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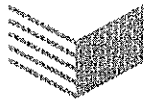

THE NATURE OF THE BOOK

Print and Knowledge in the Making

ADRIAN JOHNS

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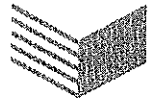


Introduction

The Book of Nature and the Nature of the Book

Pick up a modern book. This one will do: the one you are looking at right now. What sort of object is this? There are certain features about it of which you can be reasonably confident. Its professed author does indeed exist and did indeed write it. It contains information believed to be accurate, and it professes to impart knowledge to readers like you. It is produced with its author's consent, and it is indeed the edition it claims to be. If the dust jacket announces that it is the product of a given organization—in this case the University of Chicago Press—then this too may be believed. Perhaps you may even say to yourself that that fact vouches for the quality of its content. You may safely assume that the book you now hold will have been printed in many copies, and a copy of the same book bought in Australia, say, will be identical in all relevant respects to one bought in the United States or in Great Britain.

Begin to use this object. It should immediately become clear that there are things about its proper utilization of which a reader like you can be equally confident. This book has not been produced with a specific, individual reader in mind. To some extent, at least, it is a commercial product, designed to appeal to purchasers. Its cost may have limited its readership somewhat, but its distribution will still have been fairly widespread, and it may be available for consultation in a number of libraries. Readers will not have to endure any formal vetting or approval process before being permitted to read this book. You yourself are free to carry it around and to lend it to others. You are not free, however—beyond certain legal limits—to reproduce its contents in your own right for commercial gain. Nor may you now proceed to issue translations, epitomes, or abridgments of those contents. It is improbable (but not impossible) that you will choose to declaim the text of this book aloud in a public place, and it is even more unlikely that you will make it the focus of a collective act of commemoration, worship, or similar ritual. Some books are indeed used in these ways, incidentally, but this is probably not going to be one of them. In short, while in

some respects this book's usage is up to you, in others it appears to be quite closely constrained.

That we can assume all these things of such an object—that such an object actually exists—derives from our living in what many people call "print culture." Such phenomena, we say, are due to printing. Or rather, we would say this, but so infallibly reliable are they that we rarely even have to articulate the relation. It is obvious, self-evident, even necessary. The practical consequence is that we do not have to agonize over the reliability of a published book before we can put it to use. We do not need to undertake investigatory work to confirm that its author does exist and that its text is authorized. No literary spy need be hired to ascertain that it was indeed made by its stated publisher and that its contents will be the same as those of another copy of the same book found in any other place. In our world, all these characteristics are inherent in virtually any published book (and the duties of a "literary agent" are comparatively mundane). We take them for granted, every day of our lives. We depend on them, and our reliance is, by and large, justified.

It is this very self-evidence that encourages us to ascribe all these characteristics to a technological order of reality. If called upon, we may assert that printed texts are identical and reliable because that is simply what printing *is*. The identification is as momentous as it is straightforward. It has become the point of departure for all current interpretations of print and its cultural consequences, and is the root from which the very concept of "print culture" has grown.[1] It is thereby also the foundation of a conviction that that culture has rendered possible the establishment of veracious knowledge in modern society. Yet this book argues that it is substantially false. Not only that: *The Nature of the Book* maintains that it is probably the most powerful force resisting the acceptance of a truly historical understanding of print and any cultural consequences it may foster.

This book contends that what we often regard as essential elements and necessary concomitants of print are in fact rather more contingent than generally acknowledged. Veracity in particular is, it argues, extrinsic to the press itself, and has had to be grafted onto it. The same may be said of other cognate attributes associated with printing. In short, *The Nature of the Book* claims that the very identity of print itself has had to be *made*. It came to be as we now experience it only by virtue of hard work, exercised over generations and across nations. That labor has long been overlooked, and is not now evident. But its very obscurity is revealing. It was dedicated to effacing its own traces, and necessarily so: only if such efforts disappeared could

1. For this term, see below, pp. 10–11, and Eisenstein, *Printing Press*, I, 43–159. I am not sure of its genesis; Eisenstein, its prime recent exponent, seems to take it from McLuhan (e.g., *Gutenberg Galaxy*, 146–9).

printing gain the air of intrinsic reliability on which its cultural and commercial success could be built. Recovering it is therefore a difficult task, but one well worth attempting. This book tries accordingly to excavate the complex issues involved in the historical shaping of print—issues that our conventional notion of print culture obscures with all the authority of a categorical definition. *The Nature of the Book* is the first real attempt to portray print culture in the making.

Yet how could print conceivably be anything else? If it were really the result of a significant process of historical construction, then surely we could not now find it so obvious, universal, and undeniable. If it could have developed differently, then surely it would now differ noticeably from place to place, and in any one place it would still bear the traces of its development. We would see the wreckage of failed alternatives all about us. In practical terms, we would indeed have to worry about the specific status of a given printed book in order to use it. Questions of where it had come from, who had made it, and whether or not its putative author acknowledged its content would all need to be posed and answered before we could safely trust any printed book. That they do not constitutes a powerful reason to accept the obvious.

Even a little reflection suggests that there is greater complexity to the subject than this. Any printed book is, as a matter of fact, both the product of one complex set of social and technological processes and also the starting point for another. In the first place, a large number of people, machines, and materials must converge and act together for it to come into existence at all. How exactly they do so will inevitably affect its finished character in a number of ways. In that sense a book is the material embodiment of, if not a consensus, then at least a collective consent. Its identity can be understood accordingly, in terms of these intricate processes. But the story of a book evidently does not end with its creation. How it is then put to use, by whom, in what circumstances, and to what effect are all equally complex issues. Each is worthy of attention in its own right. So a printed book can be seen as a nexus conjoining a wide range of worlds of work. Look closely and you are likely to find simplicity and inevitability in neither the manufacture of an object like this nor its subsequent construal. The processes leading to the deployment of a book and those consequent upon its use both depend on too many contingencies. That in turn means that print cannot be as straightforward as it seems.

One way to appreciate the implications is to examine more closely places where printing exists, but where its cultural consequences seem very different from those familiar to us. There are two such places, separated from us by space and by time. The first may be found in certain regions of the world where, to international publishers' disgust, so-called "piracy" has become a

prevalent commercial practice. You could not be so sure of all those "self-evident" facts about this book if you had bought your copy in such a place. It might indeed prove reliable. But it might also have been produced by an anonymous manufacturer, and have different contents. Its purported author might have no idea of the claims it contained. Some such companies produce not just unauthorized reprints of existing books, but wholly new texts claiming to be written by best-selling authors. Their products threaten to compromise both the economic production of authorized works and, by generating correspondingly divergent readings, their reception. The potential effects are suggested by the most notorious of all recent controversies to arise from publishing. The author Salman Rushdie was complaining of piracy of his works in Pakistan and India long before the appearance of his *Satanic Verses.* When it did appear, the book was properly published in neither country; the protests that occurred in Lahore and elsewhere, and that first set in train the events leading eventually to Khomeini's fatwa, centered on the public reading of unauthorized copies and photocopied extracts. A Penguin representative even noted that piracy would permit readers to circumvent the Indian government's subsequent ban on the book.[2]

Rushdie's is admittedly an extreme case. But for good or ill, countless authors and publishers have encountered to some degree the loss of control induced by piracy. It means that the experiences associated with print are indeed different from those familiar to most Western readers. And any suggestion that the intrinsic cultural consequences of technology have simply been inadequately realized in such settings would be difficult to endorse. The evidence of recent international trade disputes indicates that modern technology, far from eliminating such practices, may even be facilitating them. The arguments currently raging over such matters are intense and important. Few claim to know how they will end.[3]

The alternative is to look not to other places in our own time, but to other times in our own place. It is possible to argue not only that print may differ from place to place, but also that its nature has changed over time even in our own society. If this is so, the implications are again substantial, but in rather different ways. Such an argument compels us to reappraise where our own concept of print culture comes from, how it developed, when it took hold, and why its sway continues to seem secure. These are

2. *The Times*, 24 November 1984; Appignanesi and Maitland, *Rushdie File*, 42; Pipes, *Rushdie Affair*, 24, 85, 113, 201–2.

3. These disputes extend far beyond "copyright" as conventionally understood, and include conventions now being forged to cover the "inventions" and "texts" produced in areas such as biotechnology and genome research. The economic, cultural, and moral implications at stake in these, as in the battles raging over computer and music software, are truly massive. For confrontations between the USA and China over the latter, see Faison, "Copyright Pirates."

some of the questions addressed in the following chapters. Tactically forgetting that we ourselves "know" what printing is, *The Nature of the Book* begins by asking the question of what printing *was.* It addresses how the people of the sixteenth, seventeenth, and eighteenth centuries constructed and construed the craft, in their own setting and for their own ends. This entails comprehending the complex social processes by which books came to be made and used in their society—the society in which printing first really thrived, and in which any consequences it might have were first fully manifested. The result is that what began as a tactical decision to forget our own knowledge is soon vindicated as rather more. As chapter 2 will show in detail, early modern printing was not joined by any obvious or necessary bond to enhanced fidelity, reliability, and truth. That bond had to be forged.

If an early modern reader picked up a printed book—*De Natura Libri,* perhaps—then he or she could not be immediately certain that it was what it claimed to be, and its proper use might not be so self-evident. Piracy was again one reason: illicit uses of the press threatened the credibility of all printed products. More broadly, ideas about the correct ways to make and use books varied markedly from place to place and time to time. But whatever the cause, it is not easy for us to imagine such a realm, in which printed records were not necessarily authorized or faithful. What could one know in such a realm, and how could one know it? We ourselves routinely rely on stable communications in our making and maintenance of knowledge, whether of the people around us or of the world in which we live. That stability helps to underpin the confidence we feel in our impressions and beliefs. Even the brisk skepticism we may express about certain printed materials—tabloid newspapers, say—rests on it, inasmuch as we feel confident that we can readily and consistently identify what it is that we are scorning. Instability in records would equally rapidly translate into uncertainty of judgment. The most immediate implication, then, would be epistemic.

In a sense, the point is a well-entrenched one. It has been made at least since the sixteenth century, when printers and others took to lauding their craft for its power to preserve. The contrast they drew was with previous scribal forms of reproduction, which they delineated as intrinsically corruptive. It now seems almost indisputable. We should recognize, however, that the first identification of that contrast was partly a product of interest. Printers stood to gain from what was originally a contentious argument, not a straightforward observation. If, on the other hand, it is not printing per se that possesses preservative power, but printing put to use in particular ways, then we ourselves may usefully draw some rather different distinctions. We may look not just for differences between print and manuscript reproduction, but for different ways in which the press itself and its products have been (and continue to be) employed. The roots of textual stability may be

sought as much in these practices as in the press itself. And knowledge, such as it is, has come to depend on that stability. Here, then, is one way in which a social history of print can prove not just interesting, but consequential. A reappraisal of print in the making can contribute to our historical understanding of the conditions of knowledge itself.

TYCHO BRAHE, GALILEO GALILEI, AND THE PROBLEMS OF "PRINT CULTURE"

The central concern of this book is the relation between print and knowledge. As its title suggests, to pursue this theme it focuses in particular on *natural* knowledge—knowledge of Creation and of humanity's place within it. To that extent, *The Nature of the Book* may be regarded as contributing to the discipline known, rather anachronistically, as the history of science.[4] It proposes a new account of how early modern Europeans put printing to use to create and maintain knowledge about the natural world.

The focus on the history of science is not, however, an exclusive one. The ambit of *The Nature of the Book* is not exhausted by scientific knowledge, and none of its conclusions should be regarded as restricted to science alone. Science is treated here as just one among a range of activities characterized by the creation and use of knowledge. The historical problems identified in the course of this book were so general that they applied to all of them, from scriptural exegesis, through astronomy, experiment, and alchemy, to the formation of political ideologies and representations of gender. All make their appearances in the following chapters. Nonetheless, the widely accepted status of modern science as the most objective, valuable, and robust kind of knowledge currently available makes it a peculiarly appealing subject for the historian of printing.[5] This high status means that any conclusions demonstrable for science stand a chance of being accredited a fortiori for other activities now held in lower repute. Furthermore, the history of science offers an unusually clear opportunity to discuss the assumptions and implications of the historiography of print. For it is in the history of science that one finds the figure who, more than any other, personifies print culture as conventionally understood. That figure is the Danish nobleman and astronomer Tycho Brahe (fig. 1.1).

4. As explained further below, I share other historians' doubts about using the terms "science" and "scientist" in reference to periods before they became recognized by contemporaries, and will therefore employ them sparingly in this book. For the issues involved, see Jardine, "Writing Off the Scientific Revolution"; Copenhaver, "Did Science Have a Renaissance?"; Pickstone, "Past and Present Knowledges"; and the polemical argument in Cunningham and Williams, "De-centring the 'Big Picture.'"

5. I should stress the attributive and pragmatic character of such a representation; claims that scientific knowledge actually *is* objective are, of course, extremely controversial, and the image of science as such has been questioned many times.

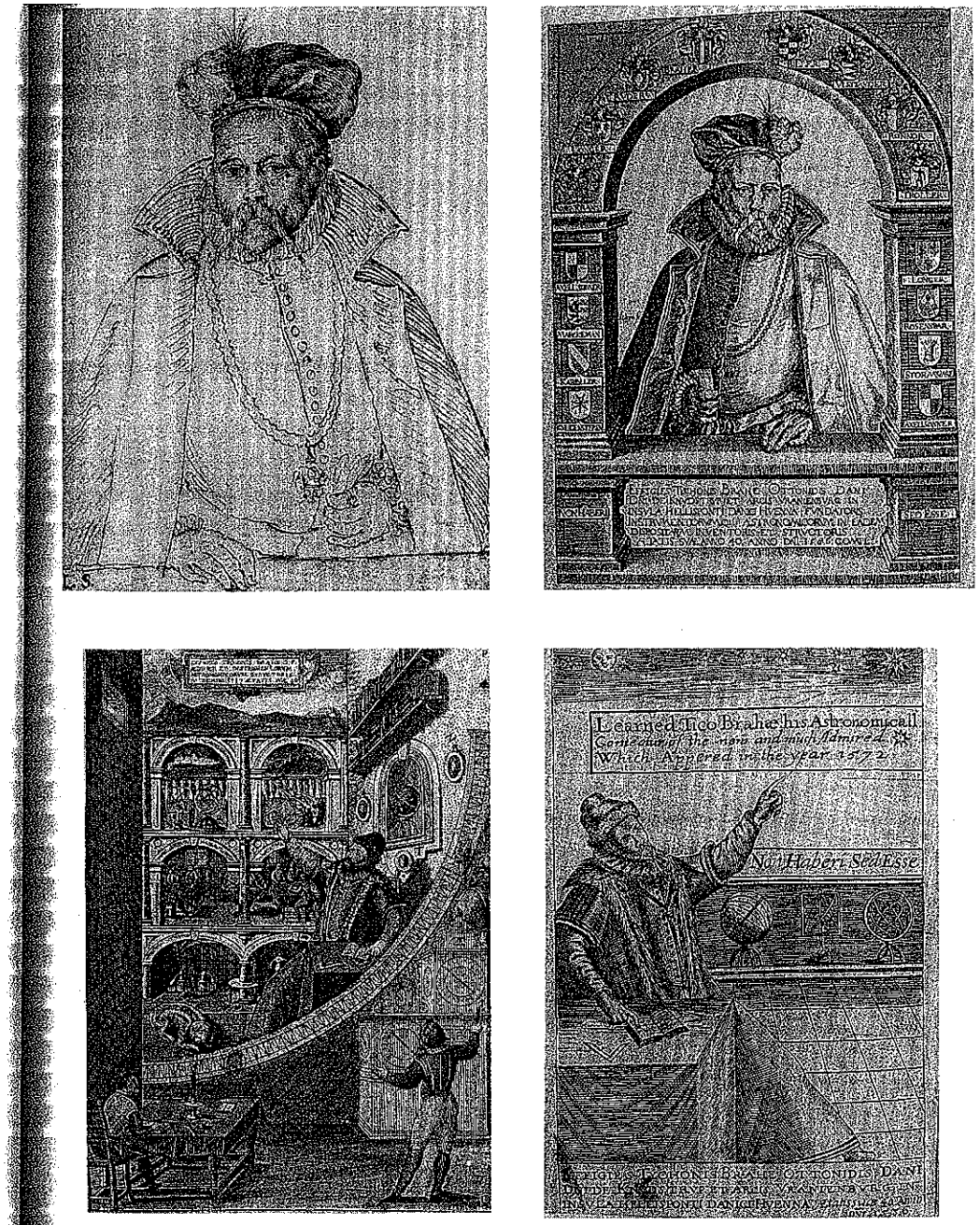
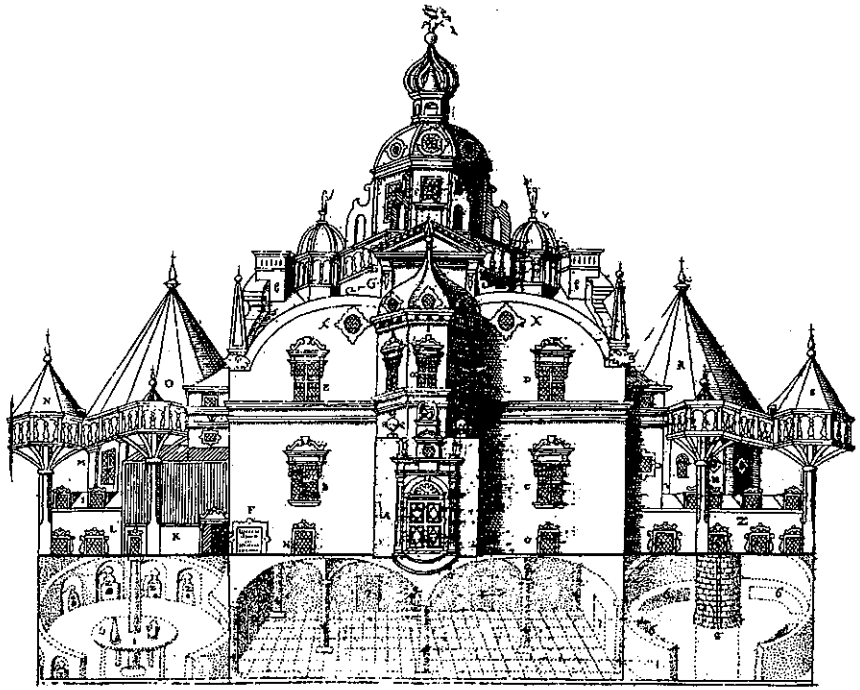


FIG. 1.1. Tycho Brahe: different representations for different readers. (*top left*) Hand-copied portrait. Reproduced from Tycho Brahe, *Opera Omnia*, I. (By permission of the Syndics of Cambridge University Library.) (*top right*) Printed portrait from the work in which Tycho attacked Ursus. Tycho Brahe, *Epistolarum Astronomicarum Libri*. (By permission of the Syndics of Cambridge University Library.) (*above left*) Tycho with his mural quadrant, as portrayed in a presentation impression of the *Astronomiae Instauratae Mechanica* (1598). (By permission of the British Library, C45.h.3.) (*above right*) Michael Sparke's English version of Tycho's mural quadrant portrait, published with his astrological prophecy in 1632 as *Learned Tico Brahae his Astronomicall Conjectur*. (By permission of the Syndics of Cambridge



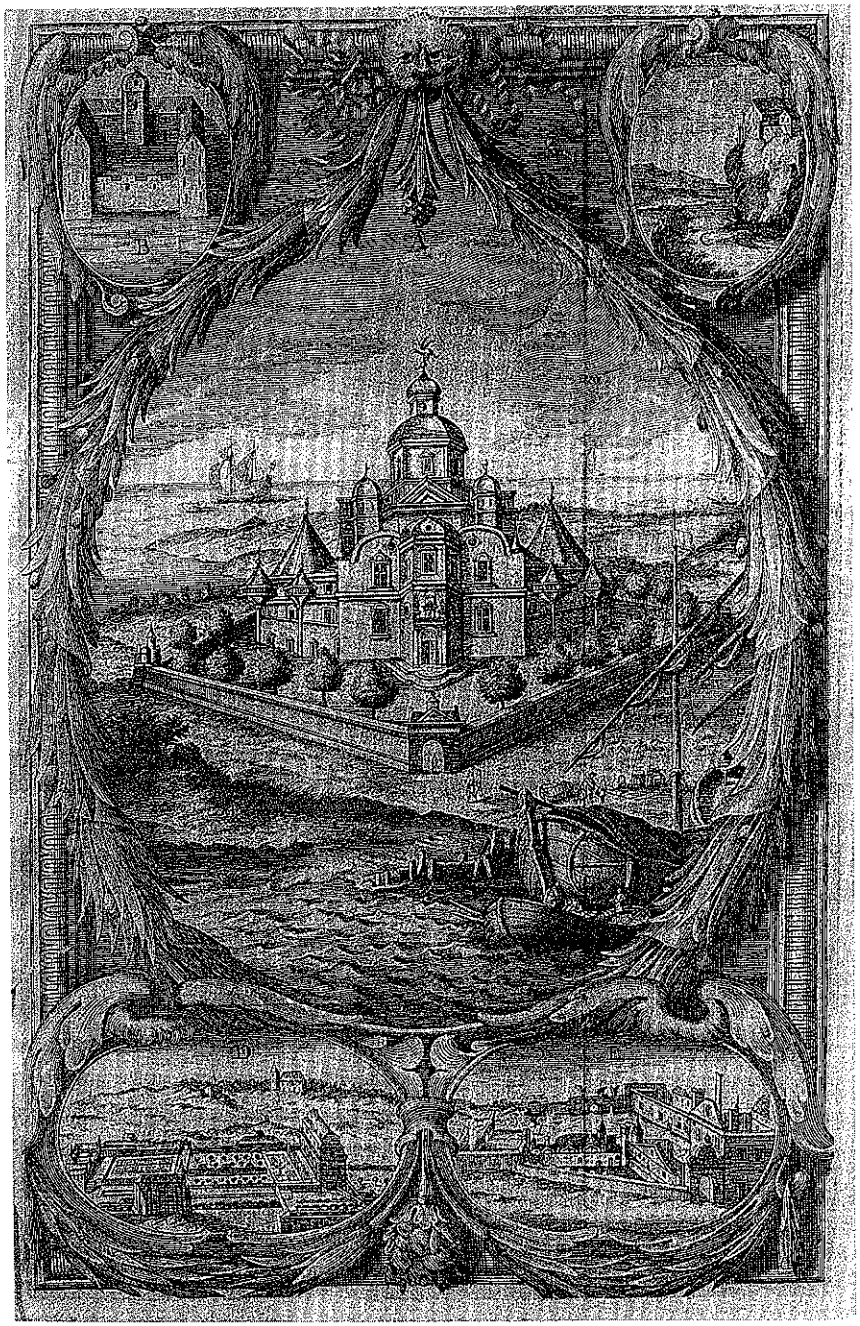


FIG. 1.2. Changing representations of Uraniborg. (*above*) Elevation, as shown in Tycho's own publication. Tycho Brahe, *Astronomiae Instauratae Mechanica* (1598). (By permission of the British Library, C45.h.3.) (*opposite*) Elevation, as printed after Tycho's death. Curtius [L. Barrettus, pseud.], *Historia Cœlestis*. (By permission of the Syndics of Cambridge University Library.)

In 1576 the king of Denmark granted Tycho feudal powers over a small island named Hven, lying in the sound just north of Copenhagen. Here Tycho erected a remarkable castle-observatory, in which he lived and worked for the next two decades. His work at this palatial observatory, which he called Uraniborg (fig. 1.2), resulted in an unequaled series of observations and interpretations of the heavens. They secured for him a reputation as the greatest of all astronomers. Almost immediately, Tycho himself became an icon of the very enterprise of astronomy. Mathematical practitioners in succeeding generations came to see in him an unimpugnable model of the harmony of nobility and "mechanic" skill. In the hands of modern historians, moreover, Tycho has again proved a powerful emblem, in two important and revealingly paradoxical respects. First, Uraniborg has become the outstanding Renaissance exemplar of the importance of locale in the making of knowledge.[6] This is an important issue, to be addressed

6. Hannaway, "Laboratory Design." Shackelford has responded to Hannaway, with more heat than really necessary, in "Tycho Brahe."

later in this chapter. At the same time, however, Tycho has come to personify the role of print in transcending place and rendering natural knowledge universal. He has thus become emblematic of the transformation of local craft into global science. This latter apotheosis has been due above all to Elizabeth Eisenstein's *The Printing Press as an Agent of Change.* Published in 1979, this is still probably the most influential anglophonic interpretation of the cultural effects of printing. Yet *The Nature of the Book* pursues for the most part a quite different approach from hers. A consideration of Tycho Brahe provides the ideal opportunity to specify how and why it does so.[7]

The unifying concept of Eisenstein's argument is that of "print culture." This "culture" is characterized primarily in terms of certain traits that print is taken to endow on texts. Specifically, those produced in such an environment are subject to conditions of *standardization, dissemination,* and *fixity.* The last of these is perhaps the most important. According to Eisenstein, printing meant the mass reproduction of precisely the same text, repeatable on subsequent occasions and in different locations. No longer need any work suffer the increasing corruption that Eisenstein assumes to be endemic to any "script culture." She focuses on this attribute of fixity as the most important corollary of the press, seeing it as central to most of the effects of print culture.[8] For example, in conditions of fixity the simple practice of juxtaposing texts became immensely significant. Newly available printed representations of opposing astronomical, anatomical, or other knowledge could be placed side by side, and their viewer could now be confident that conclusions drawn from comparing such reliable texts would be worthwhile. Correspondents on the other side of Europe could do the same, with representations that could be supposed identical.[9] Such scholars no longer needed to concern themselves primarily with the fidelity of their representations, and were freed from spending their lives eradicating scribal mistakes. It was fixity that liberated them from such labor and thus made possible the progressive improvement of knowledge. This is the basis on which

7. Eisenstein, *Printing Press*, abridged as *Printing Revolution.* For examples of Eisenstein's influence in a range of fields, see Tribble, *Margins and Marginality*, 3–4; Neuschel, *Word of Honor*, chap. 6; Olson, *World on Paper*, 37 and passim; Rose, *Authors and Owners*, 3–4; Sommerville, *Secularization*, 48, 70, 79, 178, 180, 219 n. 1; Anderson, *Imagined Communities*, 30–49; Eamon, *Science and the Secrets of Nature*, 6–9, 94–6; Lowood and Rider, "Literary Technology and Typographic Culture" (where "typographic culture" and "print culture" are indistinguishable). Many more could be cited. It is difficult to be sure, but I would estimate that Tycho Brahe is referred to at least as frequently in *Printing Press* as any other Renaissance figure.

8. Eisenstein, *Printing Press*, 71–88, 113–26.

9. Eisenstein, *Printing Press*, 74–5, 597; *Printing Revolution*, 42–88. It is worth pointing out that these phenomena are similar to those attributed by anthropologists to the invention of writing, e.g., in Goody, *Logic of Writing*, 134–8, 174.

Eisenstein can claim that the Renaissance and Reformation were rendered permanent by the very permanence of their canonical texts, that nationalism developed thanks to the stabilization of laws and languages, and that science itself became possible on the basis of phenomena and theories reliably recorded.[10] With this new foundation of certainty at their disposal, "scientists" (as Eisenstein insists on calling them) could begin to develop new doubts about their previous authority, namely antiquity. The "Scientific Revolution" was thus inconceivable without a preceding printing revolution.[11] And for Eisenstein Tycho Brahe personifies both.

Eisenstein's Tycho was an autodidact. This in itself was remarkable: before the printing revolution, not enough faithful editions could have been amassed in one place to enable him to teach himself. But while he was doing this, Tycho was able to place authoritative printed representations of the Copernican and Ptolemaic systems of the heavens side by side before his eyes. By this simple process of juxtaposition, he could immediately see that there were serious discrepancies. Later, working on Hven, he instigated a program to rectify the data and theories on which astronomy was based. He and his assistants labored for years to produce a systematic corpus of recorded observations of the heavenly bodies, using not only Tycho's own careful observations but those sent to him by astronomers across central Europe. When ready, Tycho could then supervise the correct printing of this vital material in his own printing house, using paper made in his own paper mill (figs. 1.3 and 1.4). As a result, one nova—"Tycho's star," as it came to be called—became "fixed" to the extent that it continued to be shown on celestial globes long after it had disappeared from the sky.[12]

In this guise has Eisenstein's Tycho entered a current debate over science itself. Bruno Latour has built an account of the making and power of science on her representation of a print culture, first in his concept of "immutable mobiles"[13] and more recently in that of "mediators."[14] Latour identifies the collection and deployment of durable paper entities as the foundation

10. Eisenstein, *Printing Press*, 80, 117, 180–2, 200–10, 212, 646. The argument about nationalism has since been developed more thoroughly by Anderson in *Imagined Communities*, esp. 41–9.

11. Eisenstein, *Printing Press*, 107, 186, 193–4, 197, 640; Hunter, "Impact of Print"; Leed, "Elizabeth Eisenstein's *The Printing Press as an Agent of Change.*"

12. Eisenstein, *Printing Press*, 577, 583–4, 593, 596–603, 623–5, 629–30, 640, 699.

13. Latour, *Science in Action*, 52, 132–44, 226; Latour, "On the Powers of Association"; Latour, "Visualization and Cognition." Compare also Latour, "Give Me a Laboratory"; Latour and Woolgar, *Laboratory Life*, 45–53, 69–88; and Callon, Law, and Rip, *Mapping the Dynamics of Science and Technology*, 7–14, 35–99.

14. Latour, *We Have Never Been Modern*, 77–82, 128–9, 138; Latour, "Technology Is Society Made Durable," 104–6, 127; Latour, "Where Are the Missing Masses?" 237.

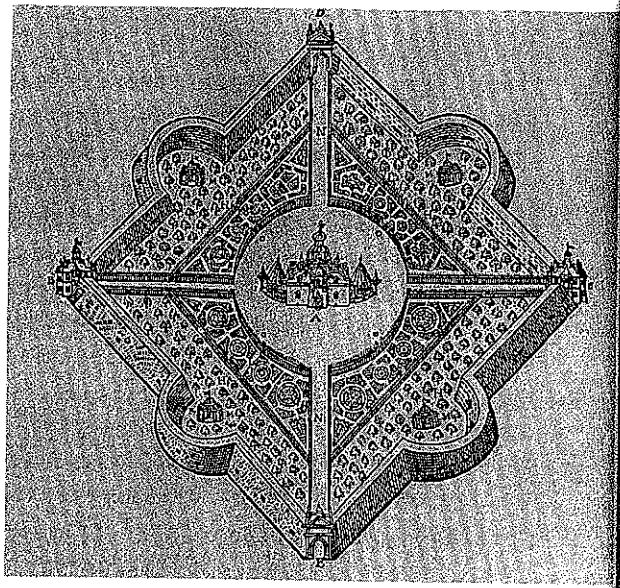


FIG. 1.3. Uraniborg. Ground plan, showing Tycho Brahe's printing house (at B). Tycho Brahe, *Astronomiae Instauratae Mechanica* (1598). (By permission of the Syndics of Cambridge University Library.)

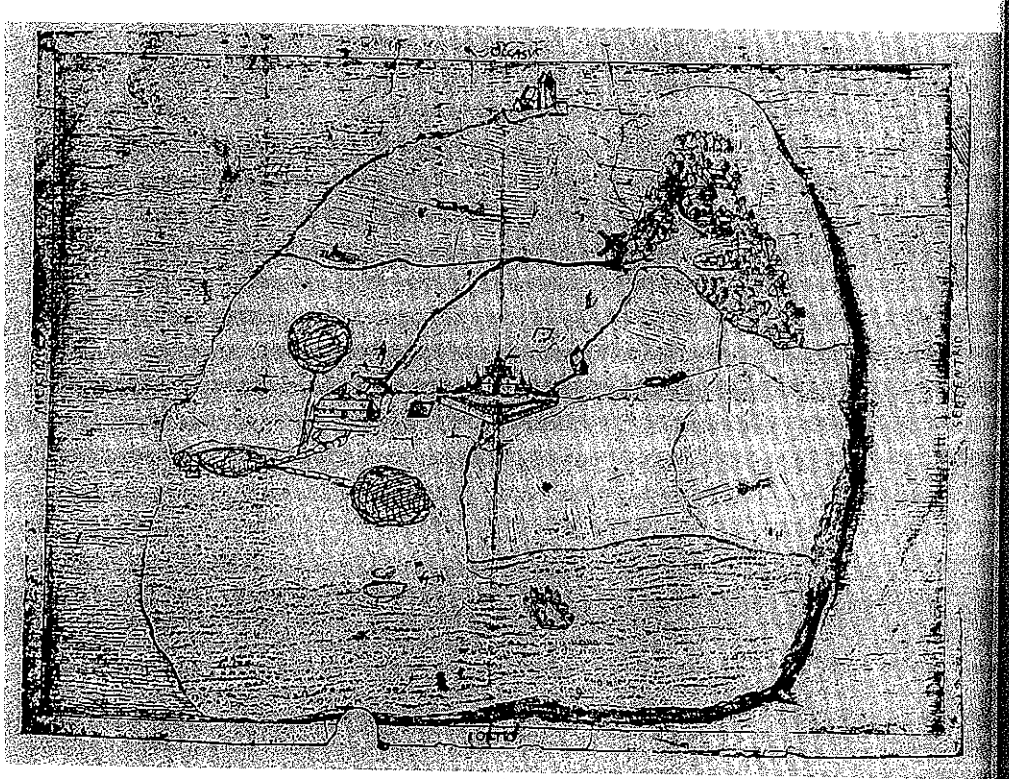
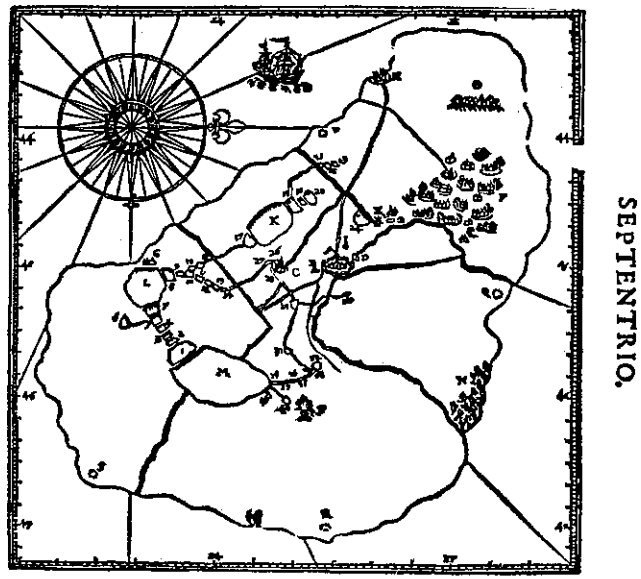


FIG. 1.4. The island of Hven. (*above*) Map from Tycho Brahe's manuscripts, showing the paper mill in relation to Uraniborg. Tycho Brahe, *Opera Omnia*, IV. (By permission of the Syndics of Cambridge University Library.) (*opposite*) The printed map issued by Tycho in his *Astronomiae Instauratae Mechanica* (1598). (By permission of the Syndics of Cambridge University Library.)



of science's success. The creation and circulation of such objects, Latour maintains, enabled Tycho to master natural and social entities that were otherwise beyond reach. He could use print both to capture heavenly bodies, as Eisenstein claimed, and, furthermore, effectively to turn every observatory in Europe into an extension of Uraniborg. This he achieved by distributing printed forms on which astronomers could enter their observations before returning them to the central site of Hven.[15] In doing so, he pioneered a practice central to the development of modern science. For this, Latour thinks, is essentially how the modern laboratory sustains its authority too. The Latourian laboratory is an inscription engine, dedicated to the construction, collation, dispersal, and accommodation of such materials. It is a compelling and enormously influential argument. And it is consonant not only with Eisenstein herself, but more extensively still with her inspiration and bête noire, Marshall McLuhan.[16] Latour's vision of science in

15. Latour, *Science in Action*, 52, 132–44, 226–7; Latour, "Drawing Things Together"; Latour, "Visualization and Cognition," 11–14; Latour, "Politics of Explanation," 159; Callon, Law, and Rip, "Putting Texts in Their Place," 223, 228–9.

16. A plausible summary of McLuhan's views in relation to Latour's might run as follows. Like Latour, McLuhan urged the importance of what he called the "network" as a category of analysis, important in deciding ways of perceiving the world. He too identified a railway system as the representative network par excellence (compare Latour, *We Have Never Been Modern*, 117; and Latour, *Aramis*). What McLuhan's networks achieve—what lends them their power—is their ability to produce changes in scale. They permit individuals and organizations to localize and universalize by allowing them to magnify and reduce traces of the

action depends on Eisenstein's "print culture"—and thereby implicitly on McLuhan's "Gutenberg Galaxy"—to underwrite the stability of both knowledge and society.[17]

The Tycho of Eisenstein and Latour has become the incarnation of textual, social, and epistemic order. But just how credible is this Tycho? There is something altogether too neat, too immaculate, about the figure and his achievements. As Philip Marlowe put it in *The Big Sleep,* such testimony displays "the austere simplicity of fiction rather than the tangled woof of fact."[18] Maybe the Tycho so far portrayed will change somewhat if we investigate more closely how his "mediators" actually came into being and were put to use. For Tycho does indeed represent perhaps the purest example of a particular kind of printing, and a particular way of using the products of the press. Like Regiomontanus before him, and Hevelius after, he controlled his own printing operation. His was a singular printing house, however. It was as geographically isolated on the island of Hven as it was socially isolated from the companies of the European book trade. It was even physically embedded in the five-meter high, five-meter thick wall that enclosed his entire estate. Such isolation meant, at least in principle, that Tycho could produce books when, for whom, and in whatever form he liked.[19] Works like his *Astronomiae Instauratae Mechanica,* which described Uraniborg in all its glory, were scarcely intended to be *published* at all, but were to be distributed as gifts to patrons at courts and universities (fig. 1.5). The more prestigious were not just printed books, but hybrids—hand-colored, individualized tributes, presented to their intended recipients on specific dates.[20] Tycho meant to bypass the structures of the international book trade altogether.

things on which they wish to operate to roughly the same size without destroying them. The "message" of his networks is that they permit such control; and what is perceived as reality is in fact the current state of competing networks in dynamic interaction. The boundary between natural and social must therefore be forgotten when considering them. In such a world of natural/social hybrids, power comes from "translation." This is the agency by which we "enlarge the scope of [our] action" and affect sites distant from ourselves. See McLuhan, *Understanding Media,* 3–21, 56–61, 89–105, 338–45, 346–59; compare Latour, *Science in Action,* 108–21, 223–32, 247–57, and *We Have Never Been Modern,* 10–12, 49–142. A reassessment of McLuhan is, I think, overdue, though attention to his work is currently reviving. Eisenstein herself roundly denied following him, but with an insistence and a perseverance that almost amounted to protesting too much: e.g., *Printing Press,* ix–xi, xvii, 40–1, 88, 129, 171.

17. Compare Shapin, "Following Scientists Around," 541, 545–6.

18. Chandler, *Chandler Collection,* I, 143.

19. Thoren, *Lord of Uraniborg,* 144.

20. Brahe, *Astronomiae Instauratae Mechanica* (1598); Brahe, *Opera Omnia,* V, 317–8. A list of known copies with their recipients is in Norlind, *Tycho Brahe,* 286–93.

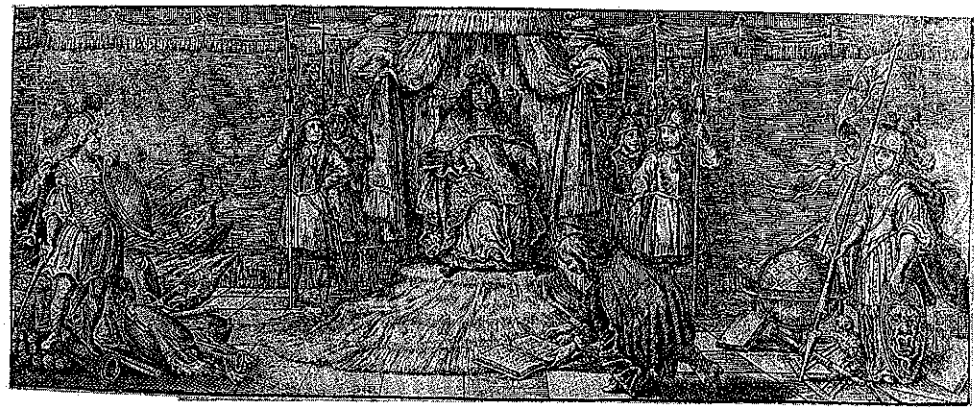


FIG. 1.5. The presentation of an astronomical volume to an absolute monarch: Hevelius offering his *Cometographia* to Louis XIV of France. The vignette portrays Hevelius's dedication of the book to Louis; it does not represent a real scene. Hevelius, *Cometographia.* (By permission of the Syndics of Cambridge University Library.)

The recipient of a book like Tycho's *Astronomiae Instauratae Mechanica* was thus likely to be found in a distinctive place: a royal court or a university. Here a book took its place and gained its meaning only amid a vast arsenal of other objects directed to similar ends. It would be encountered alongside natural curiosities, thaumaturgical wonders, mathematical devices, paintings, musical compositions, alchemical medallions, magical machines, and other books (fig. 1.6). In such surroundings, every aspect of appearance and handling mattered for creating an impact. The reader of such a work, in such a place, would be consciously engaging in a distinctive system of practices and ideas—in Tycho's case, feudal ones. The giving and receiving of such gifts was an important part of court culture, enmeshed in conventions of status recognition, reciprocation, and reward. This could not fail to affect the way in which that reader regarded the book. It was invested with enhanced credit, being untainted by "mechanick" influence, and it was accorded the privileged reception due to such a noble gesture.[21] The veracity of its contents warranted respect. They could not be dismissed without cost. Yet at the same time such a gesture all but commanded creative responses—including challenges—from suitably prestigious interlocutors. Tycho's book would now fall subject to the conventions surrounding philosophical and mathematical disputes in these settings. The variables that determined both whether a "scientific" debate would even take place, and, once battle had been joined, how it would proceed, were local ones: to whom one pre-

21. Westman, "Astronomer's Role." See also Hannaway, "Laboratory Design"; and compare Eamon, "Court, Academy and Printing House," 41.

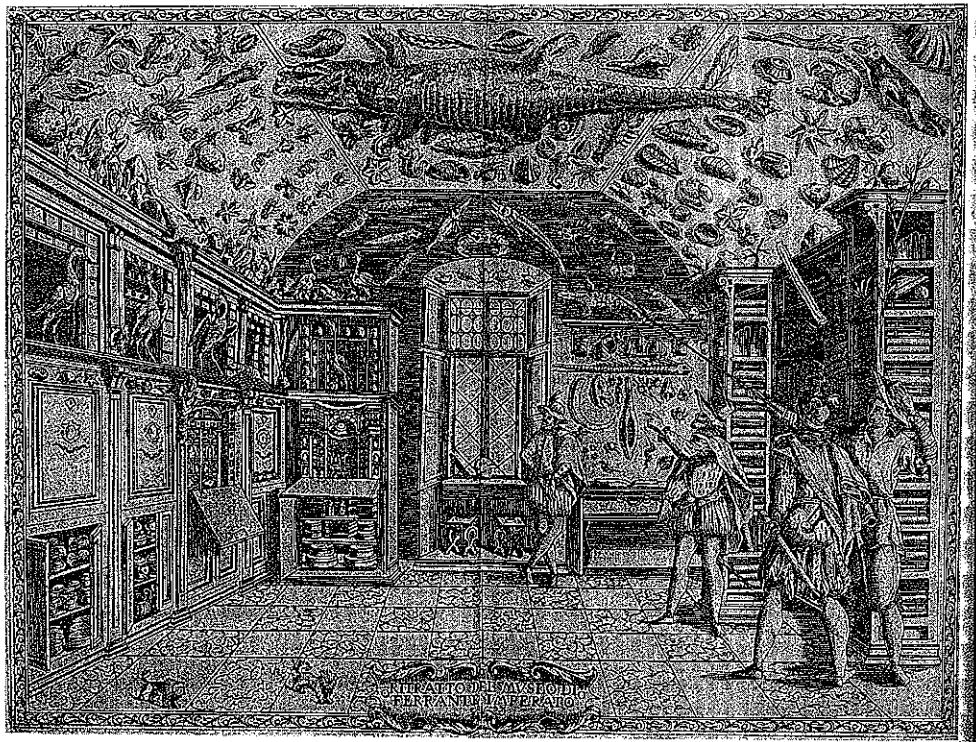


FIG. 1.6. The place of books in the cabinet of curiosities. In places like this—a museum of curiosities in Naples—books, along with crocodiles, fossils, and a panoply of natural and artificial marvels, served to facilitate conversation (see Findlen, "Courting Nature," 68-9). Imperato, *Historia Naturale*. (By permission of the Syndics of Cambridge University Library.)

sented the book, through which channels it was distributed, with which patron it was identified. Disputes like this were affairs of honor, conducted through appropriate intermediaries and champions. Printed books were their vehicles. That was what they were *for*.[22]

When, therefore, Tycho found himself attacked by Nicolai Reymers Baer (or Ursus), a recognized mathematician but a man of low birth whom he himself had accused of plagiarism, a scientific debate was not the principal outcome. Rather unusually, Tycho did in fact deign to reply himself. But

22. In addition to the works of Biagioli and Hannaway cited here, see Findlen, "Economy of Exchange"; Findlen, "Courting Nature," esp. 61; Moran, *Alchemical World*, esp. 9, 93–4, 97, 110–2; Smith, *Business of Alchemy*, 49–50; Daston, "Factual Sensibility"; and Davis, "Beyond the Market." Compare also the difficulties experienced by Becher in translating commercial documents for courtly readers: Smith, *Business of Alchemy*, 139.

he did so with a series of elaborately indignant letters to his fellows across Europe, which he had printed on his press at Uraniborg and circulated in 1596. In this correspondence he recited the tale of Ursus's alleged theft and argued that, whatever the date of Ursus's publication, Tycho had *printed* the cosmology first. Ever willing to recall his opponent's low birth, he even seems to have suggested that Ursus be executed for his presumption. But the more philosophical side of the dispute he delegated to a second, the relatively humble Kepler. The result was Kepler's "Defense of Tycho against Ursus," a remarkably sophisticated historical argument for the status of astronomical hypotheses and their creators. It was never printed.[23]

Much even of this story could be taken as reinforcing Eisenstein's image. However, two elements make it less confirmatory. The first is that Tycho was extremely atypical in his successful use of print. Other writers regarded him not as representative of their own situation, but as a model that they sought, with widely varying degrees of success, to emulate. Like most icons, he stood for an ideal that was unrealizable. The second is that, as his argument against Ursus implies, even Tycho himself found the ideal impossible to achieve. That was why he built his own printing house and paper mill: he discovered that he could not otherwise obtain acceptable materials and workmanship.[24] Even with these in place, moreover, most of his work remained unprinted until after his death.[25] Latour's preprinted forms, for example, seem to be mythical; Tycho did correspond extensively, but left no trace of having used such objects.[26] And while he began producing the images and descriptions for the *Astronomiae Instauratae Mechanica* as early as

23. Brahe, *Epistolarum Astronomicarum Libri*, 33–4, 148–51; Brahe, *Opera Omnia*, VI, 61–2, 179; Jardine, *Birth of History and Philosophy of Science*, 9–28 and passim (15 for Ursus's peasant background); Dreyer, *Tycho Brahe*, 183; Rosen, *Three Imperial Mathematicians*. Tycho's decision to strike at Ursus personally (which Kepler, for one, found surprising) may well be related to the fact that, as Hannaway points out, his status was feudal in origin; Tycho was not a courtier. See Hannaway, "Laboratory Design," 589 n. 11. For Tycho's conflicts see also Gingerich and Westman, *Wittich Connection* (which contrasts Tycho's treatment of Ursus to his response to the relatively well-born Wittich), and Thoren, *Lord of Uraniborg*. I am grateful to Robert Westman for conversations about this affair, which remains one of the more controversial among scholars of early modern astronomy.

24. Brahe, *Opera*, VI, 224, 365 n; VII, 214, 274; IX, 175; X, 302. Even with the mill in working order, he remained reliant on the cooperation of nearby parishioners to provide raw materials, as they were exhorted to do in regular "rag sermons."

25. In particular, the star catalogue (circulated only in manuscript until years after Tycho's death, and then inaccurately printed) and the *Astronomiae Instauratae Progymnasmata* (begun at Uraniborg, but completed only under the aegis of his heirs in 1602).

26. I have found no trace of these preprinted forms in Tycho's *Opera Omnia*, nor in any relevant secondary authority. I am also unable to find Latour's source for this central claim; it may well derive from an imaginative reading of certain passages in Eisenstein's *Printing Press*, e.g., 626–7.

1585, soon after building his printing house, the volume was not completed until thirteen years later. By that time he was in exile in Hamburg—the only place he could find with printers capable of finishing the book, even though he had brought his own press with him from Hven. Taken by his son to the Holy Roman Emperor, the book now became an instrument in Tycho's attempt to secure imperial patronage.[27] This proved successful, and he removed to Prague. But he soon discovered that even here, in the center of the empire, no printer able to undertake his prized star catalogue could be found. He was reduced to circulating hand-copied versions, and the catalogue remained unprinted on his death (fig. 1.7).[28]

At that point his works began to fall out of court circles altogether. They descended into the hands of the book trade. Even the *Astronomiae Instauratae Mechanica* was reprinted commercially. Such books were likely to be produced to different standards. They stood at risk of piracy and imitation, despite Rudolf II's stern commands forbidding such "printers' frauds." They were also likely to be read in different ways, by different people, in different places and for different reasons. Their accreditation became far more insecure. So, for example, the English astronomer royal, John Flamsteed—who, as we shall see, identified himself profoundly with Tycho—dismissed the posthumous printing of his star tables as, quite simply, a "fraud."[29] Tycho's inscriptions appear to have become distinctly mutable once they fell out of his control and left the courtly matrix (fig. 1.8).

If even Tycho Brahe found it so difficult to maintain his printed materials as mobile and immutable, what hope is there of explaining the achievements of less powerful figures in Eisenstein's terms? Attempting to do so would mean attributing to printed books themselves attributes of credibility and persuasion that actually took much work to maintain. It would thereby draw our attention away from important problems that any individual, even Tycho, had to overcome.[30] Talk of "print culture" is strangely ethereal when compared to Tycho's struggles. It stands oddly disconnected from the professed experiences of real historical figures. For example, who actually

27. Brahe, *Opera*, V, 317–8; VIII, 166, 177, 388.

28. Thoren, *Lord of Uraniborg*, 150, 185–7, 367, 381–97, 414–5, 421, 478. Tycho had planned to present the catalogue to Rudolf II on New Year's Day, apparently a customary occasion for gift-giving: Kaufmann, *Mastery of Nature*, 106. For Rudolf II's undertaking to provide a "new Uraniborg," see Brahe, *Opera*, VIII, 178, 188. It is also likely, of course, that Tycho's circulation of the catalogue in manuscript was intended to enhance its status as a collectible object.

29. Brahe, *Astronomiae Instauratae Mechanica* (1602); Curtius, *Historia Cœlestis*; Flamsteed, *Preface to John Flamsteed's "Historia Cœlestis Britannica,"* 99–100. For Rudolf's condemnation of "Typographorum fraudem," see Brahe, *Opera*, II, 9.

30. Compare Schaffer, "Eighteenth Brumaire," 178–92, on the concept of the "ideal reader."

printed (and reprinted) Tycho's pages? It is a question worth asking, since Tycho himself spent many frustrating years seeking suitable printers—and the astronomer Christoph Rothmann, at least, believed that Ursus had been able to plagiarize his world system because he had been employed in Tycho's printing house.[31] And how were those pages employed by their recipients? Of what use were they *to them?* How did Tycho ensure that such distant readers took them as authoritative, especially when, as was often the case in early modern testimony about celestial observations, they conflicted with figures produced locally? Eisenstein and Latour begin by decreeing such issues peripheral. *The Nature of the Book* does the opposite. If we are to understand how and why printed texts became trustworthy, it argues, we need to appreciate all of them, in something approaching their full "woof."

The disconnected air exhibited by Eisenstein's account is not accidental. In her work, printing itself stands outside history. The press is something "*sui generis,*" we are told, lying beyond the reach of conventional historical analysis. Its "culture" is correspondingly placeless and timeless. It is deemed to exist inasmuch as printed texts *possess* some key characteristic, fixity being the best candidate, and carry it with them as they are transported from place to place. The origins of this property are not analyzed. In fact, the accusations of technological determinism sometimes leveled against Eisenstein may even be wide of the mark, since she consistently declines to specify *any* position on the question of how print culture might emerge from print.[32] But the example of Tycho does suggest that the focus of her approach is *in practice* highly selective. The portrait it generates identifies as significant only the clearest instances of fixity. It regards instances when fixity was not manifested as exceptional failures, and even in the successful cases it neglects the labors through which success was achieved. It identifies the results of those labors instead as powers intrinsic to texts. Readers consequently suffer the fate of obliteration: their intelligence and skill is reattributed to the printed page. Tycho's labors deserve better. To put it brutally, what those labors really tell us is that Eisenstein's print culture does not exist.

There is an alternative. We may consider fixity not as an *inherent* quality, but as a *transitive* one. That is, it may be more useful to reverse our commonsense assumption. We may adopt the principle that fixity exists only inasmuch as it is recognized and acted upon by people—and not otherwise. The consequence of this change in perspective is that print culture itself is

31. Dreyer, *Tycho Brahe*, 184 n. 1.

32. Eisenstein, *Printing Press*, e.g., 159, 166–8, 609 n, 89–90, 702–3. See also Grafton, "Importance of Being Printed." The fact that Eisenstein is simultaneously too provincial (thus missing the contingent elements of print culture by her lack of a comparative perspective) and not local enough (thus missing the work needed to make print culture at all) may be inferred from Cohen's discussion in *Scientific Revolution*, 357–67.

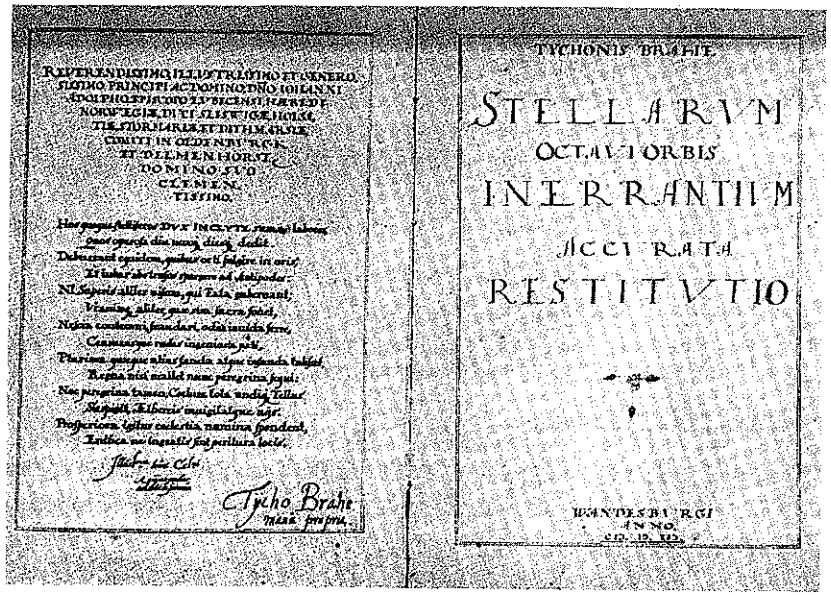


FIG. 1.7. Tycho Brahe's star catalogue, distributed in manuscript to princes and patrons. Note the careful imitation of a printed page. Reproduced from Norlind, *Tycho Brahe*, 297. (By permission of the Syndics of Cambridge University Library.)

immediately laid open to analysis. It becomes a *result* of manifold representations, practices and conflicts, rather than just the monolithic *cause* with which we are often presented.[33] In contrast to talk of a "print logic" imposed on humanity,[34] this approach allows us to recover the construction of different print cultures in particular historical circumstances. It recognizes that texts, printed or not, cannot compel readers to react in specific ways, but that they must be interpreted in cultural spaces the character of which helps to decide what counts as a proper reading. In short, this recasting has the advantage of positioning the cultural and the social where they should be: at the center of our attention.

If Tycho Brahe has hitherto been made the personification of print culture, then the experiences of his near-contemporary, Galileo Galilei, may in turn stand for this new approach. In 1610, Galileo produced the first of a series of dramatically successful books, called the *Sidereus Nuncius*. In vivid illustrations, he showed mountains and valleys on the surface of the Moon,

33. Compare the discussions of power in Latour, "On the Powers of Association," and Latour, "Technology Is Society Made Durable." This suggestion has obvious resonances with certain works in critical theory, such as Fish, *Is There a Text in This Class?* Since my aim is primarily historical I shall not be making many explicit links with such material, though the parallel deserves to be noted. Compare also McKenzie, *Bibliography and the Sociology of Texts*.

34. E.g., Kernan, *Printing Technology, Letters and Samuel Johnson*, 48 ff.

FIG. 1.8. Iconic representation of the preservation and publication of Tycho Brahe's manuscripts. The four Holy Roman Emperors shown are Rudolf II, Ferdinand II, Ferdinand III, and Leopold I. These respectively sponsored Tycho's writings (*paravit*), preserved and digested them into tables (*usurpavit*—which could also mean "usurped"), recovered them from Kepler's family and saved them from damage during the Thirty Years' War (*recepit*), and published them (*publicavit*). The motto dedicates the book to the emperors as rulers of the two realms represented by the globes—exerting dominion over the terrestrial world politically, and over the celestial by possession of these manuscripts. The imperial message is reinforced by Ferdinand II's gesture towards Hercules, always a symbol of Hapsburg aspirations. Ironically, the double meaning of the term *usurpavit* could well be apt: Curtius's manuscripts were actually very corrupt copies, which did Tycho's reputation no favors in the eyes of astronomers such as John Flamsteed. (Evans, *Making of the Habsburg Monarchy*, 332–4; McDonald, "Maximilian I"; Ashworth, "Habsburg Circle"; Dreyer, *Tycho Brahe*, 371–4.) Curtius [L. Barrettus, pseud.], *Historia Cœlestis*. (By permission of the Syndics of Cambridge University Library.)

and the discovery of new stars in Orion and the Pleiades (fig. 1.9). These and other "nebulous" regions—the Milky Way in particular—could now be resolved into stars. Above all, however, Galileo revealed four previously unknown satellites revolving about Jupiter, providing a vivid model of Copernican cosmology. This discovery, embodied in a small book, would soon establish him as the foremost philosopher on the Italian peninsula. Yet it