Technologies of Theatre

Joseph Furttenbach and the Transfer of Mechanical Knowledge in Early Modern Theatre Cultures

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New Perspectives on Early Modern Theatre Cultures

The centerpiece of the present volume is a theatre-technological manuscript from the early 17th century, until now more or less ignored by secondary literature. It offers in rare detail information about the technical *savoir-faire* of a series of historically important festival performances at the Medici court in Florence, including the 1608 pastoral *Il Giudizio di Paride* (*The Judgement of Paris*) and *La Liberazione di Tirreno* (*The Liberation of Tyrrhenus*), a combination of ballet and masked-ball (*veglia*), staged in 1617.[1] The manuscript, which contains a series of well-known images from Remigio Cantagallina (around 1582 – 1656) and Jacques Callot (1592 – 1635) as well as numerous technical sketches and drawings, can now be attributed to the city of Ulm's master mason and architecture theorist Joseph Furttenbach the Elder (1591 – 1667).[2] The manuscript is presented here in full and in English translation for the first time, accompanied by a selection of critical discussions, theoretical framings and historical contextualisations.

Theatre and stage technology owe their gradual dissemination from Italy to a form of competition between European courts, fought out by way of the arts, that began in Early Absolutism. The demonstrative expense of festival and theatre spectacles, alongside their depiction in pamphlets and festival literature, belonged to the symbolic media with which sovereigns could display their financial potency and political equality, if not superiority.[3]

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1 The manuscript consists of 4 sections divided according to content: (1) A description of the six *intermezzi* that were inserted into the pastoral *Il Giudizio di Paride*. This was staged by Michelangelo Buonnaroti the younger (1568 – 1646) and performed on the 25th of October and again on the 19th of November, 1608, in the Teatro degli Uffizi. This section also describes the machines used. (2) A description of the ships used in the sea battle staged on the Arno on the 3rd of November, 1608, under the title *Argonautica*. (3) A description of the Teatro Mediceo in connection with the performance of *La Liberazione di Tirreno* on the 6th of February, 1617. (4) A description of the horse ballet *Guerra di Bellezza* held in October of 1616 on the Piazza Santa Croce.

2 On this, see the detailed commentary in the new edition of the *Codex iconographicus 401* (ed. Hole Rößler, forthcoming).

3 On intercourt rivalry, see Volker Bauer. »Höfische Gesellschaft und höfische Öffentlichkeit im Alten Reich. Überlegungen zur Mediengeschichte des Fürstenhofs im 17. und 18. Jahrhundert«,

Joseph Furttenbach traveled to Italy between 1610 and 1620, which is to say during a time which theatre-historical research treats as pioneering for Early Modern European theatre. Free-standing, monofunctional theatre buildings emerged from hall theatres, the static book-wing proscenium stage became the movable stage with wing chariots and a backdrop.[4] Start and end dates of this development are given on the one hand by the Renaissance of Greco-Roman stage forms in the Teatro Olimpico in Vicenza (1580 – 1585) following the plans of Andrea Palladio (1508 – 1580) and Vincenzo Scamozzi (1548 – 1616) and on the other by the installation of a wing-stage in the Teatro Farnese in Parma (1617 – 1618) following plans by Giovanni Battista Aleotti (1546 – 1636). From the perspective of a discourse oriented toward historical innovation, which takes its narrative from art- and theatre-history interested primarily in stage forms and stylistic epochs, there is little of interest in Furttenbach's writings. As a result, he has until now been characterised by theatre-historical scholarship primarily as someone who resisted innovation.[5] However, one comes to different conclusions upon attending more closely to the specific strategies that Furttenbach used in transferring the knowledge he acquired in Italy into a confessionally-mixed and war-damaged German-speaking realm, and then using it to develop his designs.

Furttenbach's drawings of the Florentine Theatre, today preserved as the *Codex iconographicus 401* in the Bavarian State Library, arose during or shortly after his stay at the private art academy of Guilio Parigi (1571 – 1635) in Florence around 1617.[6] The pen of a student, uncertain in its graphical technique, offers in the

in: *Jahrbuch für Kommunikationsgeschichte* 5 (2003), pp. 29-68; Werner Paravicini and Jörg Wettlaufer (eds.), *Vorbild – Austausch – Konkurrenz. Höfe und Residenzen in der gegenseitigen Wahrnehmung. 11. Symposon der Residenzen-Kommission der Akademie der Wissenschaften in Göttingen*, Stuttgart: Thorbecke, 2010. Susanne Rode-Breymann has shown some of the consequences of this intercourt rivalry by studying the proliferation of Hell scenes. One would have to consider whether this proliferation corresponded solely to the desire for a symbolic expansion of the political sphere of power beyond terrestrial space, or if Hell did not become an obligatory stage motif precisely because it allowed for the performance of a number of stage-technological effects in rapid succession. Susanne Rode-Breymann, »In Charons Nachen. Die Unterweltszene in der Barockoper«, in: *Musik & Bildung* 6 (2000), pp. 24-32; Roswitha Jacobsen, »Theater als Medium höfischer Kommunikation«, in: *Daphnis* 42.2 (2013), pp. 467-489.

4 See Siegfried Albrecht, *Teatro. Eine Reise zu den oberitalienischen Theatern des 16. – 19. Jahrhunderts*, Marburg: Jonas Verlag, 2001.

5 See Stijn van Bruggen, »Bühnentechnik der italienischen Renaissance in Deutschland«, in: *Bühnentechnische Rundschau* 92.3-5 (1998), pp. 34-36, 48-52, 54-60.

6 We refer to a ›private art academy‹ insofar as the academy was located in Parigi's private living and working space. ›Art‹ is used here in the broad sense of the *artes mechanicae*. See Jutta Bacher, »Artes Mechanicae«, in: *Erkenntnis, Erfindung, Konstruktion. Studien zur Bildgeschichte von Naturwissenschaften und Technik vom 16. bis zum 19. Jahrhundert*, ed. by Hans Holländer, Berlin: Gebrüder Mann, 2000, pp. 35-49.

treatise-like drawings insight into the technical foundations of several Medici festivals that proved to be ground-breaking for European festival- and spectacle literature.[7] The emphasis in these drawings falls upon the stage-technology used in the performances, and what can be learned from it. Hence, the drawings are not recordings of Furttenbach's immediate impressions of the stagings (the creator of the images remains silent on the question of whether he was himself actually present at the stagings). Instead, the *Codex iconographicus 401* offers some indication of what Parigi taught in his academy, on what sort of technical knowledge was transmitted to architects, engineers and artists (on this, see the contribution from Hole Rößler in this volume). As well as providing insight manuscript into the functioning of advanced theatre technology, the manuscript poses the question of the mediation and transfer of theatre -technological knowledge, particularly with respect to Furttenbach's well-known texts on theatre and stage technology. This seems noteworthy to us not least because the name Furttenbach has long been associated in architectural history with the spread of architectural and engineering knowledge in southern Germany and central Europe, despite the fact that relatively little was known about the communicative, medial and material practices and logics of this transfer or its cultural and ideological context.

Joseph Furttenbach the Elder (1591 – 1667)

Joseph Furttenbach was born in 1591 in the imperial city of Leutkirch in Württemberg, the twentieth child of the patrician Hieronymus II. Furtenbach (1539 – 1596) and his second wife Clara Föls, of Konstanz.[8] His father, a forestry superintendent, was the head of the city council, the city treasurer and master mason of Leutkirch. At the age of 10, Joseph's mother sent him to the German school in Isny in the Allgäu, although he transferred back to the city chancery in Leutkich after only a few years. When he was approximately 16, Joseph traveled to Italy, in order to complete an apprenticeship as a merchant there. Members of

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7 See for example Claude-François Ménestrier, *Traité des tournois, joustes, carrousels et autres spectacles publics*, Lyon: Jean Muguet, 1669, p. 153 f.

8 On Joseph Furttenbach's biography, see: Margot Berthold, *Joseph Furttenbach (1591 – 1667). Architekturtheoretiker und Stadtbaumeister in Ulm*, unpublished Dissertation, München 1951. A condensed version of this study appeared in essay form: Margot Berthold, »Joseph Furttenbach von Leutkirch, Architekt und Ratsherr in Ulm (1591 – 1667)«, in: *Ulm und Oberschwaben. Zeitschrift für Geschichte und Kunst. Mitteilungen des Vereins für Kunst und Altertum in Ulm und Oberschwaben* 33 (1953), pp. 119-179. See also the new edition of the second (and only preserved) part of Furttenbach's diary-like »Lebenslauff«, based on recent scholarship: Joseph Furttenbach, *Lebenslauff 1652 – 1664*, ed. by Kaspar von Greyerz, Kim Siebenhüner and Roberto Zaugg, Köln a. o.: Böhlau, 2013.

his family enjoyed exceptionally intense trade relations with upper Italy. After a two-year stay in Milan, where he learned Italian (amongst other things), Joseph moved to Genoa, where he would remain for seven years (albeit interrupted by lengthy travels that would take him to Rome and also to Florence, where he stayed at least a year).

Italy stirred Furttenbach's interest in architecture and construction, and his stay there – originally conceived as a mercantile peregrination – was transformed into a *peregrinatio mechanica et militaris*.[9] Furttenbach, who had neither attended university nor a Latin school, sought access to «the most renowned Ingegnieri and their academies» (»zu den vornembsten Ingegnieri und in dero *Achademien*«), in order, as he formulated it in the foreword to his 1627 travel handbook *Newes Itinerarium Italiae*, »not only to hear the learned discourses there, but also to see if the latter would enable me to carry out and complete the work myself.«[10] In Genoa, he was introduced to the (Italian) arts of fortification architecture, the design of *castra doloris* (decorated catafalques), and perspectival construction by Paolo Rizio – »an excellent engineer whom God has gifted with understanding, of whom I can boast that he is my honored patron and instructor.«[11] Moreover, he also acquired in Genoa a certificate of apprenticeship in the *Arte de la Bombardieri*, this time from the artillery and pyrotechnics master Hans Veldhausen of Augsburg. Also important for Joseph – and not just for his role as theatre architect, stage engineer, and scenographer –, was his approximately year-long stay in 1617 at the private academy of Giulio Parigi (1571 – 1635) in Florence.

9 Jörg Jochen Berns, »Peregrinatio academica und Kavalierstour. Bildungsreisen junger Deutscher in der Frühen Neuzeit«, in: *Rom – Paris – London. Erfahrung und Selbsterfahrung deutscher Schriftsteller und Künstler in den fremden Metropolen. Ein Symposion*, ed. by Conrad Wiedemann, Stuttgart: Metzler, 1988, pp. 155-181. This discusses above all the literary results of travelling.

10 »allda nit allein ihre vernünfftige discursi zuhören/ sonder auch ein Muht zu fassen/ ob ich durch derselben befürderung/ die Werck selber führen unnd zu end bringen möchte.« Joseph Furttenbach, *Newes Itinerarium Italiae: In welchem der Reisende nicht allein gründtlichen Bericht, durch die herrlichste namhaffteste örter Italiae sein Reiß wol zubestellen, sonder es wirdt jhme auch […] beschrieben, was allda […] an fürstlichen Hoffhaltungen […] denckwürdig zu sehen […]*, Ulm: Saur 1627, foreword, unpaginated [fol.):( ):(r].

11 »ein von Gott mit Verstand hochbegabter trefflicher Ingegnier, den ich für mein hochgeehrten Patron und Lehrmeister berühme.« This is probably the today little-known engineer and cartographer Pier Paolo Rizzio. See Massimo Quaini, »Cartographic Activities in the Republic of Genoa, Corsica, and Sardinia in the Renaissance«, in: *Cartography in the European Renaissance* (*The History of Cartography*, vol 3), ed. by David Woodward, 2 vols., Chicago: Univeristy Press, 2007, Vol. 1, pp. 854-873, here p. 868 (with references). Reference is made to a drawing of Rizzio's in: Antoine-Marie Graziani (ed.), *Vistighe Corse. Guide des sources de l'histoire de la Corse dans les archives génoises*, 2 vols., Ajaccio: Piazzola, 2004, Vol. 2, p. 240.

Giulio, son of Alfonso Parigi the Elder (†1590) and student of Bernardo Buontalenti (1531 – 1608), came from a family of architects. He worked as an architect, painter, and festival organiser for the Medici.[12] In 1594, he became a member of the *Accademia del Disegno*, which was supported by the Medici and dedicated to the education of artists and architects. On several occasions, he held the academy's offices of consul and *festaiolo*, the stager of courtly festivals.[13] The little we know of Parigi's *Accademia* comes from scattered remarks in the artist biographies of Filippo Baldinucci (1625 – 1696). There, we read with respect to the content taught that »Giulio Parigi had opened a school – or perhaps we should say an academy – in which one reads Euclid and is instructed in mechanics, perspective, and the art of civil and military construction.«[14]

Between 1563 and 1638, the *Accademia delle Arti del Disegno*, founded by Co- simo I de' Medici (1519 – 1574), existed as an affiliation of artists and architects in the service of the Medici, but without its own grounds or academy buildings. The academy members committed themselves on the basis of certain principles to education and training in their workshops or *studioli*. Their students were not only residents of Florence, artists working there, and members of the nobil- ity, who acquired as potential patrons their own expertise at the academy; also studying at the academy were a number of foreign artists and architects. Even Parigi's private academy (which at least in its early years could have functioned like a satellite campus for the *Accademia del Disegno*) took in, besides artists, the sons of the Italian nobility as well. Their education was oriented less toward

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12 See Annamaria Negro Spina, *Giulio Parigi e gli incisori della sua cerchia*, Neapel: Società Ed. Napoletana, 1983; Daniela Smalzi, »Giulio Parigi architetto di corte: la progettazione dell'ampliamento di palazzo e piazza Pitti«, in: *Architetti e costruttori del barocco in Toscana. Opere, tecniche, materiali*, ed. by Mario Bevilacqua, Roma: De Luca Editori d'Arte 2004, pp. 69-88.

13 See Herrmann Schlimme, »Die frühe Accademia et Compagnia dell'Arte del Disegno in Florenz und die Architektenausbildung«, in: Ralph Johannes (ed.). *Entwerfen. Architekten- ausbildung in Europa von Vitruv bis Mitte des 20. Jahrhunderts. Geschichte – Theorie – Praxis*, Hamburg: Junius, 2009, pp. 326-343.

14 »Aveva Giulio Parigi eretta in casa sua una scuola, o vogliamo dire accademia, nella quale leggeva Euclide, insegnava le meccaniche, prospettiva, architettura civile e militare«. Quoted following Schlimme (as note 13), pp. 339 f. On the Early Modern education of architects, see Günther Binding's survey work *Meister der Baukunst. Geschichte des Architekten- und Ingeni- eurberufes*, Darmstadt: Primus, 2004; Johannes (as note 13) (unfortunately without discussion of the element of the architect's journeys). For Florence or upper Italy specifically, see: Mi- chael Kiene, »Das Berufsbild des Architekten im 16. Jahrhundert. Bartolomeo Ammanna- ti als letzter Dombaumeister und als Hofarchitekt in Florenz«, in: *Marburger Jahrbuch für Kunstwissenschaft* 26 (1999), pp. 157-187; Renata De Lorenzo, »Being an engineer and being an architect in eighteenth-century Italy: professional identity as a reflection of political fragmen- tation«, in: *Engineering Studies* 3.3 (2011), pp. 171-194.

an artistic-artisanal praxis, i. e. sketching and modeling, engraving or etching, than toward a theoretical and aesthetic education that would allow them to later adequately judge architectural and technical designs. The academy thus possessed some traits of a knight's academy.[15] Besides the Italian or Florentine architects, artists and scenographers who attended Parigi's academy were artists like Jacques Callot and Remigio Cantagallina, who contributed to the international renown of the Parigi School. Arthur Blumenthal concludes: »As a link between Bernardo Buontalenti (1535) and the seicento scenographer Giacomo Torelli (1608 – 1678), Parigi assisted in the creation of the Baroque Stage, in fact, of a whole era.«[16] Through Parigi, Furttenbach became acquainted with the functioning of the *periaktoi* (*Telari*) stage and its decoration elements, thus becoming familiar with a dynamic stage space organised to create the illusion of depth. Alongside the drawings contained in the *Codex iconographicus 401*, Furttenbach collected a large number of engravings and models that would later form the basis for his own design praxis (and then find their way into his own private *Kunstkammer*).[17]

In January of 1620, the now 29-year-old Furttenbach returned to Upper Swabia. The following year, he settled in Ulm, where he became a sort of manager for a local merchant.[18] In 1627, Furttenbach began his publishing career, which would make him famous in the German-speaking world as an architecture theorist equally well-versed in ship-building and theatre construction, in garden architecture and in the construction of fortifications and artillery. Before his death in 1667, Furttenbach authored more than a dozen treatises, rich with images, which were printed first in Ulm and then later in Augsburg and disseminated widely throughout the German-speaking world.[19]

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15 See Norbert Conrads, *Ritterakademien der Frühen Neuzeit. Bildung als Staatsprivileg im 16. und 17. Jahrhundert*, Göttingen: Vandenhoeck & Ruprecht, 1982.

16 Arthur R. Blumenthal, *Giulio Parigi's Stage Designs. Florence and the Early Baroque Spectacle*, 2 vols. PhD, New York University, 1984, Vol. 1, p. 1.

17 Joseph Furttenbach. *Architectura Privata Das ist: Gründtliche Beschreibung/ Neben conterfetischer Vorstellung/ inn was Form und Manier/ ein gar Irregular, Burgerliches Wohn-Hauß*, Augsburg: Remboldt and Schultes, 1641, p. 37 and 46.

18 Kaspar von Greyerz, »Joseph Furttenbach: Autograph, frommer Lutheraner, kultureller Mediator, Kunstkammer-Patron«, in: Furttenbach (as note 8), p. 18.

19 Appearing in quick succession were Furttenbach's description of his Italian journey (*Newes Itinerarium Italiae*, 1627), a book on artillery (*Halinitro Pyrobolia: Beschreibung einer newen Büchsenmeisterey*, 1627), and treatises on civil architecture (*Architectura Civilis*, 1628), ship-building (*Architectura Navalis. Das ist: Von dem Schiffgebäw/ auff dem Meer und Seekusten zugebrauchen*, 1629) and fortification (*Architectura Martialis. Das ist: Außführliches Bedencken/ uber das/ zu dem Geschütz vnd Waffen gehörige Gebäw*, 1630). After taking office as the master mason of Ulm in 1631, he published an universal-architectural text on civil and military construction (*Architectura Universalis. Das ist: Von Kriegs: Statt- und Wasser-Gebäwen*, 1635), a further tract on civil architecture (which also contained his well-known designs for a *periaktoi*

In comparison with the architecture-theoretical writings of his era, Furtten-bach's books are engagingly unacademic. They neither perform Vitruvius' exe-gesis, nor speculate on the orderings of columns. Instead, Furttenbach favors the knowledge of craftsmen and experience. Against the background of the Thirty Years War, his discussions are always directed toward the practical, contextually-determined implementability and immediate applicability of architectural know-ledge. A Lutheran, Furttenbach also outfitted his architectural program with the religiously-motivated promise of a wide-ranging *Recreation* (in the doubled sense of reconstruction and recovery) for a society damaged by the war. In 1631, Furttenbach was named the master mason of the city of Ulm, and in 1636 also elected to the Ulm City Council. Furttenbach achieved renown beyond the German-speaking world for his cabinet of curiosities or *Kunstkammer*, visited by countless locals and foreigners, which was located in the attic of his town house in Ulm, which he had built in 1640.

Before we discuss in what follows aspects of Early Modern technology trans-fer as exemplified by Furttenbach, one should first ask at a general level about the social and epistemological context of stage and theatre technology in their relationship to the technological knowledge of the *Artes mechanicae* and machine engineering. Here, the various functions of secrecy deserve special attention, in-sofar as they determined the conditions and possibilities for technology transfer in the Early Modern era and offer a means for understanding the state of the current sources.

Secrecy: Protection of Invention and Control of Reception

In looking back upon his time in Italy Furttenbach concludes that, with respect to the stagecraft knowledge of engineers, »particularly those in *Italia*, […] in

stage) (*Architectura Recreationis. Das ist: Von Allerhand Nutzlich: vnd Erfrewlichen Civilischen Gebäwen*, 1640), a text on the house he built in 1640 in Ulm (*Architectura Privata*, 1641), a further book on artillery (*Büchsenmeisterey-Schul*, 1643), a book on instruments (*Mechanische ReißLaden/ Das ist/ Ein gar geschmeidige/ bey sich verborgen tragende Laden*, 1644), and finally his most comprehensive work (*Mannhaffter Kunst-Spiegel/ Oder Continuatio, vnd Fortsetzung allerhand mathematisch- vnd mechanisch-hochnutzlich- sowol auch sehr erfrölichen Delectationen* […], 1663), in which he recapitulated once more all of his learning. Links to high-quality digital versions of all of Furttenbach's writings (as well as to the ten architectural tracts that he published under the name of his son, Joseph Furttenbach the Younger) and biographical sources have been collected by Hole Rößler at http://www.holeroessler.de/furttenbach.html. Until now, only a few passages on scenography and theatre construction have been translated into English and made available to non-German-speaking theatre scholarship. See Bernard Hewitt (ed.), *The Renaissance Stage. Documents of Serlio, Sabbattini and Furttenbach*, Coral Gables: University of Miami Press, 1958.

part such masters are reluctant to communicate the proper *modus* and keep many things confidential.«[20] Without addressing the reasons for this reticence, Furttenbach warns of the loss of knowledge threatened by such a state of affairs: »indeed, it is often buried in the earth together with the people.«[21] The tendency toward secrecy that Furttenbach observes is in point of fact a striking characteristic of Early Modern stage- and theatre-technology. Countless reports confirm that stagecraft knowledge was, for a long time, arcane knowledge linked strictly to individuals. To give just a few examples: during his educational journey, the noble-man Barthold von Gadenstedt (1560 – 1632) attended the *intermezzi* between the acts of the comedy *La Pellegrina*, staged in 1589 by Bernardo Buontalenti in the theatre of the Uffizi. He noted in his diary that his request to examine the machines more closely was treated dismissively: »We would have liked to have the opportunity to see how it was operated, but it was seriously forbidden to show it to anyone.«[22] The architect Andreas Boeckler (1617 – 1687), a friend of Furttenbach's, wrote to the latter in 1653 telling him he had seen in Regensburg the performance of an opera of Giovanni Burnacini (†1656). However, his request to inspect the machines used was also turned down: »Because the Italians are very envious and value their things very much, I was not able to see the machine.«[23] And, at the beginning of the 18th century, the architect Leonhard Christoph Sturm (1669 – 1719) was forbidden during his stay in Paris from inspecting more closely the *Salle des Machines* in the Tuileries, at the time the largest machine theatre. »I had thought that with the promise of good compensation I would have been allowed by the concierge to spend a whole day inside and take the measurements of everything, but my request was refused rather rudely.«[24]

20 »Wiewol ich aber selbert bekenne/ daß in dieser *Matteri* andere mehr hochberümbte/ und wolerfahrne *Architecti* noch auff den heutigen Tag/ Insonderheit aber in *Italia* gefunden wer-den/ […] daß zum theil solche Maister den rechten *modum* nit gern und so vertrewlich Je-dermänigklichen *Communicieren*.« Joseph Furttenbach, *Architectura Recreationis, Das ist: Von Allerhand Nutzlich: und Erfrewlichen Civilischen Gebäwen*, Augsburg: Schultes, 1640, p. 61.

21 »ja es wird offt gar mit sambt dem Menschen in die Erden vergraben.« Ibid.

22 »Wir hetten gern die gelegenheit wie solchs möchte regirt werdenn, aber es whar ernstlich ver-boten, das man solches niemand soll sehen lasenn.« Herzog August Bibliothek Wolfenbüttel, Cod. Guelf. 67.6 Extrav, pag. 678. Quoted following Werner Friedrich Kümmel, »Ein deut-scher Bericht über die florentinischen Intermedien des Jahres 1589«, in: *Analecta Musicologica* 9 (1970) (= Studien zur italienisch-deutschen Musikgeschichte, Vol. 7), pp. 1-19, p. 19.

23 »weilen die italiener gar neidisch und ihre sachen hoch halten, allso habe ich die *machina* nicht zu besehen kommen können.« Joseph Furttenbach, *Cronica oder historische Beschrei-bung, was sich in Ulm und etlichen anderen Orten […] verloffen und zugetragen hat*, Ms. 3 vols. (1620 – 1635/ 1635 – 1648/ 1649 – 1666), Stadtarchiv Ulm: H-Furtenbach 1-3, Vol. 3, pp. 89 f.

24 »Ich habe vermeinet mit Versprechung guter *Recompens* zu erhalten/ daß mir der *Concierge* nur einen gantzen Tag erlauben möchte darinn zu bleiben/ und alles abzumessen/ bin aber fast rüde mit meiner Bitte abgewiesen worden.« Leonhard Christoph Sturm, *Durch einen grossen Theil von Teutschland und den Niederland biß nach Pariß gemachete Architectonische*

Similarly, the striking lack of contemporary print sources on Early Modern theatre technology indicates a conspicuous lack of desire to make this technology public.[25] While visual depictions of spectacular stage effects were widely distributed in the 17th and 18th centuries, in numerous and occasionally quite opulent festival publications, the circulation of stagecraft knowledge in print form remained something of an exception. The small number of stage-technological writings of the 17th century confirm this impression[26]: precisely what they do *not* do is to distinguish themselves through the publication of important innovations. Instead, they document a general trend in the *Artes Mechanicae* towards the discursivisation and de-personalisation of tacit knowledge, and indicate the increasing codification of technical knowledge in all areas.[27] In theatre research, this state of affairs with respect to historical sources has led to a situation in which the spectacle propaganda of the courtly festival reports was held – at least by some – to be the reality of theatrical festivities of the Baroque era.[28] Against this backdrop, it seems necessary to study more closely the reasons and functions of secrecy.

During the Early Modern era, the vehemently-defended secrecy of technical knowledge was in no way restricted to the domains of stage- and theatre technology. Although attempts had been made since the 16th century, through the use of privileges from the authorities, to secure rights for inventors – at least within the borders of their territories – secrecy nonetheless remained the most secure means of protecting one's inventions and defending one's cultural

Reise-Anmerkungen, Augsburg: Wolff and Detleffsen, 1719, p. 53. On the widespread practice of allowing inspection in exchange for a small sum, see Michaela Völkel, *Schloßbesichtigungen in der Frühen Neuzeit. Ein Beitrag zur Frage nach der Öffentlichkeit höfischer Repräsentation*, München and Berlin: Deutscher Kunstverlag, 2007.

25 Carla Bino has already suggested that the conspicuous lack of theatre-technological sources in the case of Bernardo Buontalenti is the result of deliberate attempts at concealment. Carla Bino, »Macchine e teatro. Il cantiere di Bernardo Buontalenti agli Uffizi«, in: *Nuncius. Annali di storia della Scienza* 18.1 (2003), pp. 249-268, pp. 251 f. See also Isabella Innamorati, »I congegni segreti della meraviglia«, in: *Storia del teatro moderno e contemporaneo*, ed. by Roberto Alonge and Guido Davico Bonino, 4 vols., Turin: Einaudi, 2000 – 2004, Vol. 1, pp. 1139-1162

26 One should mention here Nicola Sabbattini's *Pratica di fabricar scene e machine ne' teatri* (1638), Joseph Furttenbachs scattered remarks on the transforming stage (*periaktoi*) and theatre machinery, above all in the *Architectura Recreationis* (1640) and the *Mannhaffter Kunstspiegel* (1663), and Fabrizio Carini Motta's treatise *Trattato sopra la struttura de'Theatri e scene* (1676) and *Costruzione de teatri e machine teatrali* (1688).

27 On the concept of tacit knowledge, which stems from Michael Polanyi, see Harry M. Collins, »What Is Tacit Knowledge?«, in: *The Practice Turn in Contemporary Theory*, ed. by Theodore R. Schatzki, Karin Knorr Cetina, and Eike von Savigny, London: Routledge, pp. 107-119.

28 Richard Alewyn, »Das große Welttheater«, in: Alewyn and Karl Sälzle (eds.), *Das große Welttheater. Die Epoche der höfischen Feste in Dokument und Deutung*, Hamburg: Rowohlt, 1959, pp. 9-70.

capital.[29] However, the reasons for keeping secret theatre machines (the cause of the rarity of corresponding sources) were different than those for water, mill, or military technology. The ›invisibility‹ of theatre machines before, during and after their use, beside their relatively infrequent codification in print and image, was motivated not solely by a fear that inventions could be stolen, but also through the expectation of a specific aesthetic and thus social and political productivity. This is the reason why, in Furttenbach's descriptions of Florentine theatre technology, he repeats again and again that the machines are hidden by decorative elements, with the result that »one cannot see how it works.«[30] In his *Pratica di fabricar scene e machine ne'teatri* (1637/1638), the first printed book about stage construction, theatre machines and decorations, the Italian architect Nicola Sabbattini (1574 – 1654) repeatedly names limitation of visibility as a relevant task for theatre construction and performance praxis. Sabbattini admonishes his readers that the understage is to be covered with boards on the side facing the audience, »so that the machines, or whatever else is used under the stage, cannot be seen by the spectators.«[31] Similarly, when changing the scenery, the *periaktoi*

29 On this, see Markus Popplow, »Erfindungsschutz und Maschinenbücher. Etappen der Institutionalisierung technischen Wandels in der Frühen Neuzeit«, in: *Technikgeschichte* 63.1 (1996), pp. 21-46; as well as Marcus Popplow, *Neu, nützlich und erfindungsreich. Die Idealisierung von Technik in der Frühen Neuzeit*, Münster: Waxmann, 1998, pp. 47-64; Pamela O. Long, *Openness, Secrecy, Authorship. Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance*, Baltimore and London: Johns Hopkins University Press, 2001; Daniela Lamberini, »Patents for Machines in Grand Ducal Tuscany and the Diffusion of Technical Knowledge in Europe, c. 1564 – 1640«, in: *Technik in der Frühen Neuzeit – Schrittmacher der europäischen Moderne* (= Zeitsprünge. Forschungen zur Frühen Neuzeit 8.3/4), ed. by Gisela Engel and Nicole C. Karafyllis, Frankfurt a. M.: Klostermann, 2004, pp. 356-375; Carlo Belfanti, »Guilds, Patents, and the Circulation of Technical Knowledge: Northern Italy During the Early Modern Age«, in: *Technology and Culture* 45.3 (2004), pp. 569-589. An overview of the existing research on strategies for concealing craft knowledge in the Early Modern era can be found in Karel Davids, »Craft Secrecy in Europe in the Early Modern Period: A Comparative View«, in: *Early Science and Medicine* 10.3 (2005), pp. 341-348. Koen Vermeir calls for a non-dichotomous understanding of the Early Modern concept of the secret, in particular for theatrical forms of openness. This also holds for the theatrical display of machines and technologies, for example in the *Theatra machinarum*. See Koen Vermeir, »Openness versus secrecy? Historical and historiographical remarks«, in: *The British Journal for the History of Science* 45 (2012), pp. 165-188.

30 »mann nit gewahr werden kan, wie es zuegeht.« Pag. 87/fol. 6ʳ. See also pag. 72/fol. 23ᵛ; pag. 80/fol. 11ᵛ; pag. 71/fol. 23ʳ. Barthold von Gadenstedt makes a similar remark regarding a flying triumphal chariot with Juno and a cloud filled with musicians in the third intermezzo to *La Pellegrina*: »for no one could tell how it was possible that such a thing could be controlled, or how such a thing could move about openly in the air.« Herzog August Bibliothek Wolfenbüttel, Cod. Guelf. 67.6 Extrav., pag. 674. Quoted following Kümmel (as note 22), p. 14.

31 »acciòche non vengano vedute da' Spettatori la Machine, ò altro, che dovera servire sollo il Palco«. Nicola Sabbattini, *Pratica di fabricar scene e machine ne'teatri*, Ravenna: Paoli & Giovannelli, 1638, p. 3.

had to be turned as quickly as possible, in order to prevent anyone from getting a glance behind the scenery.[32]

Furttenbach and Sabbattini attempted to summarise the aesthetic effect enabled by the spatial and optical distance from the machine with the concept of amazement, a term which was generally constitutive for the Early Modern discourse about machines.[33] According to Sabbattini, in order to produce enjoyment (»gusto«) or amazement (»maraviglia«), spectators must not be permitted to see how the cloud and flying machines rose up from the ground or descended from the (stage) heavens.[34] Likewise, Furttenbach writes that the mechanically produced movements and actions in the sky above the stage produced »amazement among the spectators.«[35]

In the courtly context of Baroque festivities, technically produced amazement served above all to display the magnificence of the prince. As such, keeping secret stage- and theatre-technological knowledge was a form of political affect control.[36] It is in this sense that Giovanni Battista Strozzi (1551 – 1634), author of the libretto to the fourth intermezzo of *Il Giudizio di Paride*, writes that the objective was to astonish (»far stupire«) every spectator through the elegance (»grandezza«) of the

32 See ibid., p. 77. As a result of its screening function, Furttenbach refers to the front pit with a term from fortification engineering: »Vorwerck« (outworks). This served, among other things, to ensure that »the astonished people, in part familiar with the craft, were unable to get too close to the scena, and thus could only look astonished upon what was happening.« Joseph Furttenbach, *Mannhaffter Kunst-Spiegel/ Oder Continuatio, und fortsetzung allerhand Mathematisch- und Mechanisch- hochnutzlich- So wol auch sehr erfrölichen delectationen, und respective im Werck selbsten experimentirten freyen Künsten*, Augsburg: Schultes, 1663, p. 115.

33 On this, see Jan Lazardzig, »Die Maschine als Spektakel. Funktion und Admiration im Maschinendenken des 17. Jahrhunderts«, in: *Instrumente in Kunst und Wissenschaft. Zur Architektonik kultureller Grenzen im 17. Jahrhundert*, ed. by Helmar Schramm, Ludger Schwarte and Jan Lazardzig, Berlin and New York: de Gruyter, 2006, pp. 167-193; and Jan Lazardzig, *Theatermaschine und Festungsbau. Paradoxien der Wissensproduktion im 17. Jahrhundert*, Berlin: Akademie, 2007, particularly pp. 36-49 and pp. 63-79.

34 »per il gusto, ò maraviglia, che ne prendono gli Spettatori, non vedendo come si nascondo le machine venendo da Terra, ò come uscendo dal Cielo esse calino à basso.« Sabbattini (as note 31), p. 127.

35 »verwundern der zuesecher.« See pag. 83/fol. 21ʳ, pag. 84*/fol. 21ᵛ. On amazement as the goal behind using theatre machines, see also Furttenbach (as note 20), pp. 63, 67, 69. The concentration on the »amazement« of the intermezzi had poetological consequences; this is suggested in Anton Francesco Grazzinis Madrigal »La Commedia che si duol degli Intermezzi«, where the»Komödie« complains that she is being mistreated by the intermezzi and threatens to die because the spectators are interested in nothing other than the staged wonders of the intermezzi. See Carlo Verzone (ed.), *Le rime burlesche edite e inedite di Antonfrancesco Grazzini detto il Lasca*, Florenz: Sansoni, 1882, p. 229.

36 Roy Strong, *Art and Power. Renaissance Festivals 1450 – 1650*, Woodbridge: Boydell, 1984, pp. 39 f. and passim.

intermezzi.[37] On this basis, the letter written by the Mantua engineer Gabriele Bertazzolo (1570 – 1620) to his duke Vincenzo Gonzaga (1562 – 1612), in which the former reports in great detail on failed as well as successful uses of theatre machinery, is to be read not just as aesthetic criticism, but also as information about the technical state of the symbolic politics at a competing court.[38] Similarly, the maestro di casa Cosimo Gianfigliazzi remarks in a report also intended for Vincenzo Gonzaga that although the performance was nice, the machines used were no comparison in »size« (»grandezza«) or »mastery« (»Maestria«) to those used in March of the same year during the festivities surrounding the wedding of Francesco Gonzaga and Margherita von Savoyen.[39]

Locating the aims of the courtly theatre spectacle in the representation of cultural capital and thus of financial and political potency not only justifies the rapid development of theatre machinery from the second half of the 16th century to the middle of the 17th century: it also explains the relative narrowing of interest in their effects to the capacity to produce amazement. This was held to be the mildest sentiment, and thus the one that corresponded best in the spectrum of affects to the courtly demand for discipline.[40] As such, it would be misguided to take as one's point of departure a simple equivalence of theatre machinery and affective control.[41] Instead, the desired (and attainable) effects

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37 »Che'l fin degli intermedi si puo dir che sia il far con la grandezza loro stupire ciaschedun riguardante.« Giovanni Battista Strozzi, »[Prescrizioni per Intermedi]/[Prescriptions for Intermedi]« in: Claude V. Palisca, *The Florentine Camerata. Documentary Studies and Translations*, New Haven and London: Yale University Press, 1989, pp. 220-225, here p. 224.

38 See Angelo Solerti, *Musica, Ballo e Drammatica alla Corte Medicea dal 1600 al 1637. Notizie tratte da un Diario con appendice di testi inediti e rari*, Florenz: Bemporad, 1905, pp. 55 f. Bertazzolo had staged a sea battle for the wedding of Francesco Gonzaga and Margherita von Savoyen that took place in March of the same year, and was as a result sent to the Florentine court as a ›specialist‹ and observer. On this, see Paolo Carpeggiani, »Studi su Gabriele Bertazzolo. I: Le feste fiorentine del 1608«, in: *Civiltà Mantovana* 12 (1978), pp. 14-56. On the significance of the Mantuan spectacle for Florentine festivals, see Tim Carter, »A Florentine Wedding of 1608«, in: *Acta Musicologica* 55.1 (1983), pp. 89-107; Sara Mamone, *Déi, semidei, uomini. Lo spettacolo a Firenze tra neoplatonismo e realtà borghese (XV – XVII secolo)*, Rom: Bulzoni, 2003, pp. 126-147.

39 »[…] le macchine non si possono agguagliare nè di grandezza nè di maestria.« Lettera di Cosimo Gianfigliazzi a Vicenzo Gonazaga (Florenz, 23.09.1608). Archivio di Stato Mantova, Fondo Gonzaga, b. 1126. Zit. n. Carpeggiani (as note 38), p. 33.

40 On the political function of wonder and amazement in courtly culture, see Lorraine Daston and Katharine Park, »Wonders at Court«, in: *Wonders and the Order of Nature, 1150 – 1750*, New York: Zone Books, 1998, pp. 100-109. Also amazing is that theatre plays no role in such an influential study.

41 As, for example, in Erika Fischer-Lichte, »Repräsentation und Erregung von Affekten. Zu Techniken der Schauspielkunst und der Theatermaschinerie im 17. Jahrhundert«, *Imagination und Repräsentation. Zwei Bildsphären der Frühen Neuzeit*, ed. by Horst Bredekamp, Christiane Kruse and Pablo Schneider, Paderborn: Fink, 2010, pp. 219-233, here p. 231.

of machinery were limited to amazement not least because Early Modern court theatre, in contrast to the moral-didactic intentions of religious school theatre, did not seek an intense emotional excitation from its spectators.[42]

Insofar as the machine-wonders of the theatre functioned for quite some time essentially as an instrument of and for princely representation, one can understand why the secrecy of theatrical machinery and stagecraft knowledge served engineers as more than just a means of securing their personal cultural capital and thus their appointments and patronage. The primarily political aim of emotional effects on the audience could only be reached through an unconditional novelty of stage-technological effects.[43] One hears echoes of the resulting imperative of originality in Julius Bernhard von Rohr's (1688 – 1742) 1729 *Ceremoniel-Wissenschafft der großen Herren*: »As soon as one play has ended, new masks, scenes, machines and decorations – along with other things necessary for the art of deception – are produced, in order to give the world another theatrical performance.«[44] Conversely, the stage spectacle risked missing its target when its effects were known in advance. Hence, everything depended upon preventing its mechanical fundaments from becoming public knowledge.[45]

42 Deliberate limitation of the intended emotional effects of the flying machines to amazement can also be shown for the early private opera houses. As such, according to the dramatist Andrea Pertucci (1651 – 1704), who worked for the Teatro San Bartolomeo in Naples, it was one of the architect's tasks to ensure that the »flights and machines were impressive, majestic, and worthy of admiration.« »I voli, e le machine spetta ordinarli agli Architette, ne prederanno l'aura dal Poeta, acciò che siano vaghi, sicuri, maestosi & ammirabili […].« Andrea Perrucci, *Dell'arte rappresentativa premeditata, ed all'impoviso parti due*, Neapel: Mutio, 1699, p. 31. These »beautiful curiosities« (*belle stravaganze*) could be admired (*hanno ammirato*) in the theatres in Venice, Rome, Naples, Milan, Bologna, Parma, Florence, Palermo, and other locations. Ibid., p. 137.

43 According to Michel de Pure (1620 – 1680), two types of novelty are responsible for the aesthetic charm, the doubled »beauty« of theatre machines: on the one hand, »the surprising appearance of novel objects« (»la suprise des nouveaux objets«), on the other, »the invention of actions and movements« (»l'invention des ressors & des mouvemens«). Michel de Pure, *Idée des spectacles anciens et nouveaux*, Paris: Brunet, [1668], pp. 301 f. See Lazardzig, »Maschine als Spektakel« (as note 33), pp. 177 f. In the ›anthropological‹ theory of the 17th century, the affect of amazement was generally held to be a reaction to the novelty of a perceived object. On this, see Hole Rößler, *Die Kunst des Augenscheins. Praktiken der Evidenz im 17. Jahrhundert*. Münster: Berlin: Lit, 2012, pp. 83-93.

44 »Ist ein Schauspiel geendiget, so werden schon neue Masquen, Scénen, Machinen, Decorationen, und andere zur Verstellungs-Kunst benöthigten Dinge ausgearbeitet, um der Welt ein abermahliges Schau-Spiel vorzustellen.« Julius Bernhard von Rohr, *Einleitung zur Ceremoniel-Wissenschafft Der großen Herren*, Berlin: Rüdiger, 1729, pp. 806 f.

45 In this regard, the theatrical machine resembles military technology and fortification architecture, which only provide an advantage insofar as they remain unknown to the enemy. Furttenbach himself reports that travelers who recorded fortifications (either in words or images) had to reckon with draconic punishments. Furttenbach (as note 10), p. 39. See Lazardzig, *Theatermaschine und Festungsbau* (as note 33), pp. 114 f.

This held in particular, as Leonhard Christoph Sturm remarked in his introduction to machine technology, for publication in book form. First printed in 1702 and intended explicitly for laypersons and their need for (courtly) conversational knowledge, Sturm's text remarks that »one could easily fill an entire book with artful *Inventionibus Mechanicis*, […] capable of producing amazing effects in the *Theatro*. However, the latter diminish greatly in value as soon as they become known in books.«[46] The author's reference to the danger of inflation present in the circulation of knowledge constitutes the brevity of his own remarks. Additionally it confirms that the aesthetic effect of the theatre machine and the political-social productivity that depended upon it was only attainable insofar as the machine itself remained hidden. The value of theatre-technological knowledge, in its dependency upon exclusivity, was the object of a comedy written by Gian Lorenzo Bernini (1598 – 1680) around 1644. The cause of the comedy's dramatic conflict are the attempts of various figures to coax from the ›theatre engineer‹ Gratiano the secrets to constructing his machines. Their demonstrative superficiality and dysfunctionality in other regards are an unconcealed critique of the machine-fixation of the courtly theatre audience. Admittedly, Gratiano himself is fixated upon the utmost secrecy, which is why he has the machines be constructed at a location where no one can see them, particularly no members of the court. For »if they have been seen even once, they are no longer beautiful.«[47]

The conception of technical ignorance as the basic condition of the affective success of theatre machinery remains discernible even where this form of theatre aesthetics is called into question. Luigi Riccoboni (1676 – 1753) for example, in his 1738 *Réflexions historiques et critiques sur les différens théâtres de l'Europe*, makes knowledge of the mechanical origins of effects the precondition of a (desirable) disillusionment: »One must constantly call to mind the construction of the stage, and recall that that which one sees has been produced by beams, ropes,

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46 »Mit artigen *Inventionibus Mechanicis*, die auf dem *Theatro* verwunderliche Würckungen thun können/ […] wäre leichtlich ein gantzes Buch auszufüllen/ wiewol dieselbigen/ so bald sie in Büchern bekannt würden/ ihren Werth sehr verlieren müßten.« [Leonhard Christoph Sturm], *Das Neu-eröffnete Rüst-Zeug oder Machinen-Haus* (= Des eröfneten Ritter-Platz. Anderer Theil), Hamburg: Schiller, 1710, p. 55. The first edition appeared in 1702 under the title *Das neueröfnete Machinen-Hauß*. On this, see Marcus Popplow, »Popularisierung von Technik um 1700. ›Das neu-eröffnete Machinen-Hauß‹ von Leonhard Christoph Sturm«, in: *Technikvermittlung und Technikpopularisierung. Historische und didaktische Perspektiven*, ed. by Lars Bluma, Karl Pichol and Wolfhard Weber, Münster anda.: Waxmann, 2004, pp. 171-196, here p. 171.

47 »[N]on voi che nessun le veda. Se mi le fazess … tener qui cortezzan che non vedess; e si quand se sann non son più belle.« Gian Lorenzo Bernini, *Fontana di Trevi. Commedia inedita*, ed. by Cesare d'Onofrio, Rom: Staderini, 1963, p. 51. On the motifs and context of Bernini's comedy, see also the introduction to the English translation: Gian Lorenzo Bernini, *The Impressario*, trans. and introduced by Donald Beecher and Massimo Ciavolella, Ottawa: Dovehouse, 1994, pp. 5-28.

iron and counterweights, in order to protect oneself from the deception of the senses which tell us that that which we see is true.«[48] While the poet and the engineer go to every length to make the spectator forget that the effects are the product of machines, the latter must be enjoined to remember exactly this.[49]

If these theatre machines belonged to the realm of *arcana artis*, which had to be protected at all costs as part of the costly cultural competition between European courts, then their unveiling must be an act of political enlightenment. For this reason, it is not to be understood solely as a display of technological knowledge when, in 1722, the 10th volume of the French *Encyclopèdie* showed in no less than 49 plates the form and functioning of theatre machines.[50] This does not necessarily have to be understood as ›popularisation‹, but at the very least as a sign of the gradual erosion of the princely monopoly on knowledge.[51]

Beside the factor of secrecy, relevant for the ›micro‹ level (i. e., for local theatre cultures), one can find on the macro-level a further reason for the relative poverty of sources confronting the scholar of Early Modern theatre technology. This is the rarity of this technology. Baroque scholarship, through its particular interest in courtly festival culture, has created the impression that theatre was at the center of court culture. For the German speaking world, Richard Alewyn's extraordinarily influential 1959 study *Das große Welttheater* not only called atten-

48 »[…] l'on a souvent besoin de se rappeler la construction du Théâtre, & que l'on voit est porté par des poutres, des cordages, des fers & des contrepoids, pour se défendre de l'illusion de nos sens, qui nous persuade que ce que nous voyons est véritable.« Luigi Riccoboni, *Réflexions historiques et critiques sur les différens théâtres de l'Europe*. Paris: Guerin, 1738, p. 44.

49 »[…] c'est alors que le Spectateur a besoin de se rappeler qu'il est au Théâtre, & que ce qui arrive n'est qu'un effet des Machines & de la construction; mais c'est en même-temps ce que le Poëte & le Machiniste devroient tâcher de lui faire oublier.« Ibid., p. 46. The extent to which one could speak of before the 18th century of a ›competition‹ between theatre engineers and the curious public regarding the concealment or disclosure of theatrical machines requires further investigation (see Massimo Ossi, »»Dalle macchine … la maraviglia‹. Bernardo Buontalenti's ›Il rapimento di Cefalo‹ and the Medici Theater in 1600«, in: *Opera in Context. Essays on Historical Staging from the Late Renaissance to the Time of Puccini*, ed. by Mark A. Radice, Portland: Amadeus, 1998, pp. 15-35 and 297-305, here p. 16). For the 16th and 17th century, at least, it is questionable whether the available sources justify the assumption of such a ›competition‹. The critique of the machine that one finds in Riccoboni, directed at this time above all against French opera, would increase in the course of the 18th century. On this, see Alois Maria Nagler, »Maschinen und Maschinisten der Rameau-Ära«, in: *Maske und Kothurn* 3.2 (1957), pp. 128-140.

50 Denis Diderot et al. (eds), *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, Paris anda, 1751 – 1780, *Receuil de planches*, Vol. 10 (1772), pp. 56-108. On this, see also Lazardzig, *Theatermaschine und Festungsbau* (as note 33), pp. 58 ff. Gabriel Pierre Martin Dumont is also to be understood from this perspective: *Parallèle de plans de plus belles salles de spectacles d'Italie et de France, avec des détails de machines théatrales*, Paris: Dumont, [ca.1774].

51 On the motif of disclosure in technical writing, see also Popplow (as note 46), pp. 188 f.

tion to the significance of festival and theatre at European courts for the cultural constitution of the Early Modern era, but also contributed to the creation of an image of the ubiquity and permanence of theatre that persists to this day. In the meantime, a great number of individual studies have added considerable nuance to this image, and a sense revised it. What has become clear is above all that performances in dedicated theatre structures and the use of elaborate theatre machines remained relative rarities before the 18th century. As such, they typically took place only within the framework of unique festivities, mostly court weddings. The *Teatro Mediceo*, opened in 1586, saw in the period between then and 1641 barely a half dozen performances before the theatre was closed, the room renovated and adapted for a different use.[52] The *Teatro Farnese* in Parma, built after the plans of Giovanni Battista Aleotti (1546 – 1636), was opened in 1618, but first used for a performance only in 1628. By 1732, only nine performances had taken place there.[53] Similarly, the *Salle des Machines* remained unused between 1662 and 1671, and then again until 1720.[54] With respect to the theatre at German courts in the 17th century, Ute Daniel reaches the sobering conclusion that: »one can in no way speak of continual operation.«[55] It was the commercial opera houses in Venice that first began to offer, from the second third of the 17th century onward, elaborate technology in regular performances.[56]

52 See Annamaria Testaverde Matteini, *L'officina delle nuvole. Il Teatro Mediceo nel 1589 e gli ›Intermedi‹ del Buontalenti nel ›Memoriale‹ di Girolamo Seriacopi* (= Musica e Teatro. Quaderni degli Amici della Scala 11/12), Mailand: Associazione Amici della Scala, 1991, pp. 150-154.

53 See Irène Mamczarz, *Le théâtre de Parme et le drame musical italien (1628 – 1732). Étude d'un lieu théâtral, des représenations, des formes. Drame pastoral, intermèdes, opéra-tournoi, drame musical*, Florenz: Olschki, 1988.

54 See Barbara Coeyman, »Opera and Ballet in Seventeenth-Century French Theaters. Case Studies of the Salle des Machines and the Palais Royal Theater«, in: *Opera in Context. Essays on Historical Staging from the Late Renaissance to the Time of Puccini*, ed. by Mark A. Radice, Portland: Amadeus, 1998, pp. 37-71, here p. 47 and 55-60.

55 Ute Daniel, *Hoftheater. Zur Geschichte des Theaters und der Höfe im 18. und 19. Jahrhundert*, Stuttgart: Klett-Cotta, 1995, p. 72. As such, one must raise an eyebrow upon reading in a more recent study that the »baroque opera house« (already both terminologically and architecturally a problematic category) was a relevant factor in the cultural attractiveness of a region and its economic development, without any consideration of the sometimes drastic variations in frequency of use. See Oliver Falck, Michael Fritsch and Stephan Heblich, »The Phantom of the Opera. Cultural Amenties, Human Capital, and Regional Economic Growth«, in: *Labour Economics* 18 (2011), pp. 755-766. Moreover, it remains incomprehensible why Furttenbach's school-theatre stage (falsely said to have a fixed ensemble) is treated as an »opera house«, while Gotha, out of apparent ignorance of the local theatre in Friedenstein Castle, is placed in the comparison group of regions without »opera houses«.

56 Ellen Rosand, *Opera in Seventeenth-Century Venice. The Creation of a Genre*, Berkeley, Los Angeles, Oxford: University of California, 1991, pp. 66-109, particularly p. 104.