), pp. 151–82; Jean Baptiste Saint-Lager, *Histoire des herbiers* (Paris: J.-B. Bailliere, 1885); Ogilvie, *Science of Describing* (note 25), pp. 164–74; Alexandra Cook, "The Herbarium as Boundary Object," in *Jean-Jacques Rousseau and Botany: The Salutary Science* (Oxford: Voltaire Foundation, 2012), pp. 253–95; and Ruth Schilling, "Wintergärten und Lokalfloren. Raumbezüge und Wissensordnungen in frühneuzeitlichen Herbarien," talk given at Forschungszentrum Gotha, 2014.

potential uses, herbaria made it possible for the botanically inclined to continue their studies of plant features even during the winter or other seasons during which botanical gardens and the surrounding countryside no longer contained plants in bloom. Flattened and dried, converted from three-dimensional living beings to two-dimensional nonliving ones so as to fit conveniently between the covers of a bound volume, the plant specimens in herbaria provided a useful alternative to conventional botanical illustration, capable of conveying through their materiality aspects of a plant that woodcuts or even engravings might not.

Herbaria did not long remain solely tools for scholars and physicians. With their marvelous interleaving of natural and paper worlds, they seem to have attracted the interest of princes and other collectors of the wonderful. At any rate, Duke Ernst's collections boasted an extremely early German herbarium, which seems to have left its compiler's hands in either 1602 or 1603. Originally assembled by a physician, Caspar Ratzenberger, who lived in another Saxon territory, this work in four bulging volumes showcased a grandiose red-and-black title page and samples of 928 plant species, including along with stalks, leaves, flowers, and roots, numerous nuts and seeds that warped the paper around them but made for an impressive display of nature's medicinal bounty.[30] While the exact way in which it arrived in Gotha remains unknown, Duke Ernst's interest in herbaria more generally is evidenced by the fact that he specifically ordered several herbaria to be assembled for the education of his children.[31] These herbaria, which along with Ratzenberger's remain in Gotha, exemplify yet another reason, along with visual pleasure, for the compilation of herbaria. This is their perceived usefulness as *Realien*, or collections of actual physical objects, rather than the written descriptions or illustrations of them that seventeenth-century pedagogical writers came to see as lacking. Children, they wrote, must be exposed to and learn from actual real-world objects, rather than from books alone.[32] Duke Ernst, who appointed educator Andreas Reyher to reform the school system in Gotha along exactly these

30. On the Ratzenberger herbaria at Gotha, see Gustav Zahn, "Das Herbar des Dr. Caspar Ratzenberger (1598) in der Herzoglichen Bibliothek zu Gotha," *Mittheilungen der Thüringischen Botanischen Vereins*, Neue Folge, 16 (1902), 50ff. For more on Ratzenberger, as well as on a herbarium he created and donated to Landgrave Moritz of Hesse, see Hermann Friedrich Kessler, *Das älteste und erste Herbarium Deutschlands, im Jahr 1592 von Dr. Caspar Ratzenberger angeleft, gegenwärtig noch im Königlichen Museum zu Cassel befindlich* (Kassel: August Freyschmidt, 1870); Elvira Schier, "Das älteste Herbarium der DDR / Verfasser ein Saalfelder," *Saalfelder Kulturblätter*, 1 (1962): 38–42; and Heinz Wiedemann, "Caspar Ratzenberger, ein Botaniker des 16. Jahrhunderts," *Abhandlungen des Verein für Naturkunde zu Kassel*, 62, 2 (1965): 1–7.

31. "Herbarium vivum mit der Kräuter deutschen und lateinischen Nahmen, auf Befehl Herzog Ernsts für seine Prinzen gesammelt," Forschungsbibliothek Gotha, Handschriftensammlung, Chart. A 523, A 524, and A 526; the first of these three volumes is currently inaccessible to readers for conservation reasons.

32. Kelly Whitmer, "Reimagining the 'Nature of Children': *Realia*, Reform and the Turn to Pedagogical Realism in Central Europe c. 1600–1700," *Journal of the History of Childhood and Youth*, forthcoming.

lines, clearly agreed and, through the herbaria he arranged to have assembled for his own children, made sure that they too would benefit from this still relatively new paper technology.[33]

To return to the two herbaria originally discussed – those found bound together with the foresters' paperwork – these serve to display not only Herzog Ernst's interest in this particular form of paper technology, but also its variability. Exactly the same phenomenon can be discovered in these herbaria as in the foresters' lists, namely striking inconsistencies. Though both herbaria have similar titles, they show a marked divergence from each other in terms of presentation and format. While one of the herbaria exhibits only one plant specimen per page, for example, the pages of the other one are crowded with three, four, or five specimens per page.[34] Likewise, the format of the text accompanying each plant differs significantly in the two herbaria. In the first herbarium, Latin names are clearly presented in capital letters for each of the included herbs, along with German ones, while in the second herbarium, German names are frequently the only ones recorded. Similarly, the remainder of the text accompanying each plant in the first herbarium is more expansive, with a full sentence about the medicinal function of each herb, followed by a full sentence about its location, while the second herbarium lacks any discussion of medicinal function, and descriptions of locations are briefer. As with the lists compiled by the foresters, the two herbaria, despite their similar titles and the fact that they are bound together, show few signs of coordination, let alone standardization. As experiments with paper technology, then, these herbaria, like the lists of plants assembled by the foresters, suggest that they remained works-in-progress.

Tables

Finally, we arrive at the table compiled by the man at the desk. Who was this man? Although it may be impossible ever to say for sure, there is some evidence that bears on the question. The man's name appears on a memorandum bound into the manuscript volume immediately following the chart, in a sentence that reports that the information in the table was recorded [*protokollieret*] and entered [*eingetragen*] by one individual, whose name can be read as either "Herr D. Volcker" or "Herrn D. Volcken." While the last name has, in the only article that mentions it, been read as "Volcker,"[35] a number of other considerations support the idea that the word should instead be read as "Volcken," deriving from a surname of "Volck." First, a man by the name of Volck, namely a Johann Volck,

33. On the education of Duke Ernst's children, see Woldemar Boehne, *Die Erziehung der Kinder Ernsts des Frommen von Gotha* (Chemnitz: J. C. F Pickenhan & Sohn, 1887), and Eva Bender, "Prinzenerziehung am Gothaer Hof," in Sascha Salatowsky (ed.), *Gotha macht Schule. Bildung von Luther bis Francke. Katalog der Ausstellung* (Gotha: Forschungsbibliothek Gotha, 2013), pp. 71–9.

34. Perhaps not surprisingly, the first-mentioned herbarium, which also is bound earlier in the volume, is significantly better preserved; the second one shows many signs of decay, probably owing to the greater amount of moisture to be found in the multiple specimens per page.

35. Zahn, "Zwei kleine Herbarien," p. 22 (note 18).

does indeed appear on several occasions in records of seventeenth-century Gotha. According to documents in the Thuringian State Archive, for example, this man served as a town physician (*Stadtphysicus*) in Gotha in 1620 and 1621, during both of which years he applied for a salary increase.[36] This administrative correspondence, over thirty years before the compilation of the chart in question, might safely be granted little weight, if it were not for the fact that this individual also appears in documents dating from the first half of the 1650s, which record his appointment in October 1653 as a state physician (*Landmedicus*) for the districts of Gotha and Volkenroda.[37] The fact that documents relating to this man while alive only go up to 1654 could help to explain the reference in the abovementioned memorandum to the table's compiler as "*sel.*" (that is, "*seliger*" or of blessed memory), in other words, as having died after completing at least the bulk of the chart. The "D." appearing before his name might then perhaps be read as "Dr.," indicating his medical status, rather than merely "*Dominus*" (lord, master) as a mark of respect.

This identification of the author of the table as a physician would indeed serve to explain quite a few things. Physicians, for example, were expected during the early modern period to have a significant knowledge of medicinal herbs, acquired during classes on *materia medica* offered at universities' medical faculties, as well as through the simple fact that medicinal herbs constituted a major part of the therapeutic offerings available at the time.[38] It would thus make sense for a physician to be expected to serve as an effective "supervisor" of the foresters' reports, drawing up their letters and lists of plants into a final visual or tabular form. This might be especially likely given the fact that while, during the 1640s, Duke Ernst seems to have devoted most of his attention to consolidating his rule and instituting a series of religious and school reforms, in the 1650s he seems to have turned his attention more to other issues including medical ones, issuing a series of regulations and ordinances governing medical practice and stressing the

36. ThStA Gotha Geheimes Archiv UU XIV 1.
37. Cited in Klinger (note 6), p. 304, fn 156. His name also appears in the context of a dispute over salary in 1654, for which see Klinger, p. 304, and of his earlier activity as a recommendation-letter-writer for a surgeon in 1652, for which see Klinger, p. 305, fn 162.
38. Harold J. Cook, "Physicians and Natural History," in N. Jardine, J. A. Secord and E. C. Spary (eds.), *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), pp. 91–105; Saskia Klerk, "Teaching the *materiae medicae* at Leyden University: Between Natural History, Botany and the Foundations of Medicine," in *Jahrbuch für Europäische Wissenschaftskultur/Yearbook for European Culture of Science*, 6 (2011): 143–71.
39. See for example the 1654 medical *Patent* issued by Ernst in which he declared that after paying considerable attention to his subjects, spiritual well-being ("unserer Unterthanen Seelen-Wolfahrt"), he had decided it was time to pay attention to their physical well-being as well ("unserer Unterthanen Leibes Wolfarth"): ThStA Gotha Geheimes Archiv KK 7 Vol 1 Nr 65, fol. 336. For Ernst's medical ordinances of the 1650s, see Jauernig, "Die Gestaltung des Gesundheitswesens durch Herzog Ernst den Frommen von Sachsen-Gotha vor 300 Jahren," *Wissenschaftliche Zeitschrift der Friedrich-Schiller-Universität Jena*, Mathematisch-Naturwissenschaftliche Reihe, Heft 2, Jahrgang 3 (1953/54): 209–26, which also very helpfully offers as appendices versions of this and other medical ordinances; Jauernig's conclusions have been revised and updated in Klinger, *Der Gothaer Fürstenstaat*, pp 296–311 (note 6).

importance of physicians' oversight over and supervision of surgeons, apothecaries, and a wide range of other individuals involved with medicine.[39]

Seen in this light, it appears likely that Duke Ernst's order to foresters to compile lists of medicinal herbs might relate to the concern, expressed in his first ordinance (from 1654) establishing a system of salaried *Land-Medici* and local surgeons, that apothecaries not only have a sufficient supply of the medicines they dispensed, but that this supply come as much as possible from local lands. The clause on the topic states that "So that the appointed doctors (*Medicis*) and surgeons will not lack for their cures sound materials, prepared well, for this reason provision will be made that one needs in these places not only sound, and sufficiently qualified apothecaries, but that their apothecary shops be sufficiently provided with all kinds of necessary and medically-useful materials and herbs, but especially those which can be collected in the countryside."[40] Not only Duke Ernst's original order to the foresters, but also the table that was ultimately prepared from the foresters' reports, might thus be seen as a paper technology for ensuring the availability, within the territory itself and thus not requiring any importation from external sources, of the herbs vital to apothecary shops' ability to provision the populace.

If this kind of thinking did indeed help lead to Duke Ernst's order to the foresters, this would display considerable consistency with the cameralist concerns that Duke Ernst and his advisor Veit Ludwig von Seckendorff elsewhere demonstrated.[41] Cameralist writers, even during the extremely early stages of cameralism represented by the writings of the mid-seventeenth century, repeatedly called on princes to ensure self-sufficiency through the exploitation, as much as possible, of resources to be found within the borders of their own domains. The provision of essential items for the land's well-being was not to be left to chancy and expensive imports from outside; rather, it was a prince's duty to procure information about his own territories so that he could draw on their resources to the greatest extent possible.[42] Ernst's order to the foresters clearly suggests that he was interested not only in the ability of local forests to supply much-needed wood, but also in their ability to supply medicinal plants as well. Seen in this light, Ernst's order may perhaps be viewed as an effort to increase his level of information about, and control over, yet another aspect of the territories he ruled – in this case, its naturally derived resources for healing.

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40. ThStA Gotha Geheimes Archiv KK 7 Vol 1 Nr 65, fol. 336.
41. Wakefield, *The Disordered Police State*, pp. 18–20 (note 5).
42. Albion W. Small, *The Cameralists: The Pioneers of German Social Policy* (Chicago: Chicago University Press, 1909); Axel Nielsen, *Die Entstehung der deutschen Kameralwissenschaft im 17. Jh.* (Jena: Gustav Fischer, 1911); Kurt Zielenziger, *Die alten deutschen Kameralisten. Ein Beitrag zur Geschichte der Nationalokonomie und zum Problem des Merkantilismus* (Jena: n.p., 1914); D.C. Coleman (ed.), *Revisions in Mercantilism* (London: Methuen, 1969); Jutta Brückner, *Staatswissenschaften, Kameralismus und Naturrecht* (Munich: Beck, 1977); Rondo Cameron, "Economic Nationalism and Imperialism," in *A Concise Economic History of the World* (Oxford: Oxford University Press, 1993), pp. 130–61. On changing administrative procedures related to these kinds of ideas, see James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

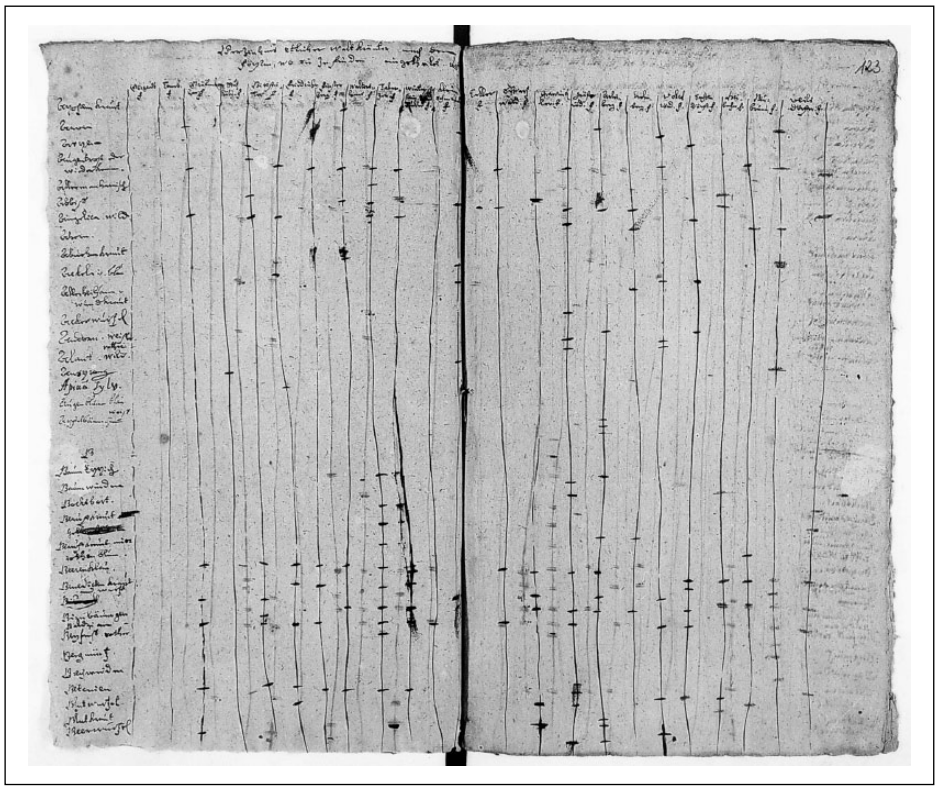

Figure 3. Botanical table. Forschungsbibliothek Gotha der Universität Erfurt, Chart. A 707, fol. 122v-123r.

What, however, about the table compiled from the foresters' lists and reports? This table might best be seen as an effort to create, in effect, a synoptic view or visualization of the location and frequency (and also thus, to a certain extent, the quantity) of medicinal herbs within Duke Ernst's territories. The table took the significant amount of collective labor that had gone into the creation of the lists – the labor of dozens of foresters and herb-women, marshaled by the state to achieve what one person could not have – and condensed it. Regarding its status as a "table," it must be acknowledged that the compiler of the document in question did not actually use that word or any similar one to refer to it. Unlike the author of the subsequent memorandum, who was indeed to refer to it as a

43. Forschungsbibliothek Gotha Chart. A 707, fol. 138r.
44. Ibid., fol. 122r: "Verzeichnis etlicher waldkräuter nach der ordnung um försten 1655." The word "Verzeichnis" only acquired its modern meaning of "list" gradually, in part as a result of its use in mercantile settings in the late Middle Ages; earlier meanings seem to suggest a more general sense of just "writing down." See entry on "Verzeichnis" in *Deutsches Wörterbuch von Jacob und Wilhelm Grimm* (Leipzig, 1854–1961), vol. 25, columns 2505–8.
45. Forschungsbibliothek Gotha Chart. A 707, fol. 122v: "Verzeichnis etlicher Waltkräuter nach der försten, wo sie zu finden in Gotha … 1655."

"*tabell*" or table,[43] its compiler labeled it on one page simply a "List [*Verzeichnis*] of various forest herbs according to the order of the forests"[44] and on another a "List of various forest herbs according to the forests where they are to be found in Gotha."[45]

Nonetheless, to the modern eye at least, there is a clear difference between the lists sent in by the foresters and the document that Volck produced, which does not look at all like a simple "list," but rather like a table of the kind that was beginning to appear in both scientific and non-scientific contexts during the early modern period.[46] This document, consisting of multiple pages, was structured in each case by a set of columns running across both sides of the page in each page opening, with each column containing at the very top the name of a forest district, all in all comprising the entirety of the forest districts in Saxe-Gotha at the time. On the far left-hand side of each page opening were listed, each below each other, in rough alphabetical order,[47] the German names of the plants from A through Z, for the total of thirteen page openings that it took to make it all the way through the alphabet (Figure 3).

The document, in short, can be seen as framed by the juxtaposition of two lists, namely one of forest districts (and indeed a list of forest districts, presumably written out in preparation for compiling the table, does appear within the bound volume several pages after the chart's end),[48] and one of plants. The intersection of these lists, and the fact that the compiler of the resulting table has clearly drawn on the foresters' lists to

46. On tables more generally, see A. S. C. Ehrenberg, "Reading a Table: An Example," *Journal of the Royal Statistical Society, Series C (Applied Statistics)* 35, 3 (1986): 237–44; Arndt Brendecke, "Tabellen und Formulare als Regulative der Wissenserfahrung und Wissensprasentation," in Wulf Oesterreicher, Gerhard Regn, and Winfried Schulze (eds.), *Autorität der Form - Autorisierung - Institutionelle Autorität* (Münster: LIT Verlag, 2003), pp. 37–53; Steffen Siegel, *Tabula: Figuren der Ordnung um 1600* (Berlin: Akademie Verlag, 2009); Barbara Segelken, *Bilder des Staates. Kammer, Kasten und Tafel als Visualisierungen staatlicher Zusammenhänge* (Berlin: Akademie Verlag, 2010); and Lorraine Daston, "Super-Vision: Weather Watching and Table Reading in the Early Modern Royal Society and Académie Royale des Sciences," *Huntington Library Quarterly*, 78, 2 (2015): 187–215. On the use of tables among physicians in particular, see Karl Josef Höltgen, "Synoptische Tabellen in der medizinischen Literatur und die Logik Agricolas und Ramus'," *Sudhoffs Archiv* 49, 4 (1965): 371–90, and Ian Maclean, "Diagrams in the Defence of Galen: Medical Uses of Tables, Squares, Dichotomies, Wheels, and Latitudes, 1480–1574," in *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe*, ed. Sachiko Kusukawa & Ian Maclean (Oxford: Oxford University Press, 2006), pp. 135–64. I would like to thank Sietske Fransen and an anonymous reviewer for several of these references.
47. By "rough alphabetical order" is meant here an order in which all items whose names *begin* with the same letter are grouped together, even if alphabetical order is not followed *within* this group, in contrast with what one might call "strict alphabetical order."
48. Although this list is titled "Verzeuchnis etlicher wald kräuter ein gebracht im Junio 1655," it actually contains not lists of herbs, unlike most of the sheets of paper that surround it, but rather a list of forest districts, within the order of their broader administrative districts, in exactly the same order in which they appear in the chart itself. Forschungsbibliothek Gotha Chart. A 707, f. 140r.
49. Confirmation that this was indeed the procedure can be found in the fact that many of the lists, especially those which appear in the bound volume *after* the chart itself, have *two* sets

record the presence of an herb in a particular forest district by notching the column at the point of intersection between the two lists,[49] permits the viewer to instantly get a sense of which herbs are located where, and how commonly overall a given herb was to be found in Duke Ernst's forest districts. (Conversely, the viewer can also instantly get a sense of which forest districts were the most plentiful in herbs.) Why not use a map, one might ask, to achieve the same effect, if location was at issue? The answer is that while maps were indeed a major tool for states during this period, a map would surely have proved impractical at representing the locations of the hundreds of different kinds of medicinal herbs on which the foresters had reported – a mapmaker would have needed to create hundreds of different symbols in order to represent all the different species in question and place them on the map.[50] In short, the creator of this document was trying to do something new. He was trying to use existing techniques for the rearrangement and compression of information, such as those adopted and adapted by scholars from merchants – his table might be seen as a sort of "ledger," into which the messy scribblings of "waste" paper were being gathered – to create a new paper technology.[51] This new paper technology aimed to enable a synoptic view of the entire topic, one perfectly calibrated to enable a ruler or advisor to make quick decisions.

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of checkmarks, one on each side of an herb's name, suggesting that some action of whatever form had been taken related to that herb – for example, the entering of that herb's location onto the chart.

50. On the administrative uses of maps during this period, see for example Josef Konvitz, *Cartography in France, 1660–1848: Science, Engineering, and Statecraft* (Chicago: University of Chicago Press, 1987); on thematic mapping, which would eventually enable the presentation of at least some biogeographical information in map form (though not to the extent that would have been required here), see Arthur H. Robinson, *Early Thematic Mapping in the History of Cartography* (Chicago: University of Chicago Press, 1982).
51. Here see Angus Vine, "Commercial Commonplacing: Francis Bacon, the Waste-Book, and the Ledger," *English Manuscript Studies*, 16 (2011): 197–218, which further develops some of the insights originally expressed by Ann Blair, "Humanist Methods in Natural Philosophy: The Commonplace Book," *Journal of the History of Ideas* 53 (1992): 541–51; see also Fabian Kraemer, "Ulisse Aldrovandi's *Pandechion Epistemonicon* and the Use of Paper Technology in Renaissance Natural History," *Early Science and Medicine* 19 (2014): 398–423.
52. For a striking example of the many tables compiled at Gotha during the mid-seventeenth century, see for example ThStA Gotha Geheimes Archiv II Nr. 2, f. 44, which presents a tabular schedule of how Ernst's sons were supposed to spend their time; among other things, it turns out that they were supposed to spend their time reading tables! "die SchulTabell sich bekand zu machen… die Tabell vor die beambten auch der Schultheißen instruction sich bekand zu machen…" A formal schedule of lessons ("Tabell der Lectionen") also shows a table structure: ThStA Gotha Geheimes Archiv E III Nr. 2, fol. 43. Another example of the fondness for tables among Gotha administrators though dating from a slightly later period (which might well, however, have been influenced by earlier trends) can be found in the Gotha administrator Wilhelm von Schroeder's projects for "State Tables" (*Staats Tafeln*); see Vera Keller, "'A Political Fiat Lux': Wilhelm von Schroeder (1640–1688) and the Co-production of Chymical and Political Economy," in Sandra Richter and Guillaume Garner (eds.), *'Eigennutz' und 'gute Ordnung'. Ökonomisierungen der Welt im 17. Jahrhundert* (Wiesbaden: Harrassowitz, 2016), pp. 353–78.

Or not so perfectly. For, while in some ways the table may appear very similar at first glance to the other tables that seem to have proliferated during this time-period at princely courts as well as elsewhere,[52] it has some features which suggest that its compiler was perhaps not the most experienced table-creator. (Or, alternatively, that his death may have occurred before he had a chance to do up a revised and more polished version of his work.) For example, rather than taking the time to use a ruler or other straightedged implement to draw the vertical lines for the table's columns – there seems to have been no shortage of rulers used in creating other tables – the lines seem to have been drawn without any such artificial guidance, and, perhaps as a result, are far from straight, as they wobble and weave across the page. Another issue to be noted is the utter lack of any horizontal lines representing *rows*. Even if they were wobbly, rows might have made it easier to the reader to determine exactly which herb was present in a given forest district; especially at the far right-hand side of the right-hand page in each page opening, most distant from the herb names written at the far left-hand side of the left-hand page, it is extremely difficult to tell *which* herb was indeed present in a particular forest district.[53] The lack of rows has another consequence: the accurate placement of each notch marking the presence of an herb in a forest district seems to have depended very much on the compiler's eyesight, which, based on the number of notches (even close to the column of plant names) that seem to hover between the heights of two different plant names, may not have been good. Nor does the compiler's decision to place notches on column lines directly to the *right* of a given forest district name, rather than directly *below*, seem particularly practical, especially given the tiny handwriting in which the forest district names appear.[54] Given all of these features of the table, it does seem likely either that its creator was inexperienced, or that the version of the table which survives today may have originally been intended as a rough draft, not a final one.

Be that as it may, the death of the table's creator did not put an end to the project quite yet.[55] As has been mentioned earlier, a brief memorandum was written at some point after the table had been completed, presenting its author's thoughts on the actual *use* of this table of plants and places, as well as the process that had generated it. (Unfortunately, the memorandum contains neither date nor signature, nor any reference to who its author may have been, though it is most likely to have been an administrator or advisor of some sort at Ernst's court.) After summarizing the circumstances of the table's original creation,[56] the

53. This may be what the author of the subsequent memorandum may be referring to when he describes the chart as "somewhat unclear and uncertain": Forschungsbibliothek Gotha Chart. A 707, fol. 138r.
54. It might perhaps be objected here that any official at Duke Ernst's court, including the Duke himself, would have been sufficiently familiar with the forest districts that this would not have caused any problems; still, the fact remains that this peculiar format is quite atypical of that found in most tables created at the time, as well as today.
55. It is possible, however, that the death may have occurred before the chart was finished; this might explain why pencil, rather than pen, was used to create the notches marked on the last several column lines of each recto page within the chart, as well as the checkmarks on the right-hand side of several lists. In other words, the pencil marks might represent the work of a different person assigned to finish the chart.
56. Forschungsbibliothek Gotha Chart. A 707, fol. 138r.

memorandum's author went on to present his view that the table was "a bit unclear and uncertain," and to suggest a number of possible ways in which further such projects might more successfully be attempted in the future. For example, he suggested that, perhaps given the difficulties the foresters had met with in their efforts to procure Ernst's desired information, foresters were not necessarily the best gatherers of information about medicinal plants; those inhabiting the newly created office of state physicians (*Land-Medici)* might be much better suited to generate this information.[57] He also commented that surveying these herbs only in forest districts might be limiting, recommending that any such future survey include not only the territory's forests but also its fields, meadows, swamps, riverbanks, and vineyards; in short, the whole of the territory.[58] Perhaps most interestingly for the purposes of this article, though, he proposed that, should the project remain in the hands of foresters, each forester draw on the information he had collected to create a "table" of his very own, identifying the various different areas *within* each forest district where herbs were to be found.[59] In this way, he could obtain a much more finely grained set of information about the more precise locations of plants – information which the 1655 chart had not been able to convey. In short, further experiments with information gathering and recording would be needed before any such graphic representation of the results could be fully useful.

As analysis of this particular episode in the history of botanical, medical, and administrative paperwork has shown, it was not so easy to create new paper technology, even in an era of widespread experimentation with it. Far from displaying the information gained from the foresters', herb-women's, and physician's efforts in a way that was genuinely useful, the table's transformation through reorganization of that information had not demonstrably led to further clarity or understanding; indeed, valuable information such as the exact location of herbs had actually been lost in the process. The attempt to merge, in written form, the various knowledges of the territory possessed by such a disparate set of actors had foundered in incommensurability.

What, then, can we learn from this episode more generally? The events that unfolded in mid-seventeenth-century Gotha, while possibly unique in some of their details, may in fact be seen as far from unusual in the broader patterns they displayed. The quest for knowledge of the territory reflected the wider challenges of the attempt, on the part of many seekers after natural knowledge during the early modern period more generally, to move from observed particulars to fruitful generalizations that would enable new knowledge. The move from the particular to the general, though, was one that was fraught with problems – especially when multiple layers of actors created multiple layers of incommensurability, as was in fact so often the case in an era in which collaborative projects increasingly sought to join together the efforts of individuals from a wide range of educational and social backgrounds. Under these kinds of circumstances, experiments with paper and pen could in fact be as inconclusive as those in the laboratory. Still further experimentation with pen and paper would be needed before science, medicine, and the state could truly work in unison – if indeed the latter has ever been successfully achieved.

57. Ibid., fol. 138v.
58. Ibid., fol. 138v.
59. Ibid., fol. 138r.

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