THE UTOPA BAROQUE ORGAN

ORGELPARK RESEARCH REPORTS
VOLUME 5/PART 2
5/2

VU UNIVERSITY PRESS

ORGELPARK

THE UTOPA BAROQUE ORGAN

at the Orgelpark

Orgelpark Research Report 5/2

SECOND EDITION (2020)

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VU UNIVERSITY PRESS

VU University Press
De Boelelaan 1105
1081 HV Amsterdam
The Netherlands

www.vuuniversitypress.com
info@vuuitgeverij.nl

ISBN 978 90 8659 781 9
NUR 664

Orgelpark Research Report 5/2

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Orgelpark Research Reports

Practical information

Orgelpark and VU University

The Orgelpark is a concert venue in Amsterdam. Its aim is to integrate the organ into musical life in general. The Orgelpark initiated the Orgelpark Research Program in 2008.
The Orgelpark Research Reports are published in cooperation with the Chair Organ Studies at VU University Amsterdam.

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Orgelpark Research Report 5/2

Introduction

The Utopa Baroque Organ

The Orgelpark is equipped with organs suited for historically informed/inspired performances of 15th/16th century music (the Van Straten Organ), 17th/18th century music (the Utopa Baroque Organ) and 19th/20th century music (the Sauer Organ, the Molzer Organ, and the Verschueren Organ). Two of these instruments share, next to their historical keydesks, a "digital interface" in the form of a three manual movable console: both the Sauer Organ and the Utopa Baroque Organ can be played on it.

Core team and Reference Group

The Utopa Baroque Organ was built under the supervision of a team comprised of six members: chairman Loek Dijkman (chair of the Utopa Foundation), Sylvia de Munck (vice-chair of the Utopa Foundation), Johan Luijmes (Artistic Director of the Orgelpark), Hans Fidom (researcher at the Orgelpark, Professor of Organ Studies at VU University Amsterdam), Peter Peters (researcher at Maastricht University), and Hans Elbertse (organ builder). A Reference Group was set up as well, in which organ builders, musicians, composers, musicologists, art historians, philosophers etc. took part. Orgelpark Research Report 5 documents the backgrounds of the Utopa Baroque Organ project.

Research Report 5/1

In October 2013, the Orgelpark published a first press release about the plan to build a "New Baroque Organ", as the Utopa Baroque Organ was called until early 2018. In order to develop its concept as transparently as possible, the Orgelpark dedicated several colloquia and symposia to it in 2014, 2015, and 2016. Orgelpark Research Report 5/1, published in 2014, documents ten extended versions of lectures presented at the first ones of these events,

including articles on musical and aesthethical aspects of the project, the way the organ might be tuned, and the way electronic sounds might be integrated in the music to be made with the instrument.

Research Report 5/2

This is Part 2 of Orgelpark Research Report 5. It presents an extended text documenting the building process of the organ by Hans Fidom. Furthermore, this Report contains three texts by Ibo Ortgies. As an expert in the domain of tuning and temperament, the Orgelpark assigned Dr Ortgies to develop solutions regarding the temperament of the Utopa Baroque Organ, and the composition of its Cymbelstern. Furthermore, the Orgelpark assigned Ortgies to document the archival sources regarding organ builder Zacharias Hildebrandt (c. 1688-1757), as a first step towards an online database, meant to become a strong knowledge resource for all research regarding the Utopa Baroque Organ; and to help safeguarding and preserving valuable historical documents. The Utopa Baroque Organ is inspired by Hildebrandt's organs in many respects.
Randall Harlow also was a member of the Reference Group. Closely involved in the conception and the development of the Utopa Baroque Organ from the very start, and strongly inspired by it, he took a next step in his seminal research into "hyperorgans", the term he coined for organs such as the Utopa Baroque Organ. A quote: "Let the Utopa Baroque Organ and its handful of peers be the first step toward a global network of hyperorgans engaging and enriching the lives of expert performers and composers, amateur musicians and lay citizens, children and the mobility impaired alike through music, both old and new - becoming immersed in new acoustic music ecologies."
Very important regarding fine-tuning our ideas about the Utopa Baroque Organ was Prof Dr Peter Williams. He followed the project with great interest. On the occasion of the International Orgelpark Symposium in 2014, he gave a lecture on "Bach and the Organ" in general, warning us not to jump to conclusions; we know a lot about Bach, and yet so little. As a result, the Orgelark decided to never ever call the Utopa Baroque Organ a "Bach Organ". Yet we of course welcomed Dr Williams' suggestion that Bohemian baroque organs might have been instruments Bach might have liked. Again a quote: "On his visits to Carlsbad, did Bach show no interest in the local Habsburg organs? - elegant, handsome, distinctive, well-made, fulltoned with colourful flue stops." We like to think that these characteristics apply rather well to the Utopa Baroque Organ as well.
Peter Williams died on 20 March 2016; we regret deeply not to be able to enjoy and discuss the sound of the Utopa Baroque Organ with him.

Abstracts and biographies

Each contribution to the Orgelpark Research Reports is followed by an abstract and a short biography of the author.

XI

Hans Fidom - The Utopa Baroque Organ at the Orgelpark

The Utopa Baroque Organ was inaugurated on 21 March, 2018. It is named after the Utopa Foundation, which initiated the Orgelpark in 2003. The objective of the Utopa Foundation is "to stimulate and promote the creative talent of people, particularly those whose potential goes unrecognised, for whatever reason."[1] The Orgelpark aims at integrating the organ into musical life by presenting it in new ways.
Therefore, the new Utopa Baroque Organ is more than "just" another baroque organ. It has a dual function: to facilitate historically informed / inspired performances of baroque organ music, more specifically the music of Johann Sebastian Bach, and to inspire composers and musicians to create new music. This article describes how each element of the organ came into being, which decisions had to be made and on what basis.

A "new" baroque organ

The idea of building a new organ in the Orgelpark was discussed for the first time in December 2012. As historically informed / inspired performances of both 15th / 16th century music and 19th / 20th century music had repeatedly proved successful in the Orgelpark, not the least thanks to the Gerritsz organ reconstruction (the "Van Straten organ", built by Orgelmakerij Reil in 2012[2]), the Aristide Cavaillé-Coll-inspired Verschueren organ (2009) and the restored Sauer organ (1922 / 2006), the dream to add an organ of comparable

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1 Website: www.utopa.nl. The Utopa Foundation initiated not only the Orgelpark, but also the Sculpture Gallery "Het Depot" in Wageningen (www.hetdepot.nl) and the "Utopa Weeshuis" in Leiden (www.utopa-weeshuis.nl).

2 Orgelpark Research Report 4 is dedicated to this instrument.

historic quality for 17th and 18th century music, especially that of Johann Sebastian Bach, became ever stronger.
In the spring of 2013, the board of the Orgelpark decided to build such an organ, with the proviso that it should inspire new music as well. Half a year later, in October, the Orgelpark published a first press release about the plan to build a "New Baroque Organ", as the Utopa Baroque Organ was called until early 2018. In order to develop its concept as transparently as possible, the Orgelpark dedicated several colloquia and symposia to it in 2014, 2015, and 2016. Orgelpark Research Report 5/1 (2014) includes extended versions of lectures presented at the first ones of these occasions. Furthermore, the Orgelpark developed a blog, aimed at including anyone interested in joining in the discussion. The responses via this portal remained limited.
The project became the responsibility of a "core team" comprised of six members: chairman Loek Dijkman (chair of the Utopa Foundation), Sylvia de Munck (vice-chair of the Utopa Foundation), Johan Luijmes (Artistic Director of the Orgelpark), myself (researcher at the Orgelpark, Professor of Organ Studies at VU University Amsterdam), Peter Peters (researcher at Maastricht University), and Hans Elbertse (organ builder).
A Reference Group was set up as well. It consisted of experts who both spontaneously, and following invitation, offered their thoughts, advice and criticism and, in doing so, assisted the decision-making process. The group included, to name just the most influential ones, musicians/organists/composers Michael Bonaventure, Franz Danksagmüller, David Franke, Hans-Ola Ericsson, Robert van Heumen, Anne La Berge, Carl-Adam Landström, Jacob Lekkerkerker, Hampus Lindwall, Peter Planyavsky, Wouter Snoei, René Uijlenhoet, and Ansgar Wallenhorst; the organ builders Kristian Wegscheider and Gerald Woehl; colour expert Hilke Frach-Renner; and the scholars Fabienne Chiang, Marcel Cobussen, Randall Harlow, Koos van de Linde, Kimberly Marshall, Ibo Ortgies, James Wallmann, and Peter Williams. Peter Williams died on 20 March 2016; we regret deeply not to be able to enjoy and discuss the sound of the new organ with him.

Inventing the future

The organ history of the past few decades offers us a quite serious lesson. Inventive future organ concepts, such as the one developed at Kunststation

Kunststation St Peter in Cologne: console and view on the main organ with its horizontal reeds.

St Peter in Cologne (Willi Peter, 1968/2004), however interesting and inspiring in itself, appear to have little chance of ever becoming widely accepted. Yet, the opposite idea, to develop "mainstream" organs matching all sorts of music, suffers from its built-in compromise: by definition, they will never be suited to any musical style the best possible way.[3] Thirdly, constructing single concept-organs in ways other than in Cologne appears to be complex as well: it is problematic, to say the least, to build new organs

3 It is interesting that the famous Müller organ at Haarlem (built in 1738) did inspire much more new music than any new organ, be its sound concept futuristic, mainstream, or historically inspired: many composers wrote impressive music with the sound of the organ at Haarlem in mind. Moreover, in the course of the International Improvisation Competition, held ever since the early 1950s, the art of contemporary organ improvisation was fuelled by it as well (Hans Fidom. "The Low Countries", in Christopher Anderson, ed., *Twentieth Century Organ Music*. New York/London: Routledge, 2011, 195-218 (Routledge Studies in Musical Genres; no. 7)).

The Arp Schnitger organ at Lübeck Cathedral, built in 1699. The interior of the organ was renewed in 1893. In 1942, the organ case was destroyed. In 2000, the new organ at Örgryte Nya Kyrka was inaugurated (photo next page); one of the sources of inspiration had been the Lübeck Cathedral organ.

with a sound quality that equals that of historical organs. Strangely enough, the one group of 20th century organs with a convincing single sound concept, developed in Denmark, Germany, and the Netherlands in the 1950s and 1960s, is currently in danger: the voicing of many of these instruments has already been "corrected", as it is called in a kind of sugarcoated newspeak.

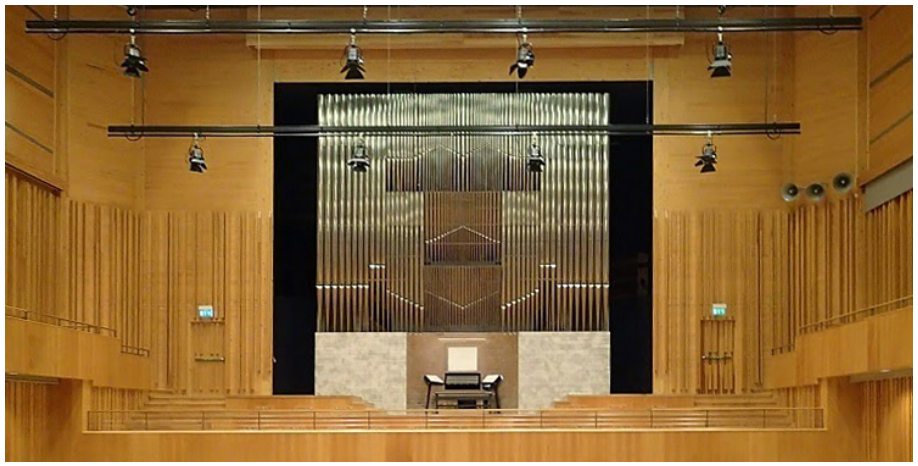
Of course, we were not the first to "read" the 20th century organ history in this way. The early 21st century already showed two distinct reactions.

The first one resulted in the succesful development and application of what is now increasingly called "process reconstruction". The underlying idea is that an organ, if it is meant to sound as inspiring as a specific historical organ, should be built using the same methods - along the same lines of thinking, and based on the same knowledge - as employed by the builder of that example. Simply copying an organ makes no sense; one has to understand why it is built the way it is. This in fact requires knowledge not only of organs and music, but of the cultures they are part of as well. Landmark instruments in this context are those in Gothenburg (Örgryte Nya Kirka, 2000; inspired by the work of organ builders such as Scherer, Schnitger and Fritzsche), Rochester (Christ Church, 2008; inspired by Casparini), and Ithaca (Anabel Taylor Chapel, 2011; based on the work of Schnitger).

The second reaction led to a thorough reconsideration of how organs could profit from the integration of digital technology. Of course, such technology can be used to make the tasks of the organist easier, the sequencer being the best example. Meanwhile, however, it appears to be capable of much more, including expanding the way organists can use the sound resources of organs.[4] Landmark instruments in this context include those in Ratingen

4 These sound resources are of such nature that they will remain out of reach for loudspeaker

(St Peter and Paul, 1953; enlarged in 2012 by organ builder Seifert with new technology developed by Sinua, Düsseldorf), Düsseldorf-Oberkassel (St Antonius, 2016; Mühleisen/Sinua), Würzburg (Hochschule für Musik, 2016; Klais), and Piteå (Studio Acusticum, first phase 2012, second phase in preparation; Woehl).



The Woehl Organ at Studio Acusticum, Piteå (Concert hall of Luleå University of Technology / Piteå School of Music).

The technology employed in the Ratingen and Oberkassel organs allows the organist to combine pipes at will, outside the context of those pipes'

organs; loudspeakers are comprosing by nature, as they are charged with fulfilling many different tasks simultaneously, Whereas a good and well-placed set of speakers may be capable of reproducing an organ's sound, for example in loudspeaker organs based on Hauptwerk set-ups (in itself a valuable solution to practice organ playing at home), or to listen to LP's and CD's, loudspeakers can and should not be expected to be able to (re)produce the complex pipe-sound combinations possible in the organs at Ratingen, Düsseldorf, and (now) Amsterdam. Once more, this makes clear that in order to listen to music the way it is intended, one has no choice but to attend its performance as it takes place. After that, the music is forever gone, which does not need to be considered (only) a problem. More on this: Hans Fidom, *Music as Installation Art*, Amsterdam: Orgelpark/VU University Press, 2011 (Orgelpark Research Reports #2).

home stops. The organ in Würzburg allows the organist to control the amount of wind flowing into the pipes. The organ in Piteå combines three historical sound concepts – in fact three organs – in a single instrument and, in the near future, a "harmonics division", meant to enable the organist to "build" new sound colors by carefully chosing combinations of mutation stops. What these organs have in common is that the search for a new understanding of what constitutes an organ begins with reconsidering the technology that links keys and pipes, rather than with inventing new specifications. That this search continues is demonstrated by plans for new organs with comparable structures in Malmö and Rostock. Researcher Randall Harlow proposed a name for this type of instrument; he christened them "hyperorgans", which have "extended capabilities that seamlessly blend the electronic and acoustic worlds along the lines of other hyper instruments developed by Tod Machover and researchers at the MIT Media Lab in the past twenty-five years."[5]

The Orgelpark decided to combine the concept of historically informed "process reconstruction" and the ideas that fuel the development of "hyperorgans" in the new Utopa Baroque Organ: that way it could indeed have a historically inspired sound pallete of the highest quality, and yet, since it would be accessible in completely new ways, invite and inspire musicians and other artists to make new music.

This was not as bold a decision as it might seem at first sight. Since 2009, we already had developed a digital console for the Sauer organ. We were inspired by visits to the organ in Ratingen, where the new technology had been developed and tested ever since 2007. After placement of the new

5 Randall Harlow. *Recent Organ Design Innovations and the 21st-century "Hyperorgan"*. 17 (published on http://www.huygens-fokker.org). Harlow notes that this development has its early roots in the Netherlands with the Fokker organ built by organ builder Pels in 1950 for the Teylers Museum in Haarlem. Thanks to the application of electro-pneumatic action, this instrument has 31 keys per octave allowing all intervals to sound pure (without any beating). The organ began a second life in the Muziekgebouw in Amsterdam in 2009, where it regularly becomes the centre of attention in a dedicated concert series. In 2017, a few loudspeaker stops were added, changing the instrument to a hybrid organ.

console in the Orgelpark in 2011, we soon learned that a historic sound concept and new technology indeed can complement each other, provided that the historic pipework's speech characteristics are not compromised by the integration of the new technology in the organ - a requirement we had to meet, since the Sauer Organ is a protected monument.[6]
So the question was: would such a combination of old and new technology (with the same proviso regarding the speech of the pipework) be possible in the context of the new organ to be built? New experiences gained with the organ in Ratingen had shown that the ability to combine any individual pipe with any other individual pipe provided a convincing way of realising new sounds. This meant that our organ would profit from being equipped with a wind-chest system that provided "single tone action" as well - yet, since its sound concept had to be baroque in every respect, cone-chests like in the organ in Ratingen would not be eligible.
The solution was inspired by discussions among organ builders about the cone-chest when it was invented. In 1879, organ builder Friedrich Lütkemüller claimed how he himself had constructed the very first cone-chest at the factory of Eberhard Friedrich Walcker, were he had been appointed in the years 1837-1842. He remembered that the first cone-chests "had been constructed as a spring-chest with little pallets, operated by little stickers."[7] Indeed, 16th century spring-chests do provide a pallet per pipe just like cone-chests - but their construction is completely different, as they

6 The Sauer organ had had its original pneumatic action reconstructed in 2006 during a outstanding restoration by Elbertse Orgelmakers. The addition of the extra console to the organ without compromising any original part, was made possible by doubling the key action directly under the wind-chests. The little motors acting upon by the key action (one per note) could now be fed from two sides, and in precisely the same way: via pneumatics. While the original action has to bridge the considerable distance between the console and the wind-chests, short tubes suffice for the new action, as that is basically electric. The digital technology in the new console makes combinations of stops possible that were impossible before.

7 Friedrich Lütkemüller. "Zur Frage über den Wert der Kegelladen." *Die Orgelbauzeitung* 1 (1879): 29-30, 37. See for a critical overview of the discussions Hans Fidom. *Diversity in Unity / Discussions about Organ building in Germany between 1880 and 1918*. Dieren: KNOV, 2002.

are the predecessor of the better known slider-chest, which forms the heart of most baroque organs. The route taken by the wind to the pipe does not, in fact, differ between spring-chests and slider-chests, whereas it does differ considerably between cone-chests and slider-chests. So what if our organ could be equipped with spring-chests? Even if the pallets per pipe in spring-chest are part of the stop action, i.e. not the key action?
The challenge hence was to develop spring-chests such that the pallets under each pipe would be operable individually from the keys; electrically of course, so that the same software as in Ratingen could be utilised. Once this became clear, we had to undertake research into the possibilities of building a baroque organ with two consoles: a mechanical console as an integral part of the case, just as in historical organs, in order to be able to play the organ in historically informed/inspired ways, and a digital console, in order to be able to discover and apply the new possibilities. We prefered to rebuild the digital console from 2011, if only to avoid adding to the sheer quantity of objects in the Orgelpark's hall.
On the basis of prior experience with both companies, it was determined that Elbertse Orgelmakers (Soest) would be involved. For obvious reasons, the Sinua firm (Düsseldorf) was also included from the very earliest stages.

Arp Schnitger? Zacharias Hildebrandt!

In the early 1670s, organ builder Berend Huß involved the still young Arp Schnitger (1648-1719) in the building of the organ at the St Cosmae et Damianikirche in Stade, Germany. Because this instrument was built in 1675 with spring-chests on the Oberwerk, it provided an important model for us; so important indeed that we seriously considered taking Schnitger's sound concept as our main reference. The first trip undertaken by the core team, in October 2013, had Stade as its destination. In addition, the team visited the Schnitger organs in Norden (1688/1692) and Hamburg (Jacobikirche, 1693). In Hamburg, the team also visited the new Flentrop organ in the Katharinenkirche, a reconstruction of the organ dating from 1607/1647, which had been destroyed during the Second World War.
In the interests of careful deliberation, the team also travelled in December, 2013 to the Bader/Reinecke/John organ in Borgentreich (1677/1710), which

The spring-chest of the organ at Stade, St Cosmae et Damiani (Huß/Schnitger, 1675). Two of the tone-drawers are partly drawn out of the chest.

has spring-chests throughout. On the recommendation of Martin Böcker, organist of the Stade organ, the Treutmann organ in Goslar/Grauhof (1737) also featured during the trip, due to its combination of North German and Central German sound concepts. As the tuning system to be employed in the new organ was also subject of research, the team visited the small Wegscheider organ in Allstedt (1990), too. This instrument has 18 pipes per octave, so that the player can choose between two temperaments: one focussed on pure thirds, with, as a by-product, a "wolf", and one focussed on better fifths. These orientations are characteristic of the two main categories of tuning system, mostly classified as either "meantone" or "well-tempered".[8] The team also visited a fourth organ, the Hildebrandt in Naumburg. As the sound concept of the organ at Grauhof was partly of Central German and partly of North German nature, we liked to get to know an uncompromised Central German organ as well. We chose the organ at

8 Contribution XII to this Report is dedicated to the temperament of the Utopa Baroque Organ. It has been especially developed for it by Ibo Ortgies.

Naumburg because Johann Sebastian Bach had approved it after it had been completed in 1746.

During the course of the two study trips, the team became ever more convinced that the differences between spring- and slider-chests do not affect sound quality and hence may be considered inaudible. In Naumburg, we were deeply impressed: in soft registrations, the subtle combinations of 8′ and 4′ stops were seductive without either individual stop losing its own colour. In larger registrations, it was especially noticeable how rich and grand the sound became without ever being too loud. Ever since the restoration of the organ by Hermann Eule Orgelbau (Bautzen), the speech of the pipework has been under discussion: the Violdigamba, for example, has a clearly defined initial transient. The sound produced on release is also highly characteristic. As a result, the Naumburg organ is more "outspoken" than many organists and organ builders are accustomed to today, something which generates regular criticism of the instrument. Because the attack and release are colour-determining aspects of the sound, the team decided not simply to adopt this criticism, but rather to apply reverse logic: such phenomena can, seemingly, arise without negatively influencing the quality of the sound. A certain "wildness" might even be considered an essential element of the sound's inherent interest. The discussion which arose, therefore, was whether in fact the sound concept of Hildebrandt might be preferable to that of Schnitger. The argument in favour of Schnitger of course was the compatibility of his sound world and the spring-chest. Given the facts that differences between spring and slider-chest seemed to be primarily theoretical, and that Schnitger's concept has enjoyed much attention for decades, the team considered this question seriously. The team also considered whether, as Hildebrandt's having worked with the only slightly older Gottfried Silbermann as a young man, might provide a justification for preferring Silbermann's more famous sound concept. Yet, the organ in Naumburg was slightly milder in terms of volume than Silbermann organs of the same size, which is of considerable importance considering the acoustic in the Orgelpark. Also, we found the rich variety in the voicing of the 8′ and 4′ stops more outspoken and audacious than in comparable Silbermann organs. Did this in itself provide a sufficient answer to the question?

The team hesitated and decided to undertake a tour of Hildebrandt organs. These included the small organ in Störmthal (1723), the 1728 organ in the St Jacobikirche in Sangerhausen, and the closely related 1749 organ in the St Jacobikirche in Hettstedt. The team also re-visited the organ in Naumburg. None of these organs' original concepts have remained unaltered. In Hettstedt the interior was replaced in 1905 with a (not uninteresting) pneumatic organ built by Wilhelm Rühlmann. In Sangerhausen the organ was restored in 1978 by Eule Orgelbau, with the restricted means and knowledge that period entailed. Similarly, the changes made to the voicing in Störmthal through the centuries had only been partially reversed during the restoration by Eule in 2008. Reservations about the organ in Naumburg were also evident: the instrument's history had been trying, with the result that Eule's restoration in 2000 had to entail the reconstruction of many stops and other significant parts, including the key action. Whether the sound which so charmed the team in Naumburg was Hildebrandt's original was beyond question: it has gone forever. The sound did great credit, however, to the Eule firm and especially to the pipework specialist and voicer Helmut Werner who, during the many years he worked for Eule, made thorough studies of Hildebrandt's methods. His great fascination for Hildebrandt above all others was evident in our conversations; we were impressed by his knowledge regarding the specific combination of scalings, construction methods and voicing of the pipework.

Because our realisation that Hildebrandt's sound has been lost failed to outweigh the impressive sound-concept found in Naumburg (elements of which were also evident in Sangerhausen and Störmthal), which had stolen our hearts, the following step became obvious: investigate the extent to which spring-chests would be compatible with Hildebrandt's sound-world. And: if the results were encouraging, what specification should the organ have?

Spring-chests

In order to allow the wind supply to proceed smoothly to the hundreds of pipes of an organ, the wind-chests on which the pipes stand are divided into small segments known as "channels". These channels are filled with wind when the organist pulls a stop (in the case of a stop-channel chest, such as a cone-chest) or presses a key (key- or tone-channel chest). In order for a pipe to sound, the relevant key must be pressed (stop-channel chest) or stop engaged (tone-channel chest), so that wind that is already in the channel can flow into the pipe.

Spring-chests, like slider-chests, are tone-channel chests: each key has its own tone-channel on which the pipes belonging to that key stand; hence, the number of the pipes per channel equals in principle the number of the stops. In the case of a spring-chest a pallet is located under each pipe in the tone-channel. When the organist engages a stop, these pallets are opened; should the organ have, for example, 49 keys, and therefore 49 tone-channels in the wind-chest, pulling a stop means opening 49 little pallets. Because each pallet is equipped with a spring, this requires a little strength. Therefore, the stop knob must be locked into place to avoid the 49 springs pulling the pallets back forcefully and cancelling the stop.

The many varieties of spring-chests fall into two main categories: "single" and "double" spring-chests. The great organ in the Nieuwe Kerk in Amsterdam (Schonat, 1655) has single spring-chests. In the event of a fault with the stop pallets, the pipes must be removed in order to be able to open up the wind-chest for repair. Double spring-chests, such as those used in Stade, are considerably more complicated, and therefore expensive, but much easier to maintain. The difference is that the pallets are mounted on a removable drawer; should repair be necessary, this drawer can be pulled out from the long side of the wind-chest.

Needless to say that the more complex variant of the spring-chest should be used in the new Orgelpark organ: the idea was to append action magnets to each pallet, and the drawers provide the perfect basis to do so. Once we would have found a manner of maintaining the wind pressure in the tone-channel, the activation of the magnet would suffice to allow the associated pipe to speak. Because each magnet is operated electrically, it could fulfil the function of both key-pallet and stop-pallet: the key was to ensure that the electrical circuit was closed only when the organist had engaged a stop and pressed a key. These are actions which the new organ's computer (like those in Ratingen and Düsseldorf) would be able simply to "see" and then translate into the activation of the magnet in the desired way - for example

according to settings chosen by the organist, who thus could make a pipe speak faster or slower, and/or only at limited "power".
However, before the team could focus on such technical questions, a pressing artistic concern required analysis: when the organ was being played via the mechanical console would the magnets not act as obstacles to the wind on its way to the pipes? Action magnets tend to be rather large.

Listening test

In order to investigate this, the Orgelpark organised a listening test during the International Orgelpark Symposium in June, 2014. Participants included leading organ builders and organ experts from all over the world. In order to facilitate the experiment, the Orgelpark developed, in cooperation with Elbertse Orgelmakers, a "test organ", equipped with the kind of wind-chest projected for the new organ, yet with an important adaptation: for each key three channels were provided. One with the capacity found in the Huß/Schnitger organ in Stade with no action magnets, an identical one with magnets, and a third with magnets but with a larger channel capacity to compensate for the volume of the magnets. Organist André Ferreira, then studying at the Amsterdam Conservatory with Jacques van Oortmerssen, played the organ, which was set up on the site of the future instrument. His task was far from easy: time and again, he had to play a short motif and repeat it. Sometimes the repetition sounded using the same channel type, most of the times the repetition sounded using another channel type.
The participants could only judge by ear whether they believed that the repetition of a motif sounded differently. On a simple form, they could check a box saying "yes" ("yes, I do hear a difference") or "no". There was space to add comments; that option was not obligatory.
The results were surprising: the "yes-boxes" had been checked significantly more often than our own experiences so far had made us expect. Even when the motives had been repeated without any change in channels, many participants had detected differences. This suggested that, in such cases, the organist might have been applying a slightly different touch; attack and release are strongly dependent on the way in which the player engages the key. But if such human differences were of more significance than whether or not there were magnets present in the tone-channels, what would that

mean regarding the interpretation of the test data? Also remarkable was the extent to which the results contradicted each other: in the case of only a small number of motives did a clear majority concur on an answer.
The test taught us that not the results themselves but the number of contradictions should be taken as an important fact. Our analysis was that, given the circumstance that organ experts tend to assume that a "wind-polluting" element in a tone-channel must have an effect on the sound, as they have been in taught in countless books and other sources on organ building, and assuming that they most probably would have felt to have failed when they would not have detected such differences, the impulse to actually detect differences must have been quite strong. This means that the test should have been carried out without any prior explanation, but this would have been difficult to justify: why would respected experts respond to an invitation to participate in a listening test without the reasons having been explained? Apart from the limited enthusiasm this would have generated, there would also have been reason for the participants to feel manipulated.
In short: we realised that listeners, especially expert-listeners, do not only listen with their ears, but immediately embed what they hear in their systems of reference to the extent that deeply held preconceptions can colour their perceptions. The conclusion was clear: the new organ should be equipped with spring-chests with magnets located outside the channels; and the channels' capacity should be as close as possible to those in Hildebrandt's slider-chests. In any other scenario, we would saddle the judgements around the sound of the new organ with the baggage of a discourse around the construction of the wind-chests; a discourse which would very likely come at the cost of the attention paid to the sound of the instrument, the music made on it and listeners' assessment of that music.
In March 2015, the core team travelled to Ratingen to discuss this matter with the engineers of Sinua. As a result, Sinua developed a completely new magnet, entirely different in both form and dimensions to normal action magnets, and, very importantly, much smaller. It looks like an AA battery, yet around 25% shorter. The magnet is hollowed-out along its length. Into this void is inserted a sticker. When the magnet is powered, this sticker moves; when the power is withdrawn, it moves back. This invention works

LISTENING TEST 2014

The Orgelpark organised a listening test during the International Orgelpark Symposium in June, 2014. Participants included leading organ builders and organ experts from all over the world. In order to facilitate the experiment, the Orgelpark developed, in cooperation with Elbertse Orgelmakers, a "test organ", equipped with the kind of wind-chest projected for the new organ, yet with an important adaptation: for each key three channels were provided.

The listening test was set up quite straightforward: time and again, organist André Ferreira played a motif twice; the respondents were invited to check whether they detected a difference between the two. If so, they were invited to specify their observations (not included in the overview here; researchers who want to dig deeper are warmly invited to contact the Orgelpark: hansfidom@orgelpark.nl).

On 6 June, Ferreira played two motifs per stop (Principal, Gedackt) or combination of stops (Principal + Gedackt); on 7 June, he played one motif per stop or combination of stops. The data in yellow represent the results of the test on 7 June. Green means that the motif(s) were played on the same channel type.

Stade	channels compliant with the channels at Stade
Stade +	higher channels (channel capacity increased)
Stade + magnets	idem, with action magnets mounted in the channel

The respondents were informed in advance which two of these three were to be compared. The bullets show the number of respondents: for example, ••••• (5) means five respondents. Not everybody answered every time.

		Difference? NO	YES	BLANK
COMPARISON STADE / STADE +				
PRINCIPAL	Stade	••••••••••••••••• (17)	•••••••••••••• (13)	•••• (4)
	Stade + / Stade	••••••••••••••••••••••• (23)	••••••••• (9)	•• (2)
	Stade / Stade +	••• (3)	•••••••••••• (12)	
GEDACKT	Stade / Stade +	••••••• (7)	••••••••••••••••••••••• (23)	•••• (4)
	Stade + / Stade	••••••••••••••••••••• (21)	•••••••••••• (10)	••• (3)
	Stade + / Stade	••••• (5)	••••••••• (9)	• (1)
TOGETHER	Stade / Stade +	•••••••••••••••••••• (20)	••••••••••• (10)	•••• (4)
	Stade / Stade +	••••••••••••••••••••• (21)	•••••••••••• (12)	• (1)
	Stade / Stade +	•••• (4)	••••••••••• (10)	• (1)
COMPARISON STADE / STADE + MAGNETS				
PRINCIPAL	Stade / Stade + Magnets	••••••••••••••••••••••••• (24)	•••••••• (8)	•• (2)
	Stade / Stade + Magnets	••••••••••••••••••••••• (23)	•••••••••••• (11)	
	Stade / Stade + Magnets	••••••• (7)	••••••••• (9)	
GEDACKT	Stade + Magnets / Stade	•••••••••••••••• (15)	•••••••••••••••••• (18)	• (1)
	Stade + Magnets / Stade	•••••••••••• (10)	••• (3)	•• (2)
	Stade / Stade + Magnets	•••••••••••• (12)	•••••••••••••••••••••• (21)	• (1)
TOGETHER	Stade / Stade + Magnets	••••••••••••••••• (18)	•••••••••••••• (14)	•• (2)
	Stade / Stade + Magnets	••••••••••••••••••••• (21)	•••••••••••••• (13)	
	Stade / Stade + Magnets	•••••••• (8)	•••••• (6)	• (1)
COMPARISON STADE + / STADE + MAGNETS				
PRINCIPAL	Stade + / Stade + Magnets	•••••••••••••••••••• (20)	•••••••••••• (12)	•• (2)
	Stade + / Stade + Magnets	••••••••• (9)	•••• (4)	•• (2)
	Stade + Magnets / Stade +	••••••••••••••••••••••••• (24)	•••••••• (8)	•• (2)
GEDACKT	Stade +	•••••••••••••••••••• (20)	•••••••••••• (12)	•• (2)
	Stade + Magnets / Stade +	••••••••••••••••• (18)	•••••••••••••• (14)	•• (2)
	Stade + Magnets / Stade +	•••••••• (8)	••••• (5)	•• (2)
TOGETHER	Stade + Magnets	••••••••••••••••• (17)	•••••••••••••• (15)	•• (2)
	Stade + / Stade + Magnets	•••••••••••••••••• (19)	•••••••••••• (12)	••• (3)
	Stade + Magnets / Stade +	•••••••••••• (12)	• (1)	•• (2)

perfectly with the spring-chests of the new organ, in the first instance because the magnet is small enough to fit inside the drawer instead of underneath it and, as a result, can remain outside the tone-channel. In addition, the cross-section of the magnet is so small that the width of the tone-channels could be less than, for example, those in Stade. This was important because, in general, spring-chests are broader than slider-chests. A third advantage of the new Sinua magnet was that the "sticker" inserted in the magnet was tellingly reminiscent of the stickers in original baroque spring-chests which open the stop-pallets; the historic means of activating stops could thus be applied without much adaptation.
Elbertse Orgelmakers took the next step: the organ builders were able to construct the wind-chests in such a way that the channel capacities would be more or less identical to those in Hildebrandt's slider-chests. This meant that the combination of Hildebrandt's sound concept and spring-chests had become a realistic option. Three further remarks need to be made in this context:

- The pallet box under the channels is, in the case of Hildebrandt chests, often located at the front of the organ, rendering the key action very simple but compromising the speech characteristics of the reeds, which remain at the rear of the chest. It is generally preferable to keep the reeds in the vicinity of the pallets; furthermore, repairs of elements in the pallet boxes should not become complex due to inaccessibility. Therefore, we discussed, and eventually decided, not to locate the pallet boxes of the new organ at the front of the chest but, in order to keep thinking in the spirit of Hildebrandt, not entirely at the rear of the chest either. The faceboards could be made entirely according to the model of the largely original slider-chests in Sangerhausen (1728).
- In order to allow organists to use their limited rehearsal time optimally and to free them from the stress associated with the relative skills of registrants (or their own ability to hand-register), we decided to equip this console, as well as the digital console, with a sequencer, rendering a mechanical stop action pointless. That meant that the stop-action would be entirely electric.

- Because the organ can only be played via the digital console when all the tone-channels are under pressure, the instrument cannot be played from both consoles simultaneously.

Four organ building companies

Once the team had arrived at the conclusion that spring-chests and the sound-world of Hildebrandt were not mutually exclusive, the decision was taken to begin constructing the instrument. The firms Elbertse and Sinua started to build the organ's basic elements (case, winding system, chests, action, reconstruction of the existing digital console) on the one hand and the hard and software for the organ's digital action on the other. As the Eule firm had been responsible for the remaining Hildebrandt organs during the DDR-era and had restored several of them, and because of organ builder Helmut Werner's expertise, it was decided that Eule would make the pipework.
As far as the voicing was concerned, the core team decided to work with another Hildebrandt expert: organ builder Munetaka Yokota. Yokota had not only carefully visited and mapped all the remaining Hildebrandt organs, but had, within the context of his work at the Göteborg Organ Art Center (GOArt), proven that he could make new pipes sound like old ones - as we had established with our own ears, listening to the aforementioned organ in the Örgryte Nya Kyrka. We visited Gothenburg in 2013: GOArt had been a decisive factor in the development of "process reconstruction" in the field of historically informed organ building, which we wanted to know more about.

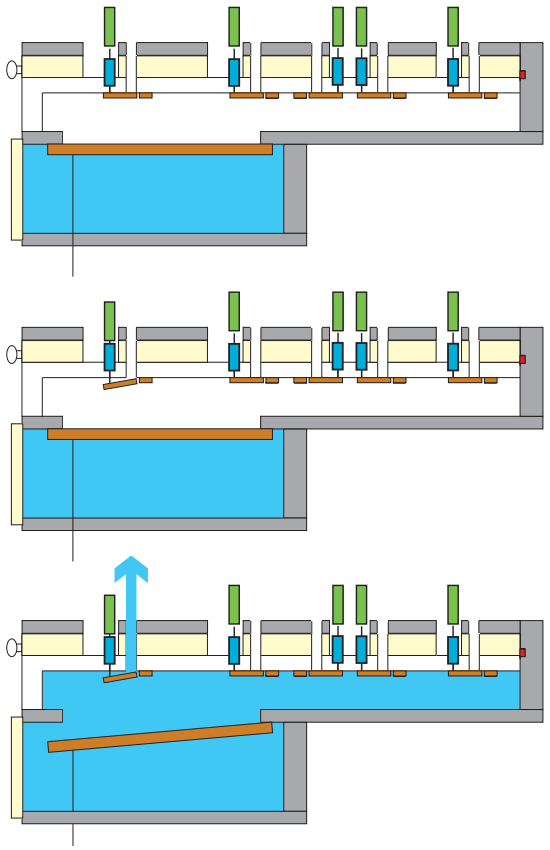
Specification

In close consultation with Werner and Yokota, the core team next determined which Hildebrandt organ would provide the best point of reference for the new organ's specification. Naumburg, with its 53 stops on three manuals and pedal, was much too large for the Orgelpark. The organs in Sangerhausen and Hettstedt seemed more relevant, each with originally about 30 stops. The organ in Hettstedt seemed the more appropriate of the pair with its slightly richer specification. The volume of the St Jacobikirche and that of the Orgelpark were closely aligned:

LISTENING TEST 2015

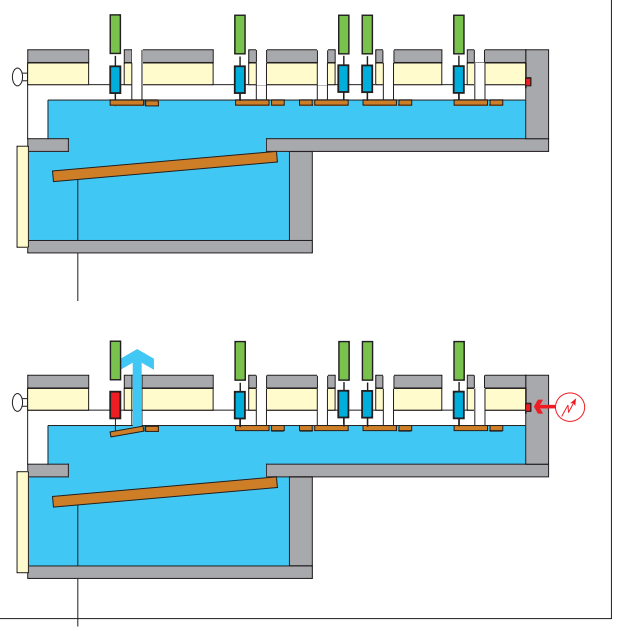
In January 2015, an additional listening test took place at the workshop of Elbertse Orgelmakers. Present were Jos Elbertse and Bert van den Heuvel from Elbertse Orgelmakers; Dirk Eule and Helmut Werner from Hermann Eule Orgelbau; Benedikt Aufterbeck, Thomas Stöckl, and Stefan Strasser from Sinua; and the complete core team.
The objective of this test was to check by ear whether the pipes, which would be voiced using the mechanical console, would sound convincing when played on the digital console as well. Playing the organ on the digital console implies that all channels are filled with wind by default; whereas playing the organ on the mechanical console would leave them empty, only to be filled when a key is pressed. For this test, the test organ was equipped with a wide selection of characteristic pipes. No differences were detected; yet if differences would be detected, the speed with which each pallet opens and closes could be adjusted by finetuning the Sinua software.

The test organ, built by Elbertse Orgelmakers, has a mechanical and a digital keyboard.



Playing the organ on the mechanical console: when the organ is switched on, the pallet box is filled with wind under pressure (blue). The second image shows that one stop (the one on the left) is activated: the beam that controls the stop pallets has moved down, opening the pallets of all pipes belonging to that stop: one per channel. In the third image, the organist has pressed the key to which this channel belongs. Wind flows from the pallet box into the channel and, via the one open stop valve, into the pipe (blue arrow.)

Playing the organ on the digital console: when the organ is switched on, all pallets are opened; the pallet box is filled with wind (blue) as well as all channels. The second image shows that the organist plays a key and has chosen a stop: both signals together activate a magnet (the red one), and wind flows into the adjacent pipe (blue arrow).



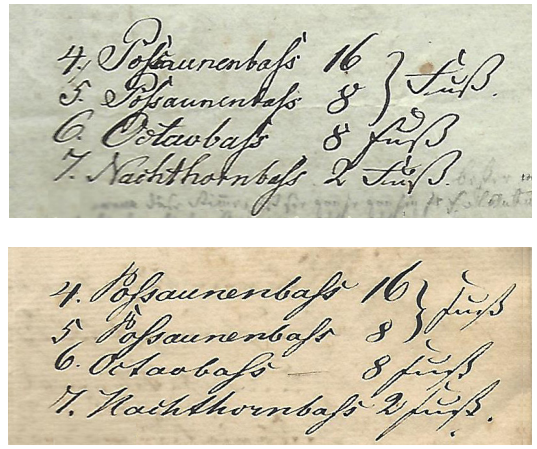
although the Orgelpark is considerably higher, it is only a few cubic meters larger.
Only the case of Hildebrandt's organ has survived in Hettstedt. However, the original specification from 1749 could be retrieved in the Hettstedt town archives. It reads as follows:[9]

Hauptwerk	**Oberwerk**	**Pedal**
Bordun 16 Fuß	Gedact 8 Fuß	Subbass 32 Fuß
Principal 8 Fuß	Viola di Gambe 8 Fuß	Violon 16 Fuß
Rohrflöte 8 Fuß	Principal 4 Fuß	Principal 16 Fuß
Quintatön 8 Fuß	Rohrflöte 4 Fuß	Possaunenbass 16 Fuß
Prästant 4 Fuß	Nassat 3 Fuß	Possaunenbass 8 Fuß
Gemshorn 4 Fuß	Octave 2 Fuß	Octavbass 8 Fuß
Weitpfeife 2 Fuß	Waldflöte 2 Fuß	Nachthornbass 2 Fuß
Cornett 4 fach	Tertia	
Cymbel 3 fach	Quinte 1 1/2 Fuß	
Sexquialter	Sifflöte 1 Fuß	
Mixtur 5 fach	Scharf 4 fach	
Trompete 8 Fuß	Vox humana 8 Fuß	

It seems as if Hildebrandt went further than Gottfried Silbermann, for whom he worked during the first three years of his career, in establishing the three characteristics which, according to the latter, a good organ should possess: *Brillance* is achieved thanks to the four compound stops on the Hauptwerk, even without considering the high-pitched stops on the Oberwerk; *Poesie* can be achieved in all manner of gradations thanks to the many 8′ and 4′ stops on the manuals, both in combination and as solo colours; *Gravität*, meanwhile, is provided by the Pedal which, despite the organ's relatively

9 We consulted the Stadtarchiv Hettstedt in March 2015. The documents mentioned by Ulrich Dähnert in his book *Der Orgel- und Instrumentbauer Zacharias Hildebrandt* (Leipzig: Breitkopf & Härtel, 1962), archive dossier no. 2193, apparently must be considered lost. Archive dossier no. 0311 ("Acta, betr. Reparaturen der Orgel in der Kirche zu Hettstedt 1822-1850") were present, as was archive dossier nr. 1365 ("An der Orgel vorzunehmende Hauptreparatur 1847-1867").

small size, is equipped with one 32′ and three 16′ stops. Of particular note is the Posaune 8′ on the Pedal. Both sources the mentioned specification is based on bracket the two Posaunenbasses together: perhaps Hildebrandt built the two as one rank, deriving an 8′ and a 16′ Posaune from it? Given the fact that a 32′ Subbass would need a lot of space, that would make sense, and it would document how important the 32′ stop was to Hildebrandt; even that important that a brighter Trumpet 8′ on the Pedal could be considered less essential.



In the town archives of Hettstedt, the specification of the organ in the Jacobikirche is mentioned twice, in the dossier Acta 0311, covering the periode 1822-1850. In both cases, the two Posaunes share the indication "Fuß": a bracket combines the two.

We chose to follow this specification as the model for the new organ; if Hildebrandt had been obliged to build an organ for a space such as that at the Orgelpark, he would probably have built something comparable. Yet, in the context of our striving for "process-reconstruction", there was no reason to slavishly following the example; most probably, Hildebrandt himself would not have done so. We added a number of stops to the specification, and made some different choices regarding the pedal division.
On the Hauptwerk, we added a Fagott 16′ to the Hettstedt specification, inspired by the specification of the larger 1757 two manual organ in the Church of the Three Kings (Dreikönigskirche) in Dresden. In two manual organs Hildebrandt apparently preferred a Fagott to, such as in Naumburg, a grander-sounding Bombarde or Trompet. A second reason to add a Fagott was that the 16′ Fagott in the Naumburg Rückpositiv works perfectly as

Postcard showing the Hildebrandt organ of the Dreikönigskirche in Dresden. The organ and the church were destroyed in 1945.

a solo stop in the bass. We decided to not to change anything else in the Hettstedt Hauptwerk specification, and to preserve its eccentricities, such as the absence of a 2′ Octav. We were curious how having no less than four compound stops as well as the three 8′ stops would inspire rethinking historically informed performances of baroque music.

The Oberwerk was originally intended to be identical to that in Hettstedt as well. This was until the core team, during their fifth study trip in March 2016, heard the Unda Maris on the organ of the Hofkirche in Dresden, begun by Gottfried Silbermann and completed, following his death in 1753, by Hildebrandt and his son Johann Gottfried in 1755. We had already been impressed by the Unda Maris on the Naumburg organ but, as this stop is "simply" a Principal 8′ tuned slightly out of tune with the "real" Principal 8′, we were initially of the opinion that an Unda Maris on our Oberwerk was out of the question: our Oberwerk, like in Hettsstedt, is based on a 4′ Principal. However, it then turned out that Elbertse had been cautious when preparing the Oberwerk chests and that space could be found for an extra stop, especially if, as would be the case with a Hildebrandt Unda Maris, it would begin at a0. We decided to investigate further. An Unda Maris in the form of a Principal 8′ would have been inappropriate; but why not choose a version of the same stop as made by Hildebrandt's contemporary Tobias Heinrich Gottfried Trost, active in the same region? Trost's Unda Maris is described in detail by Jacob Adlung in his *Musica Mechanica Organoedi* from 1768 (§ 173): Trost made the stop from wood, equipped each pipe with two mouths and a separation in the pipe-body. In fact, each pipe was really two pipes with a common pipe-foot. At Hans Elbertse's suggestion, the team chose to commission his firm to design and build an Unda Maris following Trost's example; the scaling would be chosen such that the sound-colour would be close to that of a Principal.

In principle, the team was keen to remain as close to the original pedal specification as possible as well, even if the space in the new organ precluded the inclusion of a 32′ Subbass. In order to create a similar effect, we decided to provide a Subbass 16′ and a wide-scaled Quintbass 12′. The advantage of this is that the combination of the two stops is not inferior to a "real" 32′; on the contrary, it speaks more promptly and has a more stable sound. Another advantage is that the Quintbass can also be combined

with other stops. Two other stops were eliminated from the Hettstedt specification: the Violon 16′ and the Nachthorn 2′. The function of the Violon could be perceived from the Principal 16′, which was expected to turn out rather mild thanks to the low wind pressure we projected: 63 mm water column seemed a good point of departure.[10] The Nachthorn seemed to us to be non-essential because a 2′ flute would be available via the pedal coupler from the Hauptwerk, and because Hildebrandt did not deploy high-pitched pedal stops elsewhere. Instead of the Nachthorn, we opted for a third pedal reed: a Clarin 4′ as found on the organs in Dresden and Naumburg and more useful as a pedal cantus firmus stop.

Just as in Hettstedt, the Oberwerk in the Orgelpark would be equipped with a "Schwebung": a Tremulant active on the entire division but primarily intended for the Vox Humana. The Hauptwerk was to be supplied with a Tremulant as well. In order to take advantage of the opportunities offered by the digital console, the team decided to make both accessories adjustable; Elbertse Orgelmakers therefore developed a new form of tremulant with a rotating valve located in the wind-trunk.

Hildebrandt built his pedal couplers as "wind couplers": his Hauptwerk wind-chests have a second pallet-box, and the coupler activates a pallet allowing wind into it. In the interests of ease of maintenance, we chose not to follow this example and to make a "normal" coupler. The manual coupler is a shove-coupler, following Hildebrandt's example - yet not in detail, since Elbertse had a develop a variant that could be engaged while playing; otherwise we should have to decide to leave the coupler out of the sequencer, which would undoubtedly have led to quite awkward situations during concerts. Elbertse found a solution by applying a hidden intermediate keyboard (a so-called "blind" keyboard).

As extra stops, the team chose to equip the new organ with a Cymbelstern and a Nachtigall, both from the catalogue of trade-supplier Laukhuff. The Nachtigall was installed without further adaptation. The Cymbelstern, on the other hand, was tuned entirely differently from Laukhuff's standard procedure: the eight little bells first play the notes B(-flat)-A-C-H and then

10 See the paragraph on scaling, pipe construction, and voicing below.

G#-C#-G-D; all tuned in the temperament developed by Ibo Ortgies for the instrument.[11]

Tuning, temperament, pitch

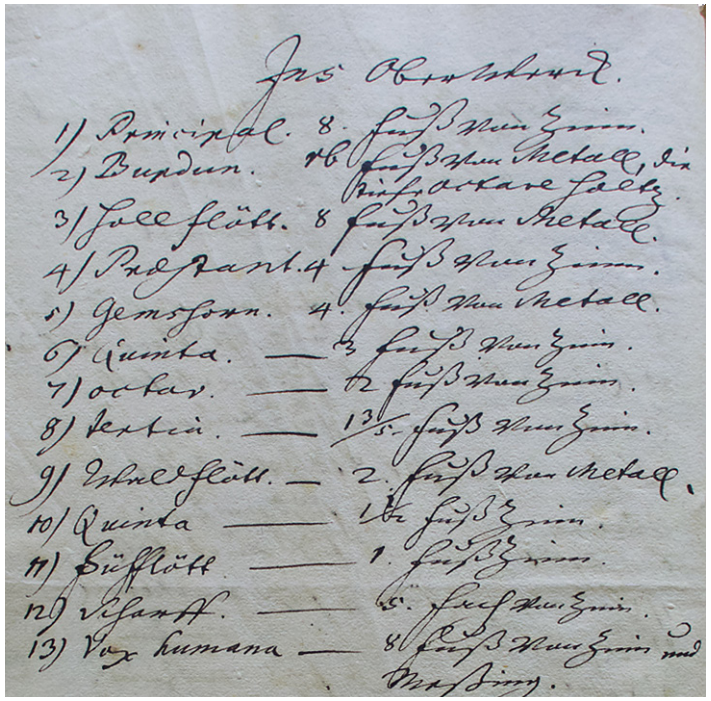
Although the visit to the Wegscheider organ in Allstedt was inspiring, the team stepped back from the idea of building a dual-temperament instrument. Eventually - yet after much discussion - the reason was simple enough: if we were to build more than 12 pipes per octave, the organ would become considerably heavier, which was, given the structure of the Orgelpark building, not an option.

We opted for a chamber pitch of a = 415.3 Hz at 20 degrees Celsius; a semitone lower than the pitch of the Sauer organ, the Molzer organ, and the Verschueren organ. As a result, the Utopa Baroque Organ can easily be integrated into ensemble music; Bach and his colleagues did not use continuo organs but their large church organs when performaning cantatas etc. Playing the new organ from the digital console, the pitch would be transposable at will. Ibo Ortgies designed a temperament that allows such transpositions. When the organ is played in chamber pitch, the tonalities with relatively few accidents include rather good thirds (even two good minor thirds), thanks to a combination of four 1/5-comma tempered fifths and two 1/10-comma tempered fifths. Is the organ played a semitone higher (for example to combine its sounds with those of the Sauer organ), the fifths that determine these same tonalities resemble equal tempered fifths (the Sauer organ has, of course, equal temperament). For more information about the tuning system and pitch used in the new organ, see the contribution hereafter by Ibo Ortgies.

In order to prevent running out of tones too quickly on the digital console, which has manuals with a compass up to g4,[12] we decided to extend

11 See contribution XIII.

12 Designing the digital console in 2011, we chose to apply this compass because the Swell division of the Sauer organ includes stops that have pipes until g4. The original purpose was to allow the organist using the super octave coupler up to the highest key on the orginal Sauer console (g3). We thought it to be a good idea to make this pipes playable by "own" keys as well.



Excerpt from Hildebrandt's self-written design for the organ at Naumburg, showing the specification of the Oberwerk. See also page 124.

the manual wind-chests with an extra fifth to a3 (g3, when the organ is transposed to choir pitch). The manuals of the mechanical console have a compass which, like those of Hildebrandt, extend only to d3. The Pedal board has a compass up to d1 (mechanical console) respectively g1 (or f1 at choir pitch). Whereas Hildebrandt's organs originally did not have the key C#, Ortgies's temperament allowed us to include it.
In terms of nomenclature, the team chose Hildebrandt's spelling for Naumburg-equivalent stops; more precisely, those he indicated in his own design for the organ, rather than those in the official document, likely a copy by a notary based on Hildebrandt's handwriting, which contains many divergences in spelling. For more information, please see contribution XIV.

Specification of the Utopa Baroque Organ (2018)

Hauptwerk (I)	**Oberwerk (II)**	**Pedal**
Principal 8′	Principal 4′	Principal 16′
Burdun 16′	Gedackt 8′	Subbass 16′
Rohrflött 8′	Violdigamba 8′	Quint bass 12′
Quintathen 8′	Unda maris 8′	Octav 8′
Octav 4′	Rohrflött 4′	Posaune 16′
Gemshorn 4′	Nasat 3′	Posaune 8′
Weit Pfeiffe 2′	Octav 2′	Clarin 4′
Sexquint altra II	Waldflött 2′	
Mixtur V	Tertia 1 3/5′	
Cymbel III	Quinta 1 1/2′	
Cornett IV	Süfflött 1′	
Fagott 16′	Scharff IV	**Extras**
Trompet 8′	Vox humana 8′	Nachtigall
Tremulant	Schwebung	Cymbelstern

Couplers

manual coupler (shift coupler), pedal coupler (mechanical)

Compass

manuals: C-d3 (mechanical console) / C-a3 (digital console)
pedal: C-d1 (mechanical console) / C-g1 (digital console)

Action

key action: mechanical / digital (two consoles)
stop action: electrical (sequencer system on both consoles)

Pitch & temperament

a = 415,3 Hz at 20° Celsius (transposable on the digital console)
four 1/5-comma fifths, two 1/10-komma fifths (Ortgies II)

Wind systems & wind pressure

four wedge bellows (9 x 5′) / 63 mm water column

Builders

Elbertse Orgelmakers, Eule Orgelbau, Munetaka Yokota, Sinua

Scaling, pipe construction, and voicing

Helmut Werner's and Munetaka Yokota's measeruments reveal that Zacharias Hildebrandt worked with three basic scales: normal, narrower and once again narrower. An analysis of the Hauptwerk scalings in the organ at Naumburg shows that a normal scaled 8′ C Principal pipe has a diameter of 150 mm; the diameters of the following c's are 90, 50, 28 and 17 mm, whereas the highest c on the Octav 4′ has a diameter of 11 mm. The principals in the Naumburg Oberwerk are slightly narrower: the lowest C of the 4′ Principal has a diameter of 83 mm, the following c's 46.3, 25.5, 15.5 and 10.3 mm respectively. These narrower scales are also found in the mixtures of the Hauptwerk. Because Hildebrandt also applied his normal scale in the small church at Störmthal, the team chose to follow the scaling system found in Naumburg. The scales for the Rückpositiv in Naumburg are of the narrowest kind, giving the principals a very overtone-rich sound. This works well in Naumburg, but would probably sound less convincing in the Orgelpark.
Hildebrandt gave his flue pipes a considerable overbite. The backside of the upper lip wall aligns almost with the front side of the lower lip wall; the difference being close the pipe wall thickness directly above the mouth section. This allows the languid to be positioned relatively high, which results in a bright overall sound quality.[13] Additionally, this mouth geometry allows for a rich set of speech types. Yokota discerns at least four of them, each of which he applied in the voicing of the Utopa Baroque Organ:

- Chiff (German: "Spuck")
- Cough
- Hiss
- Hiccup (for example audible when the wind pressure increases slowly, as is the case in - again for example - Subbass pipes that are not standing on a wind-chest but get their wind via a wind duct)

13 This means that the underlip, especially of smaller pipes, should be really flat directly under the windway; otherwise the shape of the windway would be compromised and produce all kinds of unwanted extra sounds.

Needless to say that voicing using such "tools" requires a very careful approach: it includes "sonic skills"[14] on the part of the voicer, in order to be able to decide which balance between speech types is optimal. But there is another condition to be met as well: the organ should be allowed to sound relaxed, open, free, as a stressed basic sound would render such delicate speech characteristics a nuisance all too soon. This is why the organ has a significantly lower wind pressure than Hildebrandt himself ever applied: as already mentioned only 63 mm water column instead of at least 10 mm higher, as Hildebrandt's surviving organs have today. Yokota suggested to take this rather low pressure as a point of departure. That way, he could voice the pipes according to their own style. In other words: if we would have taken the wind pressure in Naumburg as a historical piece of evidence, essential to build an organ with that sound quality, Yokota would have probably been forced to close the toe holes, and, since the area of the toe hole and that of the windway are closely related, to work on the windway and the cut-up as well - thus having to change the mouth geometry as a first step. As it turned out, there was no need to raise the pressure to make the pipes, once voiced, speak louder: the acoustics at the Orgelpark support any sound very well, so that additional amplification was not needed.
Yokota followed a comparable line of thinking and working regarding the application of nicks: it appeared possible to make, for example, the Rohrflött 4′ speak the way he had envisioned it, i.e. without nicks, but it implied so many changes in the geometry of the mouth section that the pipes no longer could be considered Hildebrandt inspired pipes. A few very small nicks made this entire procedure redundant, which gives us reason to believe that Hildebrandt himself applied nicks too.
As for the reed stops: no original example by Hildebrandt has survived. Our Fagott 16′ is based on that in the Rückpositiv in Naumburg, the Vox humana on that found in the Oberwerk of the same organ. The Naumburg Vox humana was designed and built after Adlung's descriptions by Helmut

14 This term was coined by Karin Bijsterveld. Her newest book (London: Palgrave Macmillan, 2018) is titled *Sonic Skills: Listening for Knowledge in Science, Medicine and Engineering, 1920s-Present.*

Werner.[15] The other reeds of our organ (the two Posaunes, the Trompet and the Clarin) are, like the Fagott, conceived with Gottfried Silbermann's examples of such stops in mind. The Posaune 8' has slightly narrower resonators than the Posaune 16', in order to achieve a bit more definition in its upper harmonics.
The surface of the inside of original Hildebrandt pipes gave the strong impression that Hildebrandt cast his pipe metal on linen. This impression is further supported by the fact that linen-weaving has been an important industry in the South-Eastern part of Central Germany for centuries. In order to determine what sort of linen would be most appropriate, Dirk Eule (Managing Director of Eule) organised a visit to linen-weavers Hoffmann in Neukirch, during the team's fourth study trip, where Munetaka Yokota selected various varieties. Tests with this linen proved its ideal suitability for casting pipe metal: it remained perfectly intact and the metal plates were immediately flawless (without holes or other shortcomings) and of a proper thickness. The cooling of the plates occurred quickly thanks to the granite slab under the linen – thus guaranteeing optimal elasticity and strength.
While casting the metal, a single relatively high sliding box was used with a non-adjustable opening at the rear. On exiting the box onto the casting bench, assuming a constant speed, the gradual reduction in pressure in the box as the metal exited facilitated the thinning of the metal towards the top of the pipe. The metal sheets were then planed to the correct thickness by hand. During the pre-voicing of the pipework by Yokota and his employees in Elbertse's workshop between August and November 2016, it became clear that Eule had gone about their work most diligently and had made pipes as Hildebrandt might have made them - that is: as far as we know of course. Conforming entirely to the tradition known from the work of Silbermann, Hildebrandt also opted for a relatively high tin content in his metal pipework. For the new organ, Yokota and Werner decided on a tin percentage of 87.5 % with the balance made up of lead and, in very small quantities, antimony, bismuth and copper in order to ensure the necessary strength in the metal. Comparable "pollutants" were formerly entirely common in lead/tin alloys; today, these must be added separately due to the purity of modern metals.
The shallots of the reeds are entirely cast from lead with a collar mounted on a wooden block, once again as was common in the Silbermann tradition. The boots and blocks are made of pearwood. The resonators of both Posaunes are made of pine, as are the longest resonators of the Fagott. The Subbass, Octavbass and Quintbass are made of the same material; these three stops as well as the Unda Maris and the lowest eight notes of the Principal 16' were made by Elbertse Orgelmakers. The languids of the wooden pipes, like those of Hildebrandt, are equipped with a separate front end, made of oak, allowing the voicer to determine its position and its angle when voicing. The voicer glues the oak parts to the languids once these parameters are decided upon.

15 Jacob Adlung. *Musica Mechanica Organoedi*. Berlin: Birnstiel, 1768. § 208. More importantly, with a reference to the Hildebrandt Vox humana: *Anleitung zur musikalischen Gelahrtheit*. Dresden/Leipzig: Breitkopf, 1783/2. § 200, especially page 575.

Winding system and action

In order to allow it to function optimally, as if it were a Hildebrandt organ, the instrument is equipped with four wedge bellows measuring 9 feet by 5 feet: considerably larger than their North German equivalents which mostly measure 8 feet by 4 feet. The difference (45 square feet rather than 32) was undoubtedly down to Hildebrandt's concept of utilising a larger number of stops with large pipes; a Hildebrandt organ consumes more wind than a Schnitger organ.
Because there was no other place available, we chose to locate the bellows in the lower case of the organ. Consequently, the bellows were obliged to be smaller than those in Sangerhausen (where they measure no less than 11.5 feet by 5 feet). Given the fact that the organ has a relatively low wind pressure, we thought this decision to be justifiable. An extra advantage is that all four bellows can be humanly operated from the right-hand side of the organ. This requires two calcants, weighing at least 50 kg each.
The length of the wind trunks could be limited due to the interior location of the bellows. Because the location of the pallet boxes differs from Hildebrandt's, the geometry of both the wind-trunks and the action is likewise different. The relatively low wind pressure results in only a light

pluck at the key. As a result, the attack on stops with a very characteristic initial speech (such as the Violdigamba) can be manipulated rather easily: a strong attack (by opening the pallets more quickly) results in the organ sounding more promptly than a softer attack (by opening the pallets more slowly). Experienced organists can, as a result, give extra profile to polyphonic lines.

As said, the stops are engaged and cancelled by changing the position of long wooden bars. The action which moves these bars is made of iron and operates via rollers (also made of iron) manipulated by powerful electro-magnets. These magnets are activated whenever the organist engages a stop at the mechanical console: two for the C-chest and two for the C#-chest.

An advantageous by-product of electric stop action is that the stop knobs do not have to be locked into place to prevent them springing back. It was important, nonetheless, to avoid this being solely down to the magnets; Elbertse Orgelmakers were able to make the action such that the necessary power to hold the springs open was delivered elsewhere in the system and by mechanical means.

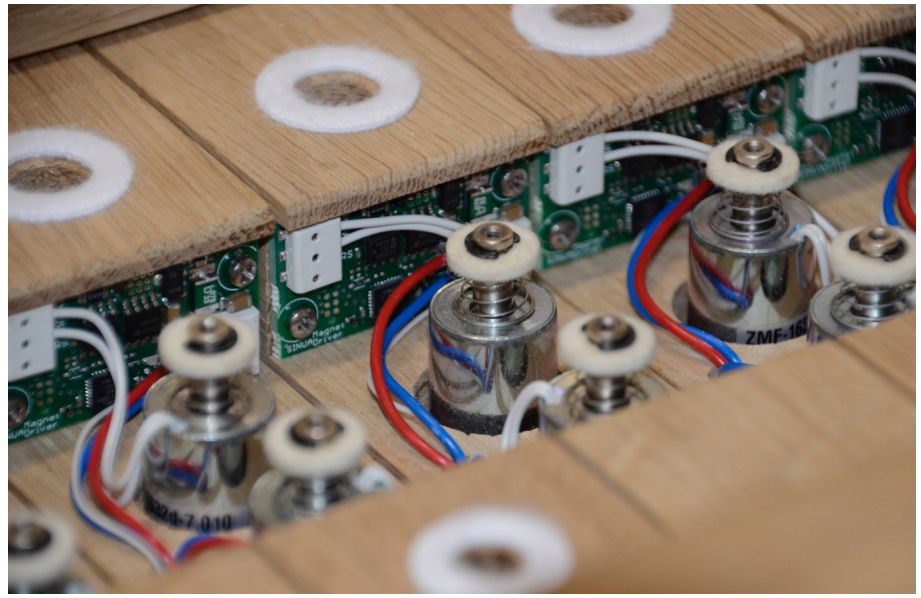
A unique facet of the action in the Utopa Baroque Organ is that powerful magnets are also employed to open all the key-pallets in all of the pallet-boxes simultaneously. These magnets are activated as soon as the organ is switched on at the digital console: all tone-channels are then permanently under pressure, so that the organ can be played via the pallets under the pipes, which act solely as stop-pallets when the organ is played from the mechanical console. Whether a pipe speaks or not is determined exclusively by the status of the Sinua magnet, in turn determined by the software in the digital console, which, in turn once again, is determined by the organist.

That the new organ in the Orgelpark is not a Hildebrandt organ is true not only because he didn't build it, but also because the design of key elements differs significantly from Hildebrandt's practices. That said, the principle of "process reconstruction" was applied as seriously as possible in all sound-producing elements of the instrument: the type and measurements of the bellows, the wind-trunking, the pallet-boxes, the design of the pallets themselves (size and overlay), the speaking point in the mechanical key action, the volume of the tone-channels and finally the construction and voicing of the pipework. This final aspect is of ultimate importance. In order

to assure that no compromises were made, the core team commissioned Munetaka Yokota to voice the organ using only the mechanical action.

Digitality

This does not however imply that the quality of voicing when the organ is played from the digital console was left to chance. Thanks to an innovation developed in the summer of 2017 by Sinua, the possibility exists to closely control the speed and the extent to which the current opens the pallet. Likewise, during release, the current is withdrawn in two stages. In both instances the parameters can be adjusted via the Sinua software. Pipes which spoke too explosively when tested from the digital console had the "behaviour" of the respective magnets adjusted, in most cases to allow the corresponding pallets to open slightly slower. The parameters thus determined for each magnet are referred to as the "sweet spot" which the console will always "remember" and get back to; the organist can introduce variations in the behaviour of each magnet.



The magnets which operate the tone-pallets are all equipped with an own processor mounted on a circuit board measuring less than 2 x 3 cm. The circuit boards are positioned immediately adjacent to each magnet inside the tone-drawer.

Utopa Baroque Organ playable on it without any great problems. This means that the 2011 console is now the interface to two organs. During the design phase of the software, the decision was made to use the same software system for both.[16] This not only to avoid confusion but, following the example of the Woehl organ in Piteå, to make different instruments "accessible" via one and the same set of keyboards. Just as in Piteå, the different sound concepts (in our case the Sauer organ on the one hand and the Utopa Baroque Organ on the other) are entirely independent. However, again as in Piteå, it is possible to combine them. This meant that the console had to be revised; only the stop controls for the Sauer organ have remained in their original place. These are divided into six groups, each with its own colour; each colour corresponding with one of the Sauer organ's six wind-chests. The white and blue stop controls refer to the two chests of Manual I, the pink and yellow to the chests of Manual II (enclosed), the green and grey to the chests of the Pedal.[17]
The 2011 design of the console was simple. In the keycheeks of all of the manuals, push buttons were installed in the same six colours as the stop controls. By pushing these buttons, the organist could determine which colour of stops (i.e. which wind-chest) would be playable on the corresponding keyboard. Each colour (wind-chest) had three buttons per keyboard to determine whether the stops in question would sound at their nominal pitch, one octave higher or one octave lower, or in combinations of the three. The pedal stops allowed only for nominal pitch and one octave higher (or, of course, a combination of the two).

Interfaces

As said, a console is, in fact, an "interface": the link between the sounds offered by the Utopa Baroque Organ and the Sauer organ, and the organist. The interface "faces" the organist on the one hand; on the other hand, it also "faces" the organ(s) in order to activate the organist's desired combinations of sound.
In the case of historic organs, the majority of sound possibilities contained within the pipework are inaccessible. Their simple technical structure and the correspondingly limiting compasses of the manuals keep these sounds out of reach for the organist: pipes are grouped exclusively in stops and must be activated as such, rather than individually.
As has already been stated, the experience gained by the core team in Ratingen showed that the ability to overcome the restrictions of this grid, i.e. to combine individual pipes at will, rendered the organ's sounds considerably richer and more interesting. This led us to ask what would happen when this option would be applied to an already beautiful historic sound-concept. In addition to the technical conditions, i.e. the choice to use spring-chests and Sinua software, another condition was of essential importance to this innovation's success or failure: the digital console needed to "face" the organist in such a way that it would invite and encourage to get to know and explore the myriad of new sound possibilities without extensive study.
The basis for the interface design was formed by two insights drawn from practical experience. Firstly, the fact that pipes are traditionally collected in stops, rather than being combinable at will, could not be viewed as having been superseded by our innovations. On the contrary: the console addresses historic sound concepts without being changed in any way, not even to make them fit the options offered by the digital technology better; in fact, we even chose the Utopa Baroque Organ to have an inequal temperament. This meant that the new console needed to have stop controls as of old. The "only" change would be the increased diversity of manners in which these stops could be engaged - or, more precisely, in which the constituent parts of the stops, i.e. the pipes, could be engaged.
Our second practical insight was that the ability to combine pipes at will is most useful and manageable if it is done primarily to create "new stops". In Ratingen, and subsequently with other organs with Sinua software, organists such as Olivier Latry have enjoyed building new stops by combining certain pipes on the lowest key of the keyboard and

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16 This means that the possibilities of the Sauer organ have been updated; it "profits", so to say, from the technology developed for the Utopa Baroque Organ.

17 In fact, the pedal pipework stands on three separate wind-chests. We found no reason at all in 2011 to make each of the three chests independently operable; neither did we in 2017.

THE MECHANICAL CONSOLE

The mechanical console of the Utopa Baroque Organ resembles the consoles of Zacharias Hildebrandt's organs. We took the original manuals at the Sangerhausen organ as the reference of our manuals: every detail was followed meticulously. As for all other details, the console of the organ at Naumburg was our example, including the blue colour.
The Hildebrandt organ at Naumburg was one of the very first to have printed stop name tabs: a combination of latin and gothic letters ("Fraktur" in German) was chosen. In cooperation with Philip Elchers (Groningen), the most similar fonts were identified, and printed on paper of the same colour as used in Naumburg in 1746. Hermann Eule Orgelbau provided the measurements and form of the Naumburg knobs. Here we took the the freedom to improve the readability of the stop names: instead of 27 mm, our stop name tabs have a diameter of 30 mm. That the console is equipped with a sequencer system, can be seen at the small display above the Oberwerk keyboard, and at the two iron foot levers above the pedal keyboard, to move back and forth in the sequencer.

then having the computer programme the same combination on the other keys. This insight means that the digital console has to "see" the Sauer organ and the Utopa Baroque Organ just as they are: organs with a sound structure determined by traditional stops. Should the organist wish to go further, for example by assigning pipes at random to whichever keys, this is entirely possible, but we chose to have such possibilities not visible in the surface functions of the interface.

That said, a pivotal question arises: if the digital console "presents" stops in the traditional sense, how in practice does it invite the player to search for and apply new sounds?

The first part of the answer, we determined, was the idea of registering in "layers", conforming to the philosophy behind Sinua's software, but taken a stage further. In Ratingen and Düsseldorf, in order to provide organists with a sense of security, Sinua has designed the interface such that it seemed as if certain stops were permanently linked to a corresponding keyboard.

In the Orgelpark the solution is different: the console does not suggest that the stops of the Utopa Baroque Organ belong to a particular keyboard, just as the wind-chests of the Sauer organ don't belong to a particular keyboard. Registering in "layers" means that (many) more than (just) one registration can be realised on each keyboard and that those registrations can be used simultaneously at will. The old colour-coded push-buttons in the keycheeks have disappeared and been replaced with new buttons via which the registration "layers" can be activated and controlled. Each keyboard has four buttons marked respectively, for example on Manual III, "III.1", "III.2", "III.3" and "III.4". These correspond with the first four registration layers on Manual III.

Following its rebuilding, the panel above the third manual (directly under the music desk), previously empty save for a single display screen, now presents quite a few controls. The upper half of the panel is occupied by a long dark glass screen behind which are located a row of six displays. Underneath five of the six displays are located black push-dials. Under the third display (from the left) are located, instead, four white buttons marked "New Layer", "Edit", "OK" and "Escape". Under these displays and their corresponding controls are located the stop controls for the Utopa Baroque Organ in a single row and in traditional order: from left to right the stops of

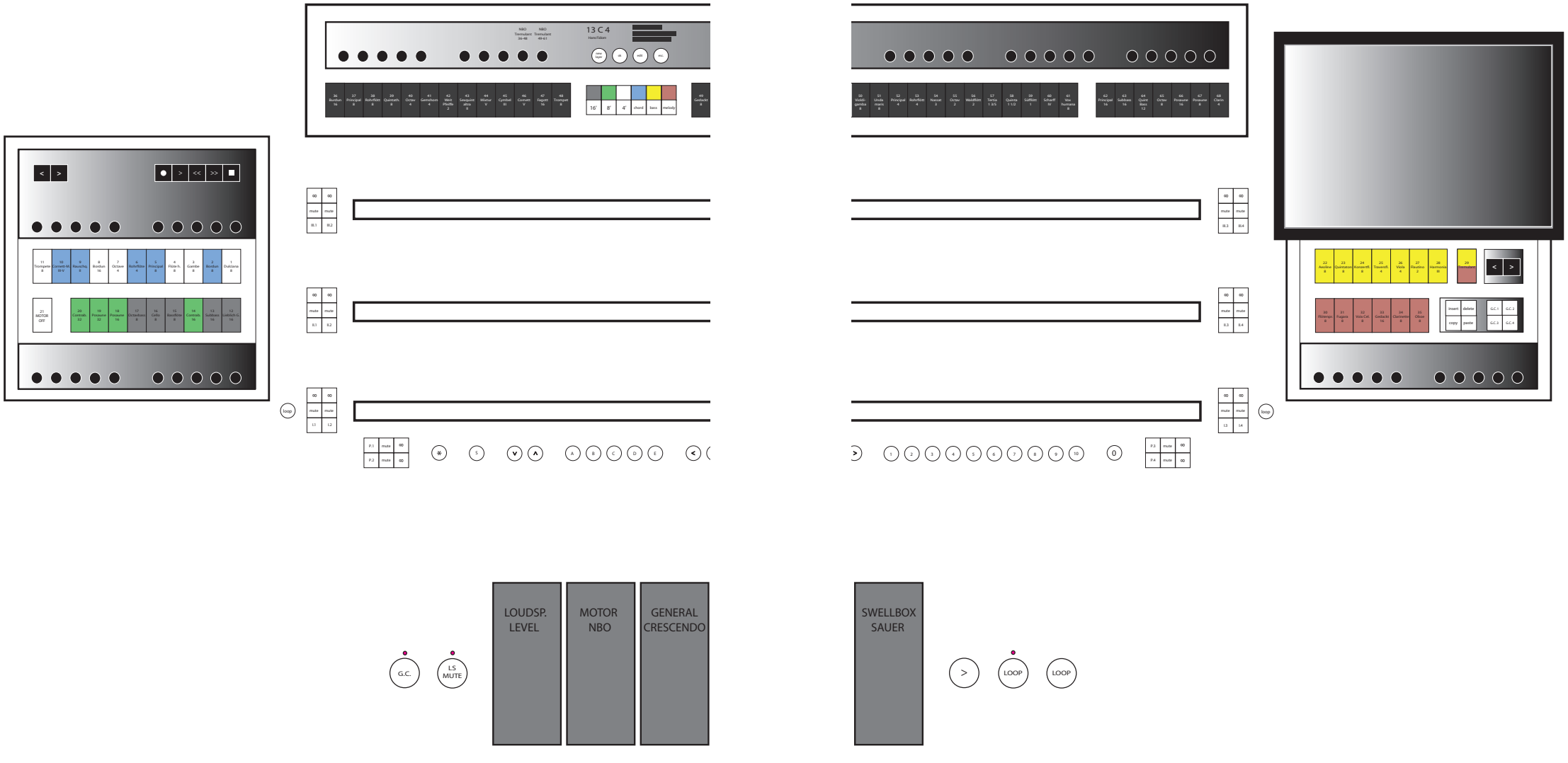
the Hauptwerk, then the Oberwerk and then the stops of the Pedal. Between the stops of the Hauptwerk and the Oberwerk there is a space occupied by six coloured buttons (corresponding to the six wind-chests of the Sauer organ) and six white push-buttons, allowing to make a layer sound in "normal" pitch (the corresponding button is labeled " 8' "), and/or an octave lower (16'), and/or an octave higher (4'). The three other buttons control other layer-properties: "Chord" allows the organist to attach a selection of keys to each key played, "Bass" lets the layer sound only on the lowest key played, "Melody", in turn, lets the layer sound only in the highest key played. The system does the latter more intelligently than bass- and melody-couplers from the era of (electro-)pneumatic organs: if, in case the melody-button is activated, the organist releases the highest key played but does not release the other ones, the system will not make the then highest key louder; it will do so only after that key is released and played again, or if another key above it is played.

In order to gain some idea of the thought-process behind the layer registration concept, here is an example of how it might be used. Once the organist has activated the button "III.1" in the bass keycheek of the upper keyboard, she can use the controls above Manual III to determine the composition of the first registration layer on Manual III, i.e. layer III.1. Let's imagine that she chooses the Principal 8' from the Hauptwerk of the Utopa Baroque Organ. On activating the button "III.2", the knob for the Principal 8' will be cancelled; the organist can now determine the sound of registration layer III.2. For example, the Principal 8' might again be engaged, but this time, by rotating one of the black push-dials, a number of notes higher or lower (let's say a third higher). The display adjacent to the respective push-dial shows that layer III.2 sounds 4 semitones higher than "normal". On playing, for example, the note C on Manual III, two pipes from the Principal 8' sound: the pipe corresponding to the note C (layer III.1) and the pipe which sounds a third higher (layer III.2).

In order to keep track of all the registration layers active, the console is equipped with a display screen. In the case of our example, the screen would display two boxes, one for each registration layer. The box named "III.1" tells the organist that in layer III.1 the Principal 8' is active, the box named "III.2" that the Principal 8' is also active but sounding a third higher than normal.

THE DIGITAL CONSOLE

The interface of the digital console has been developed in close cooperation with organist/improviser/composer Jacob Lekkerkerker. Anyone playing this console has to understand that it allows multiple layers of registration on every keyboard. With the buttons in the cheeks of each keyboard these layers can be “opened”, muted or made sound “forever” (which means applying the sustain-property to that layer). When opening a layer, the board above the upper manual shows the registration of that layer.



While playing, the organist can engage and disengage registration layers: adjacent to each layer button in the keycheeks, there is a second button marked “Mute”. Using this control allows the organist to silence a layer immediately. The display screen also has touchscreen capability. This means that the organist can also plan registrations by touching the screen, for example moving layer III.2 to another keyboard, using the drag and drop feature.

Each registration layer has its own properties. “Transpose”, the one just explained in the example, is just one among many others. Another property is “Ambitus” which the organist can use to determine in which area of the keyboard compass the registration layer is active. Another, more complex, property is called “Dynamic” with which the organist can determine the velocity of touch at which each layer becomes active. It is possible, to use the cited example, to make layer III.2 active only when employing a heavy, i.e. fast touch; in all other cases only layer III.1 will sound. There are around 15[18] of these functions which can be assigned to each layer, including some which, as described, affect the way in which the movement of the key is translated into the movement of the pallet. As a result, the organist has a level of contact with the sound via the digital interface that is barely possible with a mechanical action.

Should the organist wish to engage sounds from the Sauer organ, the first step would be “opening” a layer, for example layer III.1 on which, in our example, the Principal 8’ from the Utopa Baroque Organ has been activated. The organist opens the layer by pressing the button marked “III.1” in the bass keycheek of Manual III. The buttons above Manual III (the stops of the Utopa Baroque Organ) will revert to the situation created within that layer, in our example by engaging the stop tab “Principal 8’ “. Because the Sauer organ has a more old-fashioned construction than the Utopa Baroque Organ,[19] only wind-chests can be added, rather than individual stops.

18 The number of layer properties is expanding with every software update, hence our choice to have ten push-dials and their adjacent displays for future functions; for the time being, they are without any function.

19 It has no so-called “single-tone action”, which is to say that the pipes of the Sauer organ can only be controlled in groups (such as stops) and not individually.

Expanding on our example, should the organist want to add the blue stops to the layer, she would have to push the blue button above Manual III. In order to determine which of the blue stops would be added on pushing the button, one or more blue stops would have to be engaged from the stop panel to the left of the keyboards, for example the Bourdon 8’.

If the organist now plays on Manual III, both the Principal 8’ of the Utopa Baroque Organ and the Bourdon 8’ of the Sauer organ are heard. Layer III.2 remains programmed with the Principal 8’ of the baroque organ, still a third higher than unison pitch. As stated earlier, each layer can be deactivated by pressing the “Mute” button corresponding to the layer in question.

Next to each layer button not only a mute button but also a third button marked “∞” is provided. This is a “sustain” device; on activating, each key which is pressed continues to sound on release until struck (firmly) again. The degree of firmness required to release the note can be determined by the organist via the touchscreen. Of course the sounds can be released as well by pressing the ∞ knob again.

The Sinua system also features proven old-fashioned playing-aids including a sequencer which allow registrations to be saved in the required order. The memory for the sequencer is “user-specific”; each organist receives an individualised RFID key, so that it is impossible to access (and change) the registrations of other organists. This is likewise the case with the sequencer on the mechanical console. The digital console also allows the organist to record his or her playing, saved in the form of key and stop movements. The 2011 version of the console was already equipped to do this; it is a very useful tool, for example to analyse improvisations.

Organist Jacob Lekkerkerker was especially helpful in determining the layout of the console. At his suggestion, Sinua realised a second innovation (the first being the abandoning of the suggestion that specific stops belong to specific manuals), namely a “loop-station”. Lekkerkerker often uses this tool, much beloved among electric guitarists, as it allows a phrase to be repeated as soon as it is played. On pressing the “loop” button (located in both the bass and treble keycheeks of Manual I and also provided as a toe piston) the

organ begins to record the movement of the keys. On pressing the button again, the organ begins to repeat the keys played time and again.
Four balance pedals are located directly above the pedalboard. The organist can nominate which function is assigned to each pedal. One operates the blower which provides wind to the bellows of the Utopa Baroque Organ: the blower's revolutions per minute can be manipulated. Organists who find it exciting to work with variations in wind pressure have, therefore, and in addition to the options offered by the layers of registration, the opportunity to control the source of the wind directly. The possibility also exists for them to work with human calcants: the blower can remain switched off in order that the calcants can provide the wind and any desired effects to be produced by them. In order to optimise the opportunities in this regard, a special music stand for the calcants has been provided adjacent to the pumping pedals.
The other three function pedals on the digital console are intended for the so-called "general crescendo" of one or both organs,[20] the swell box of the Sauer organ and for the volume of the loudspeakers in the event that the organ is, via MIDI, controlling (and in fact making) electronically produced sounds.
It is important to note that the interface offered by the digital console does not have to be used at all. The console features MIDI and OSC connections which make it possible to play the Utopa Baroque Organ via other interfaces such as laptops, tablets and microphones etc. Because musicians who work with laptops etc. also like to make use of loudspeaker-produced sounds in their music, the Utopa Baroque Organ is equipped with five patchbays: locations where their microphones and loudspeakers can be connected to the sound system of the Orgelpark. Three of these patchbays are located in the organ itself, one on each "floor" (bellows, Hauptwerk, Oberwerk). The other

20 The "general crescendo" is a stop-crescendo device, It was already provided for on the console lay-out of 2011. Originally the control had the form of a "roller", or, as the Germans say, "Walze" ("Rollschweller"), as found on the Sauer organ's original console. As the digital console now also controls the New Baroque Organ, the roller has been removed - this also as a result of the insufficient leg-room to operate it comfortably.

two are located to the left and right of the organ. No standard microphones and loudspeakers are installed in the organ itself, because equipment which may now seem essential for the music of the future may turn to be obsolete all too soon. We opted, therefore, "only" to provide mounting points for such equipment so that composers, musicians and other artists feel invited to add to the organ sounds produced by loudspeakers.

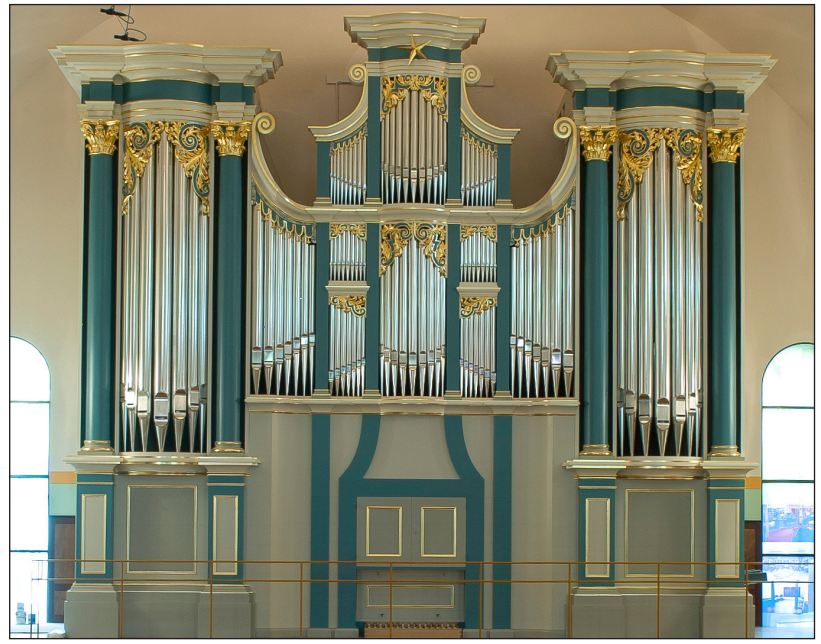
Façade, ornamentation and colour

The fifth and final study trip undertaken by the core team took place from 30 March to 2 April 2016, by which time most important decisions had already been made. The organ case was taking shape in Elbertse's workshop, Eule was already busy making the pipework.
The structure of the organ case had already been determined by the core team. It had decided against, for example, a simple contemporary case without decoration. Because the Hildebrandt organ in Hettstedt had given us the basis of the Utopa Baroque Organ's specification, the team decided that the basic form of the Hettstedt case should likewise be adopted, both in terms of its basic structure (Hauptwerk in the centre, Oberwerk above and Pedal either side) but also the profiles and proportions of the entablatures, carvings and the columns which give the pedal towers their characteristic appearance. As the specification would be slightly larger than in Hettstedt and because the bellows had to be accommodated within the case, adopting the proportions of the Hettstedt case was not possible: we needed more height. The solution lay in the relative proportions of the organ case in Sangerhausen: adopting them in the Orgelpark gave us the space we needed. All necessary measurements were taken on an additional trip and forwarded to Elbertse's cabinet makers.
At this stage we were still considering the colouring and ornamentation of the case: should the organ be decorated in contemporary colours and ornaments in order to reflect the organ's new aspects? Instead of ornamentation, was incorporating decorative lighting into the organ case a better option? On the basis of research undertaken by VU University student Fabienne Chiang, the history of organ façade design of the past three decades was charted, revealing the current fashion for such lighting, sometimes in combination with plexiglas decorations.

THE FAÇADE: PROVENANCE

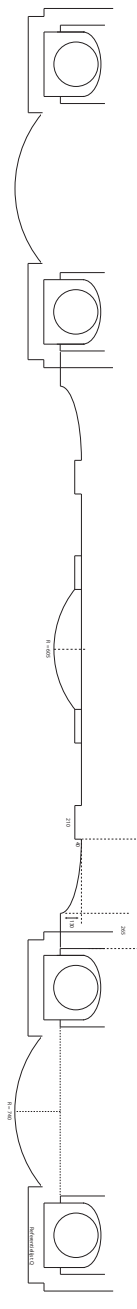
The façade of the Utopa Baroque Organ combines aspects of the façades of the Hildebrandt organs at Hettstedt (details, entabulatures, width of the organ case), Sangerhausen (proportions), and Langhennersdorf (colors and shades).

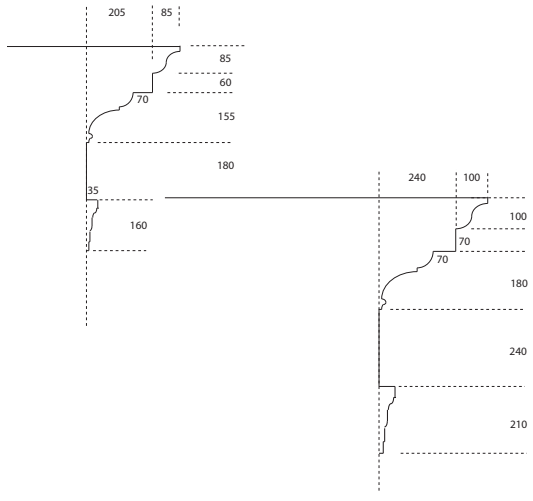
Woodcarver Gert van den Dikkenberg (Veenendaal) designed and made the shades of the Utopa Baroque Organ; he followed the example of Langhennersdorf meticulously. Upper photo: Sangerhausen; to the right: Hettstedt.



THE FAÇADE: MEASUREMENTS

The façades of the Hildebrandt Organs at Sangerhausen and Hettstedt were meticulously measured by the Orgelpark; not one detail of the Utopa Baroque Organ façade has been left to chance. Based on these measurements, a final drawing (half of it is shown on the opposite page) was sent to Elbertse Orgelmakers, including data to all kinds of details.
Initially, we thought to leave the base of the case rather simple; later we decided to follow the Hettstedt example in that respect as well.





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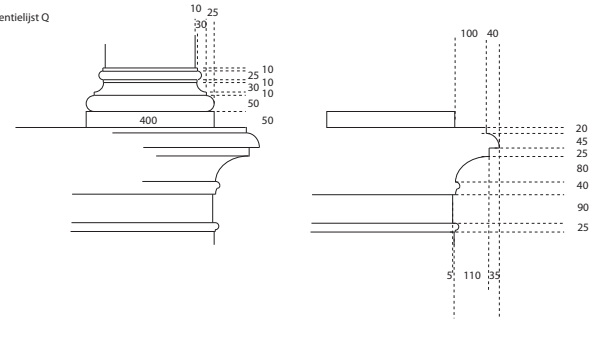
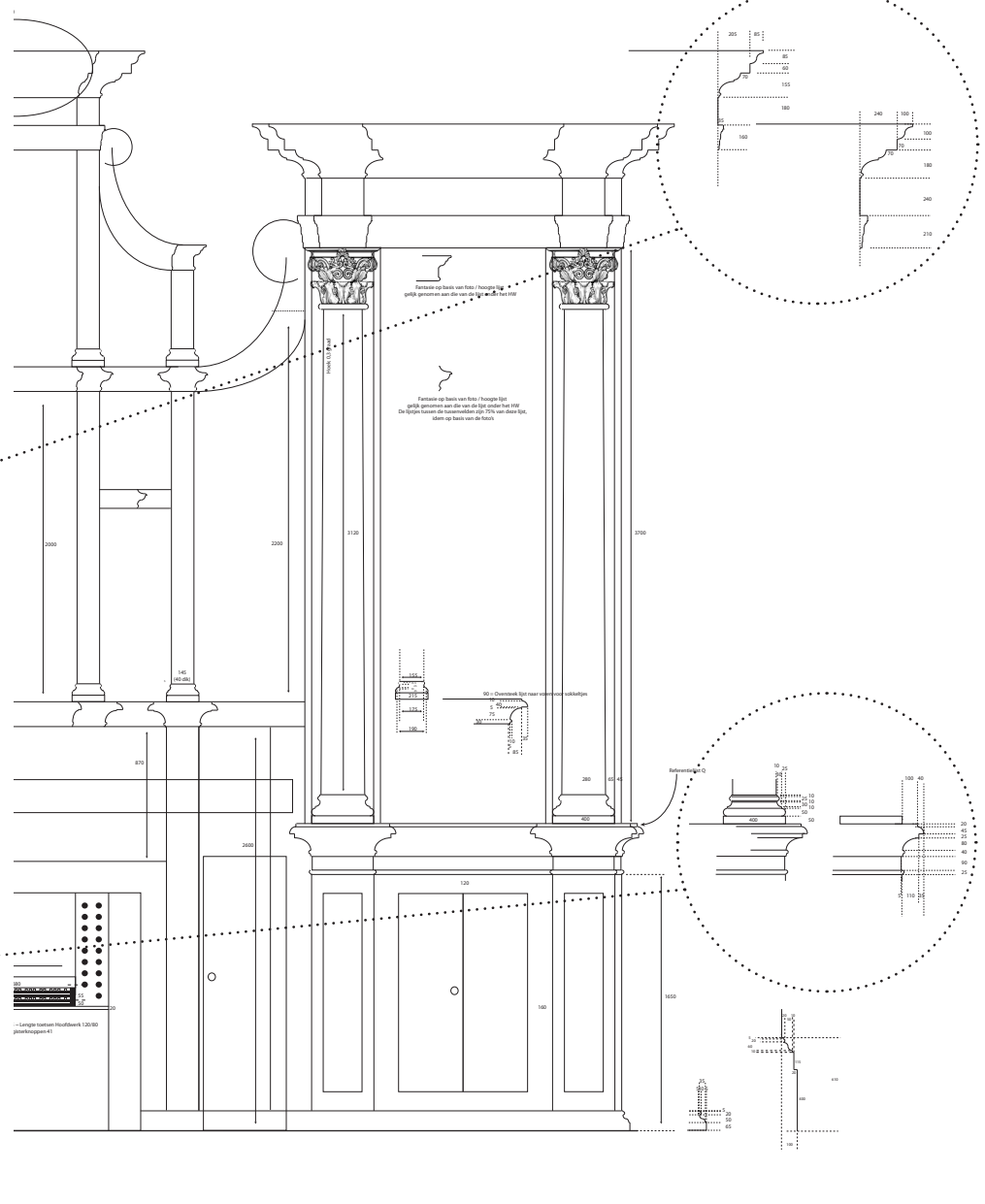




INTERMEZZO: THE VAN LEEUWEN ORGAN

In order to be able to build the Utopa Baroque Organ, the Orgelpark had to find a new place for its Van Leeuwen organ, a fine example of Dutch organ building in the 1950s. The organ had been built in 1954 for the Adventkerk in Loosduinen, near The Hague. Its new location is the concert hall of the School of Music in Nowy-Targ, near Krakow, Poland, where it is intensively played by young talents. On Thursday June 2nd, 2016, Peter Planyavsky played a farewell concert on the Van Leeuwen organ; it was the opening concert of the International Orgelpark Symposium in that year.

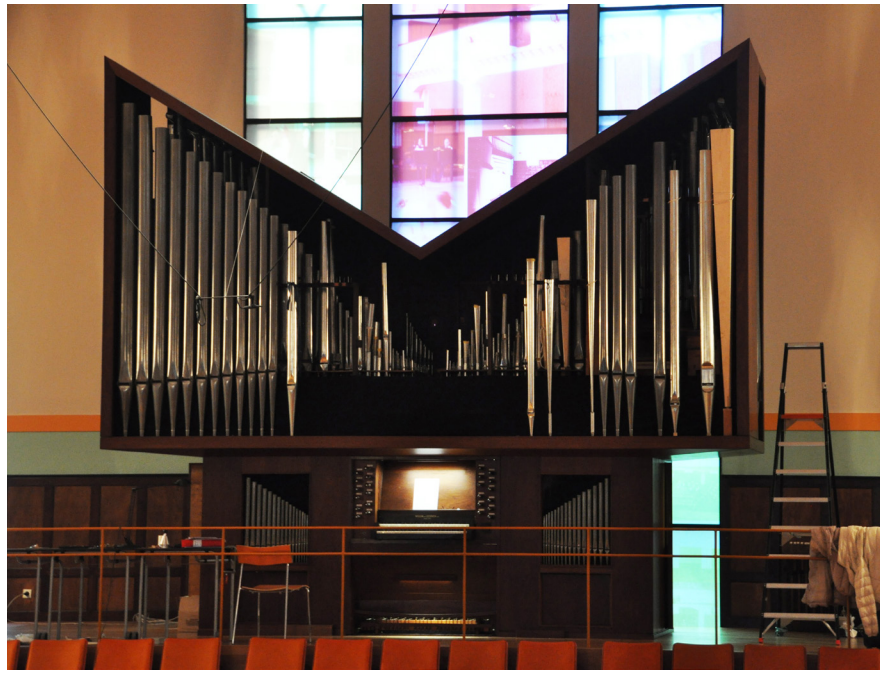
The Orgelpark placed the Van Leeuwen organ in 2006; together with the Sauer organ (until 2011 without second console) and the Viennese Molzer organ, it formed the backbone of the Orgelpark concerts in the early years. Its specification was typical "neo-baroque"; all pedal stops were transmissions from the Hoofdwerk, except the Subbas, which was constructed as a slightly conical metal stop.

The Van Leeuwen organ in its original location: the Adventkerk in Loosduinen.

Hoofdwerk (C-g3)
Prestant 8′
Roerfluit 8′
Octaaf 4′
Quint 2 2/3′
Nachthoorn 2′
Sexquialter III (from g)
Mixtuur IV-VI
Dulciaan 16′

Nevenwerk (C-g3)
Spitsgedekt 8′
Speelfluit 4′
Prestant 2′
Nasard 1 1/3′
Cymbel III
Schalmeij 8′
Tremulant

Pedal (C-f1)
Subbas 16′
Prestant 8′
Roerfluit 8′
Octaaf 4′
Mixtuur IV-V
Dulciaan 16′



In the fall of 2016, one of the last functions of the Van Leeuwen organ in the Orgelpark was being a guinee pig: several pre-voiced pipes of the Utopa Baroque Organ were placed in its façade, in order to check their sound in the Orgelpark acoustics.

The goal of the team's fifth study trip was primarily to find answers to these questions. The programme included visits to the Hildebrandt organs in Langhennersdorf (1722), Lengefeld (1726) and Sotterhausen (1730) as well as the organ in the Hofkirche in Dresden, begun by Gottfried Silbermann and completed by Hildebrandt in 1755. Although the colourful, and presumably original, decoration of the organ in Sangerhausen, where the trip began, resembled the contemporary colour scheme under consideration, the restful colouration of the Dresden organ with its rich ornamentation proved much more inspiring. A subsequent visit to Langhennersdorf revealed that the same basic colour (soft white) could also be perfectly combined with turquoise accents and gold ornamentation, and that this combination had in all probability been designed by Hildebrandt. This made us decide that the Utopa Baroque Organ would have the same colours as the organ at Langhennersdorf. This instrument had been restored in 1996 by Kristian Wegscheider at which time the colouring was reconstructed in close co-operation with Hilke Frach-Renner. Frach-Renner did some further research for the Orgelpark and was able to provide the team with precise details of the colour palette. On this basis, the team developed a definitive colour design. The painting and gilding were undertaken by the Schildersbedrijf De Jongh (Waardenburg).

Because the wooden carvings in Langhennersdorf were also deemed appropriate by the team for the façade of the Utopa Baroque Organ (beautifully detailed but quite reserved in their visual language), it was decided to use these too. Wood carver Gert van den Dikkenberg (Veenendaal) formulated the designs and produced the carvings.

Inspired by the organs in Sangerhausen and Hettstedt, a cartouche is located above the console featuring a text which tells of the organ's construction history. This was likewise designed and made by Van den Dikkenberg; the ornamental design of the cartouche follows the same idiom found in Langhennersdorf. Translated in English, the Dutch text on the cartouche reads as follows: "Inspired by the works of organ builder Zacharias Hildebrandt, contemporary and fellow countryman of Johann Sebastian Bach, has this Utopa Baroque Organ been built by and for the Orgelpark, an initiative of the Utopa Foundation, chair Loek Dijkman, vice-chair Sylvia de Munck / The Orgelpark realised this organ, that gives access to its 18th century sound world in both old and new ways, in cooperation with Elbertse Orgelmakers (Soest; technology, wooden pipes, organ case), Hermann Eule Orgelbau (Bautzen; metal pipes), Munetaka Yokota (Tokyo; voicing), Sinua (Düsseldorf; digital technology)":

Geïnspireerd door het werk van orgelmaker Zacharias Hildebrandt,
tijd- en streekgenoot van Johann Sebastian Bach, is dit

UTOPA BAROK ORGEL

gebouwd door en voor het Orgelpark, een initiatief van Stichting Utopa

voorzitter en vice-voorzitter
LOEK DIJKMAN & SYLVIA DE MUNCK

Het Orgelpark realiseerde dit orgel, dat op oude en nieuwe manieren
toegang biedt tot zijn 18de-eeuwse klankwereld, in samenwerking met

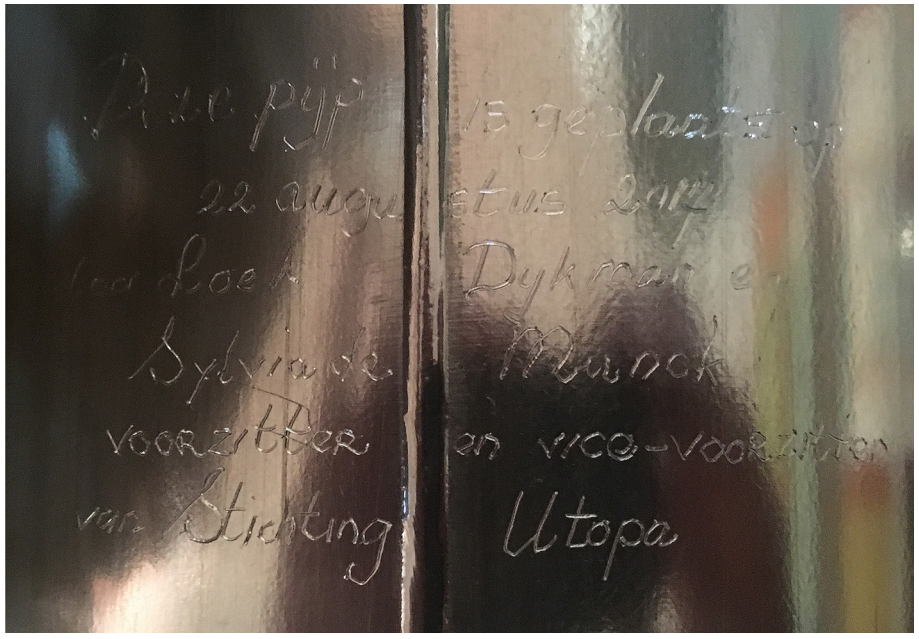
Elbertse Orgelmakers te Soest (orgeltechniek, houten pijpwerk, orgelkast)
Hermann Eule Orgelbau te Bautzen (metalen pijpwerk)
Munetaka Yokota te Tokyo (klank)
Sinua te Düsseldorf (digitale techniek)

21 maart MMXVIII

Conclusion

The Utopa Baroque Organ is a hyperorgan, equipped with technology which allows its own acoustic sounds to be heard in many more diverse ways than would be possible with traditional organ technology. The Orgelpark built the organ to complement the sound-worlds of the 15th/16th and 19th/20th centuries, represented in the existing instruments, by providing an instrument reflecting a specific sound-world of the 17th and 18th centuries. At the same time, the Orgelpark wanted to build an organ which would inspire new music. For this reason, the organ is equipped with spring-chests which, on the one hand, facilitate historically informed/inspired performances without any restriction, but also allow the organist to use that very same sound-world in entirely new ways.

It is not unthinkable that the newly rebuilt digital console might not only inspire new music, but stimulate reconsidering performance of early music as well, for example because the control of the pallets can be far more closely controlled via the digital keys than could ever be possible with mechanical organ technology. In addition, the sound of the organ can be far better judged by the organist from the digital console downstairs in the room than from the mechanical console attached to the instrument. It is an open secret that the location of the organist when making music at mechanical action instruments is one of the poorest places to judge the music made. In other words, the new aspects of the Utopa Baroque Organ might be just as inspiring for the performance of old music as its old sounds might be for the creation of new music.



The largest front pipe of the Utopa Baroque Organ was placed on August 22nd, 2017. At that occasion, it was engraved: "Deze pijp is geplaatst op 22 augustus 2017 / Loek Dijkman en Sylvia de Munck / voorzitter en vice-voorzitter van Stichting Utopa" ("This pipe has been placed on August 22nd 2017 / Loek Dijkman en Sylvia de Munck / chair and vice-chair of the Utopa Foundation").

Abstract

The new Utopa Baroque Organ is a hyperorgan, equipped with technology which allows its in every respect 18th century sound concept to be used, applied, and heard in many more diverse ways than ever has been possible; it thus inspires to reconsideration of performing old music and of making new music. The choice not to invent yet another futuristic sound concept is based on the fact that the 20th century has shown how short-lived such endeavours are; the choice to apply "process reconstruction", as developed for the first time by the Göteborg Organ Art Center, is based on the conviction that it is apparently possible to make new pipes "sound old". Meanwhile, the Sinua company proved in the St Peter and Paul church at Ratingen that a mediocre sounding organ could yet sound magnificent thanks to thorough rethinking organ interfaces with the application of digital technology; it inspired the Orgelpark to envision what would happen if a truly wonderful sound concept would be equipped with an interface based on this philosophy. The Orgelpark developed the concept of the new organ based on a simple line of thinking: a prequisite for baroque organ sound is the tone-channel wind-chest; a prerequisite for adaption of digital Sinua technology is that every pipe has its own pallet. So the Orgelpark decided to equip the organ with spring-chests. After thorough consideration, it was decided not to take Arp Schnitger's organs as a reference (although he had built an organ with spring-chests, in Stade, 1675) but Zacharias Hildebrandt, contemporary and countryman of Johann Sebastian Bach. The organ has been built by four companies: Elbertse Orgelmakers (Soest/technology, organ case, wooden pipes), Hermann Eule Orgelbau (Bautzen/metal pipes), Munetaka Yokota (Tokyo/voicing), and Sinua (Düsseldorf/digital technology).

Hans Fidom

Hans Fidom is leader of the Orgelpark Research Program and holds the Chair of Organ Studies at VU University Amsterdam. His dissertation *Diversity in Unity* (2002) marks the upcoming of new interest in late 19th and early 20th century organs and organ art. Other topics that interest Fidom are the role listening plays in music and 21st century organ (art) concepts. Hans Fidom is an organist and an organ expert as well.

XII

Ibo Ortgies - The Temperament of the Utopa Baroque Organ

To find a suitable temperament for the Utopa Baroque Organ was a task that had to fulfill a number of requirements. As so often happens when a temperament has to be specified for an instrument or even for a single performance (usually the case when a temperament for a certain performance on a harpsichord or unfretted clavichord is requested), the assignment is to find the best match given the preconditions and circumstances.

Background

The Utopa Baroque Organ has been designed mainly according to the style of Zacharias Hildebrandt (1688-1757). His work is at least occasionally closely connected to Johann Sebastian Bach. Relevant to the Orgelpark was especially the Hildebrandt organ in Naumburg, which was, upon its completion in 1746, famously examined and approved by Bach and by the organ builder Gottfried Silbermann (1683-1753). A later statement by the organist (after 1748) at the organ (and Bach's son-in-law) Johann Christoph Altnikol (1720-1759) about Hildebrandt "following Neidhardt" in matters of temperament, leaves a rather large margin of interpretation.[1]
Johann Georg Neidhardt (ca. 1680-1739) had designed and suggested several temperaments for practical use in organs for churches in villages, smaller cities, larger cities, or at a court in 1724 and 1732. With the exception of Equal

1 Cf. § 265 and footnote 44 in Ibo Ortgies. "Johann Sebastian Bach and Temperament." In: Hans Fidom (ed.): *The New Baroque Organ at the Orgelpark* (Orgelpark Research Report 5/1). Amsterdam: VU University Press & Orgelpark, 2014. § 224–270. See also the previous article in this book (Orgelpark Research Report 5/2).

Temperament (ET), which he suggested in 1732 for use at a court, all of his suggestions employ some 5ths that are smaller by a sixth of the Pythagorean comma and some of them even have the odd 5th off by a quarter.[2]
But we do not know which temperament Hildebrandt actually used in Naumburg. If he "followed Neidhardt," it might just mean that he favored at this time and occasion a finer division of the comma than the 5ths of for example Andreas Werckmeister's (1645-1706) third temperament that is based on the division of the Pythagorean comma into four equal parts.
During the latest restoration (2014) of the Hildebrandt organ (1724-1726) in Lengefeld (Saxony, Germany) by the workshop of Kristian Wegscheider it was discovered that this organ had been tuned (until 1933!) in a temperament which had "meantone characteristics" and a "not usable fifth G# - D#, also referred to as 'organ wolf'."[3] From this we may infer that Hildebrandt applied a flexible tuning practice, possibly moving from meantone in earlier years to a "handmade" ET in his later years (Dresden, Hofkirche, Silbermann organ 1750-1755).[4]
ET was the favorite temperament in most of German writings on temperament in the late seventeenth and eighteenth centuries. We do not know how exact this temperament was set usually. Any ET that was tuned aurally will have been more "lively" than the theoretical model. Individual organ builders and musicians of earlier times certainly tuned ET with a considerable margin and deviation from mathematically exact ET. The rather typical specification of ET in a contract for a new organ or its being reported in an examination report was "in an equal temperament" ("in einer gleichschwebenden Temperatur"), but there was of course only *one* mathematical model for ET. Any contemporary document that points to the use of ET can therefore not necessarily mean that more than a close approximation to ET was realized.[5]
ET is certainly the best choice if one only considers the task of transposing, since the equal steps will not change in quality. The historical argument that leans somewhat toward favoring ET is however contradicted by the wish for a variation in the harmonic quality of the chords. The more unequal, the more character is the device. While writers in the eighteenth century that favored unequal circulating temperaments did not form a majority, there is especially *today* a strong conviction about the quality of non-ET temperaments among musicians that play according to historically informed performance.
When it came to tempering the organ, all German authors on temperament in the seventeenth and eighteenth centuries referred *only* to the practice of accompaniment, to the organ playing with(in) an ensemble. This practice was the "motor" or "trigger" for developing new temperaments.[6]

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2 These are the Neidhardt temperaments summarily referred to in Table 1.

3 "Gleichzeitig war erkennbar, dass die Pfeifen noch bis 1933 in einer Temperierung mit mitteltöniger Charakteristik gestimmt waren. Das bedeutet, dass die Ende 17. und Anfang 18. Jahrhunderts gebräuchlichsten Tonarten in strahlender Reinheit erklangen, während die weniger Gebräuchlichen kaum zu benutzen waren. Erreicht wurde das durch die Bevorzugung von möglichst reinen Terzen in den Grundtonarten bei mitteltönigen Temperierungen. Die Folge davon sind etwas schneller schwebende Quinten, die in der nicht mehr verwendbaren, auch als 'Orgelwolf' bezeichneten Quinte Gis-Dis enden." Quote from Reinhard Schäbitz. "Die Klanggestalt der Hildebrandt-Orgel zu Lengefeld". In Horst Hodick and Petra Pfeiffer, eds., *Die Zacharias-Hildebrandt-Orgel zu Lengefeld*. Lengefeld: Förderverein Zacharias-Hildebrandt-Orgel Lengefeld e.V. Dresden / Sandstein-Verlag, 2014. 76–78; there 77.

4 Hildebrandt completed and finalized the organ after Gottfried Silbermann's death in 1753. This work included of course voicing and tuning.

5 A similar argument could be drawn for the *practical* application a number of unequal temperaments, especially the more tempered intervals a temperament consists of.

6 Cf. chapters 9 "Ensemble-Intonation und Orgeltemperatur" and 10 "Ausblick: Orgelrepertoire, Improvisation und Ensemble-Intonation" in Ibo Ortgies. *Die Praxis der Orgelstimmung in Norddeutschland im 17. und 18. Jahrhundert und ihr Verhältnis zur zeitgenössischen Musikpraxis*. Göteborg: Göteborgs universitet, 2004 (revised 2007; PhD-Diss.; online available at https://sites.google.com/site/iboortgies/phd-dissertationiboortgies). Cf. as well: Ibo Ortgies. "Die Temperierung als Problem der Nutzung von Orgeln in der Basso continuo-Gruppe." In Christian Ahrens and Gregor Klinke, eds., *"…con cembalo e l'organo …". Das Cembalo als Generalbaßinstrument. Symposium im Rahmen der 29. Tage Alter Musik in Herne 2004*. München-Salzburg: Katzbichler, 2008. 169–184.

Solo repertoire played no role in the discussion since improvisation was the main task of the professional organist in that time. Since the Utopa Baroque Organ is also meant to accompany ensembles, the temperament must be able to fulfill this task: the organ must be able to support an ensemble as a continuo instrument in works of any key.
However, playing repertoire i.e. interpretation of scores on the organ, is *today* the valued core of music making. The organ must be able to fulfill this rather modern task as well.
As Bach's organ works need to be playable on the Utopa Baroque Organ, if possible all of them (the question of compass is not dealt with here), a meantone temperament can be ruled out. A temperament that allows performance in all keys is required.

Preconditions and Requirements

Playing with an Ensemble

The pitch of the Utopa Baroque Organ is decided to be at "Cammerton", a1 = ca. 415 Hz, which was in Bach's time in Germany the standard for string instruments and singers. However, brass instruments, mainly trumpets and cornetti, would be a whole tone higher in so-called "Common ['(all) gemeine'] Chorton" at a1 = ca. 466 Hz.
Many pieces with trumpets are for example written in D major in "Cammerton" ("chamber pitch"), which was in Bach's time at ca. 415 Hz for a1. The instruments and singers would play and sing such a piece in D major. As said, however, trumpets were usually tuned in a pitch one whole tone higher, in so-called "Chorton" ("choir pitch"). To play in C major enabled the trumpeters to use the clear, pure tones of the natural or overtone series (trumpets did not have valves). The temperament should render the key of D major and its harmonically closely related keys (the sharp side of the circle of 5ths) in a satisfactory way without sacrificing the flat side of the circle.
Another important aspect is derived from the need to play together with woodwind instruments: The drilled holes of bassoons, oboes, flutes, later in the eighteenth century even clarinets are drilled in distances that facilitate application of unequal steps, which occur independently from the chosen temperament in the accompanying keyboard instrument. An unequal

temperament of the supporting continuo instrument will therefore give better intonation support to this kind of instruments than an ET.
Finally string players playing according to historically informed performance practice (pre 1800) seem to prefer that the three 5ths that can be played with the four open strings are tuned in (about) the same quality, for example C-G-D-A (cellos, violas) respectively G-D-A-E (violin). As a sequence of four pure 5ths results in a too wide, Pythagorean major 3rd, the four 5ths C-G-D-A-E should preferably be smaller than pure by (about) the same ratio – according to other considerations.

The soundscape of the Utopa Baroque Organ

The Utopa Baroque Organ will be built as much as possible according to baroque sound and voicing characteristics. It will offer sounds that can be both rich in partials and fundamental as well. Temperaments like ET or close-to-ET temperaments which have rather strongly tempered major 3rds do better with a fundamental sound as clashes between tones generated by partials and the tempered tones tend to be much less audible in a fundamental sound. Partial-rich sounds, however, will enhance but also be critical for the perception of 5ths and major 3rds in the chosen temperament.
As the Utopa Baroque Organ needs to sound fine in both fundamental and partial-rich registrations a temperament with a good mix of more harmonious, closer-to-pure intervals appears to be more advantageous. Mixtures and mutation stops will also enhance but be critical for 5ths and major 3rds.
While the quality of 5ths is important, major 3rds are more sensitive to temperamental change. Since the mutations of the organ will have a number of major 3rds, the quality of the major 3rds of the temperament is an important factor for the overall soundscape of the organ, especially its organo pleno. The temperament should as much as possible support this feature. Classical meantone temperament (MT), which was still the main temperament in Germany and the Netherlands in Bach's time,[7] would

7 For the situation in Germany see Ibo Ortgies. "Recent Research on Schnitger Organs. New Findings and Attributions." In Annette Richards, ed., *Keyboard Perspectives. The Yearbook of the*

support this feature best. But as MT and the related modified MTs offer only a more limited choice of playable keys and therefore do not fulfill the requirements for a circulating tonal range sketched above, the temperament ought to be of circulating character and should contain a number of pure or close to pure 5ths and 3rds (the latter for the central or "good" keys) that are rather close to pure.

Playing with the Sauer-organ

The digital console allows playing the Utopa Baroque Organ and the Sauer organ at the same time. To play both organs together requires that the deviations between the temperaments of both instruments are kept at a reasonable minimum, which again depends on the pitch of both instruments – the Sauer organ at modern concert pitch, the Utopa Baroque Organ at Cammerton i.e. a semitone lower. We agreed that differences of more than ca. 1 Hz between similar notes in the octave c1-b1 should be avoided as much as possible.

Pulling effect

The pulling effect may occur in two pipes of related pitch/"natural" intervals: unison, octave, fifth, and major third. Pipes that produce intervals rather close to the exact "natural" proportion of the respective interval will be pulled/drawn to the pure interval. The effect depends on a number of factors such as the musical interval itself, the placing of the pipes on the wind-chest, wind-chest type, and/or the distance between the pipes. The closer in terms of interval and physical distance the more favorable. The effect can't be calculated or controlled enough in the highly complex surrounding of a pipe in an organ to be sure if and how it will work.
If the pulling effect occurs, it will most likely favor a temperament that has a blend of rather pure 3rds and 5ths - which again speaks in favor of a more

Westfield Center for Historical Keyboard Studies 9 (2016). 119-150, there 122–124 (translated by Ibo Ortgies and James F. Wallmann). For the situation in the Netherlands see Ibo Ortgies and Frank van Wijk: "„Reyne Harmonie" in Alkmaar. Stemming en temperatuur in Nederland in de 17de en 18de eeuw." *Het Orgel* 99/3 (2003): 12-36.

"conservative" circulating temperament, i.e. with as much pure or close to pure intervals as possible.

Temperament and Bach[8]

We know little about Bach's actual temperament practice and are mostly dependent on theoretical writings, which - if they are proposing new temperaments - initially often do not present more than ideas that only slowly came into general use. The volumes of *Bach-Dokumente* provide us with a wealth of observations by Bach's descendants and students. It is quite likely that concrete knowledge about Bach's temperament practice would have been handed down to us, if he had regarded his own temperament principles as so important that they were worthy of formulating them in some more detail. Given the fact that this is not the case, everyone may draw his or her own conclusions. A definitive solution to the problem of Bach temperament does not exist today.
Whatever the preferences and predilections of a player might be in considering the use of one or another temperament scheme for the music of Bach, the argument drawn from current knowledge that Bach used a particular temperament is based on (modern) taste and therefore a fallacy that can never replace proper "hard" evidence. Evidence that we unfortunately simply do not have. In the end, it remains a matter for the individual to decide which temperament seems to be musically apt for the performance of any of Bach's compositions.

Summary

Considering the temperament of the Utopa Baroque Organ, the choice should be, in my view, a temperament, which

- is fully circulating (allows performance in all keys) and therefore
- can render all Bach repertoire as artistically convincing as possible, both organ and ensemble repertoire
- is not too close to ET, but

8 These two paragraphs are quoted with minor changes from §269-270 in Ortgies 2014 (see footnote 1).

- allows to play the Utopa Baroque Organ together with the Sauer organ
- gives as much "harmony" to the major 3rds as possible
- preferably contains four 5ths C-G-D-A-E that are smaller than pure by (about) the same amount (typically a fraction of one the commas)

Selecting a Temperament for the Utopa Baroque Organ

Issues of interval quality

The principles of well-tempered tunings (which historically include ET!) are well known: A number of 5ths will be tuned (tempered) smaller than pure without that any "wolf fifth" occurs in the circle of 5ths. The smaller 5ths must always be in the center of the circle (to render purer 3rds in the "good" keys, i.e. keys with fewer accidentals) but – depending on the amount of tempering more 5ths might be electable to be tempered.

The most frequently used way to design a temperament is possibly to subtract a small basic unit from all or most tempered 5ths. Most often this is done by choosing a fraction of either the Pythagorean or the Syntonic comma. As described above, the chain C-G-D-A-E preferably is tuned in 5ths of equal size, for example 5ths that are smaller by 1/x of one of the commas.Table 1 shows how there will be considerable differences in the beat speeds of the 5ths depending on the fraction of a comma that is to be subtracted from a 5th, here c1-g1 at a pitch of a1 = 415.3 Hz.

While ET 5ths (smaller by 1/12 Pythagorean comma) are slowly beating, there is a considerable leap between it and the next group of 5ths that are smaller by 1/5 or 1/6 of either comma and whose beat speeds gradually become faster.[9] Another large leap in beat rate occurs between the latter group and the two quarter-comma 5ths.

9 Fractions by units between 1/6 Syntonic comma and 1/12 Pythagorean comma, like, 1/7, 1/8, 1/9 etc., were not considered as they are notably infrequent in the historical record and as their quality changes only gradually. In the German literature on temperament of the late 17th and 18th century the fractions 1/4, 1/6 and 1/12 are most frequent, partly certainly because 12 and divisors made by its prime factors seem to allow simpler calculations.

TABLE 1

Differences in the beat speeds of the 5th c1-g1 depending on the comma fraction subtracted from it (a1 = 415.3 Hz)

Comma Fraction	*Beat Rate (Hz)*	*Metronome (MM)*	*Example (temperament or existing organ)*
- 1/12 p	-0.84	50.5	Equal Temperament
- 1/6 s	-1.54	92	
- 1/6 p	-1.7	101	Vallotti, Young, Neidhardt
- 1/5 s	-1.85	111	Schnitger/Hamburg (mod. MT)[10]
- 1/5 p	-2.0	120	Schnitger/Norden (mod. MT)[11]
			"Kellner"-like well-tempered tunings
- 1/4 s	-2.3	138	Kirnberger III, (1/4-comma Meantone)
- 1/4 p	-2.5	150	Werckmeister III
			Some Neidhardt-temperaments

10 Temperament (designed by Rudolf Kelber) since the organ restoration by Jürgen Ahrend in 1993. See Jürgen Ahrend. "Die Restaurierung der Arp Schnitger-Orgel von St. Jacobi in Hamburg." In Heimo Reinitzer (ed.), *Die Arp-Schnitger-Orgel der Hauptkirche St. Jacobi in Hamburg*. Hamburg: Christians, 1995. 167–265, there 227.

11 The temperament of the Schnitger organ has been designed by Reinhard Ruge in the 1980s. See Ibo Ortgies. "Unbekanntes über Schnitger-Orgeln. Hinweise, Funde, Hypothesen, Zuschreibungen." *Ars Organi* 64/1 (2016). 24–33, there 26.

The crux is that the larger the comma fraction is in absolute figures, the better the 3rds will be. Circulating temperaments with comma fractions of 1/4 will therefore render good or even pure thirds, but they accumulate a deficit, that needs to be balanced elsewhere in the circle of 5ths. This leads to a larger number of rather out-of-tune, but still usable Pythagorean 3rds.
1/6-comma 5ths are, of course, beating much faster than 1/12-comma 5ths and at the same time they do accelerate the speed of the beat rates of the major thirds considerably. 1/6-comma temperaments like Vallotti, Young or some Neidhardt temperaments are characterized by rather "restless" chords in the central good keys (this is even more so in even smaller fractions of the comma, that are not dealt with here, except 1/12-comma as in ET). This is covered to some degree in instruments that have a fundamental sound (i.e. less rich in partials), but not as well in the rather partial-rich instruments like the Utopa Baroque Organ is supposed to be. Therefore I have advised in this case rather not to use temperaments that apply 1/6-fractions of the comma.
1/5-comma fractions are a middle course between the two former (1/4 and 1/6). 5ths that are smaller by 1/5 Pythagorean comma get the added value, that they produce - in a chain of four consecutive 1/5 comma 5ths - a major 3rd that beats nearly exactly as fast as the first of the 5ths. For example, c1-e1, produced by c1-g1-d2-a2-e3 (> e1), beats as fast as c1-g1. Equal beat rates for some 5ths and 3rds make an effect that may be experienced as harmonious by listeners, and 1/5 Pythagorean comma 5ths are the only ones that generate this effect virtually automatically.
Compared to 1/5 Pythagorean comma, the fraction of 1/5 Syntonic comma produces slightly purer 5ths, which again render 3rds of somewhat lesser quality, and it doesn't have the positive side effect of the previously mentioned harmonious equal beat rates of 1/5 Pythagorean comma major 3rds and 5ths.
1/12-comma 5ths (ET) give the least troublesome temperament if one considers *only* the match with the Sauer organ. However, as stated above, ET is the least characterful temperament in terms of variation and the least harmonious choice among circulating temperaments. The most preferable temperament in my view would include a chain of four 5ths smaller by 1/5 Pythagorean comma between C and E.

The Temperament

Based on my above considerations I recommended the following circulating temperament, which uses a 1/5 of the Pythagorean comma as basis for the design. The Orgelpark accepted the recommendation in 2015.

Well-tempered tuning Ortgies/Orgelpark 2

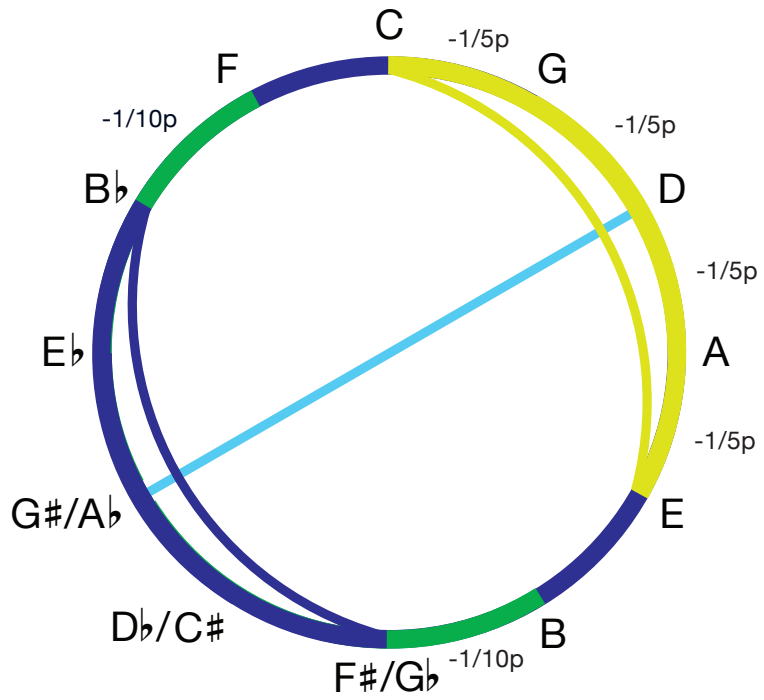
Four 5ths smaller by 1/5 Pythagorean comma: C-G-D-A-E.
Two 5ths smaller by 1/10 Pythagorean comma: B♭-F and B-F#.
The remaining six 5ths are pure.

The structure of the circle of 5ths is symmetrical with a symmetry axis D-A♭ (G#): major keys with the same amount of accidentals each have the same major 3rd (see the overview on the next pages). The quality of major 3rds increases stepwise from the only Pythagorean major 3rd F# - A# to the close-to-pure 3rd C - E; the major keys on the flat side of the circle of 5ths, however enjoy purer 5ths.

Well-tempered tuning Ortgies/Orgelpark 2

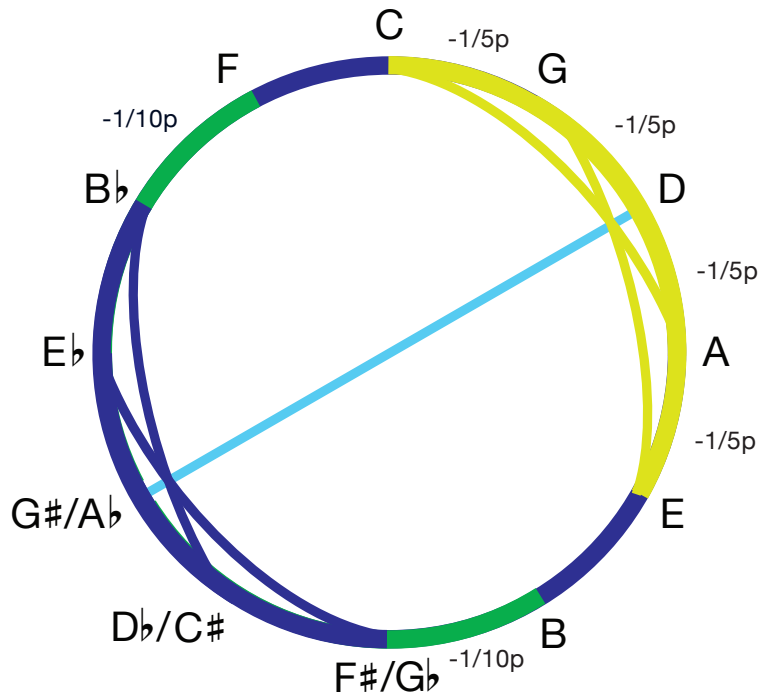
Based on 1/5 Pythagorean comma

Structure Four 5ths smaller by 1/5 Pythagorean comma: C-G-D-A-E
Two 5ths smaller by 1/10 Pythagorean comma: B♭- F and B - F#
The remaining six 5ths are pure



Light green arc (C - E): best major 3rd
Violet arc (F# - A#): Pythagorean major 3rd

The structure of the circle of 5ths is symmetrical with a symmetry axis D - A♭ (G#): major keys with the same amount of accidentals each have the same major 3rd. The quality of major 3rds increases stepwise from the only Pythagorean major 3rd F#- A# to the close-to-pure 3rd C - E. The major keys on the flat side of the circle of 5ths, however, enjoy purer 5ths. Minor keys are similarly symmetrically arranged, from A - C and E - G as best minor 3rds down to Pythagorean minor 3rds on B - D♭ and E♭ - G♭.



Light green arcs (A - C and E - G): best minor 3rds
Violet arcs (B♭ - D♭, E♭ - G♭): Pythagorean minor 3rds

Pitch: a' = **415,302** Hz

		Fifth					
Note	Frequency	Fifth		Cent	1/12 pK	Ratio	Beat/s	MM
c'	248,11	c'	g'	697,3	-2,4	1,49594	-2,01	-120,9
g'	371,16	g	d'	697,3	-2,4	1,49594	-1,51	-90,4
d'	277,62	d'	a'	697,3	-2,4	1,49594	-2,25	-135,2
a'	415,30	a	e'	697,3	-2,4	1,49594	-1,69	-101,2
e'	310,63	e'	b'	702,0	0,0	1,5	0,00	0,0
b'	465,95	h	f#'	699,6	-1,2	1,49797	-0,95	-56,8
f#'	348,99	f#	c#'	702,0	0,0	1,5	0,00	0,0
c#'	261,74	c#'	g#'	702,0	0,0	1,5	0,00	0,0
g#'	392,61	g#	d#'	702,0	0,0	1,5	0,00	0,0
d#'	294,46	d#'	bb'	702,0	0,0	1,5	0,00	0,0
bb'	441,69	bb	f'	699,6	-1,2	1,49797	-0,90	-53,8
f'	330,82	f	c'	702,0	0,0	1,5	0,00	0,0

Semitones			Distance	from c	from a
c	c#	**92,6**	c	0,0	308,2
c#	d	**102,0**	c#	92,6	400,8
d	d#	**102,0**	d	194,5	502,7
d#	e	**92,6**	d#	296,5	604,7
e	f	**109,0**	e	389,1	697,3
f	f#	**92,6**	f	498,0	806,3
f#	g	**106,6**	f#	590,6	898,8
g	g#	**97,3**	g	697,3	1005,5
g#	a	**97,3**	g#	794,5	1102,7
a	bb	**106,6**	a	891,8	0,0
bb	b	**92,6**	b	998,4	106,6
h	c	**109,0**	h	1091,0	199,2

The degree of accuracy of frequency and Cent figures is of course too high. It is meant to be a mere service for the reader. In practice one decimal after the comma is more than sufficient.

Pitch (red)	Pitch (a1) of the Utopa Baroque Organ
Note name	Utopa Baroque Organ
Frequency	given in Hz
1/12 pK	deviation from purity expressed in 1/12 Pythagorean comma
Ratio	upper interval/lower interval
Beat/s	beats per second
MM	beat rate expressed in metronome figures (= Hz) (5ths only)

	Major Third				Minor Third				
Maj.Third		Cent	1/12 pK	Ratio	Beat/s	Min. Third		Cent	1/12 pK	Ratio	Beat/s
c'	e'	389,1	1,4	1,25198	1,96	c'	eb'	296,481	-9,8	1,18679	-16,39
g'	b'	393,7	3,8	1,25538	7,98	g'	b'	301,173	-7,4	1,19001	-18,53
d'	f#'	396,1	5,0	1,25708	7,86	d'	f'	303,519	-6,2	1,19163	-11,62
a	c#'	400,8	7,4	1,26049	8,71	a	c'	308,211	-3,8	1,19486	-5,34
e'	g#'	405,5	9,8	1,26391	17,29	e'	g'	308,211	-3,8	1,19486	-7,98
h	d#'	405,5	9,8	1,26391	12,96	h	d'	303,519	-6,2	1,19163	-9,75
f#'	a#'	407,8	11,0	1,26562	21,81	f#'	a'	301,173	-7,4	1,19001	-17,43
db'	f'	405,5	9,8	1,26391	14,56	c#'	e'	296,481	-9,8	1,18679	-17,29
ab	c'	405,5	9,8	1,26391	10,92	g#'	h'	296,481	-9,8	1,18679	-25,93
eb'	g'	400,8	7,4	1,26049	12,36	d#'	f#'	294,135	-11,0	1,18519	-21,81
bb	d'	396,1	5,0	1,25708	6,25	bb	db'	294,135	-11,0	1,18519	-16,36
f'	a'	393,7	3,8	1,25538	7,11	f'	ab'	296,481	-9,8	1,18679	-21,85

Best match with the Sauer organ

Sauer	Equal (f)	Dev.f	Deviation from UBO tone
b'	247,33	-0,78	c'
c'	262,04	0,30	c#'
c#'	277,62	0,00	d'
d'	294,13	-0,33	d#'
d#'	311,62	0,99	e'
e'	330,15	-0,67	f'
f'	349,78	0,79	f#'
f#'	370,58	-0,58	g'
g'	392,62	0,01	g#'
g#'	415,97	0,66	a'
a'	440,70	-0,99	bb'
bb'	466,91	0,96	b'
	ø	**0,03**	

Max	0,99
Min	-0,99
Stand.Dev.	0,5914

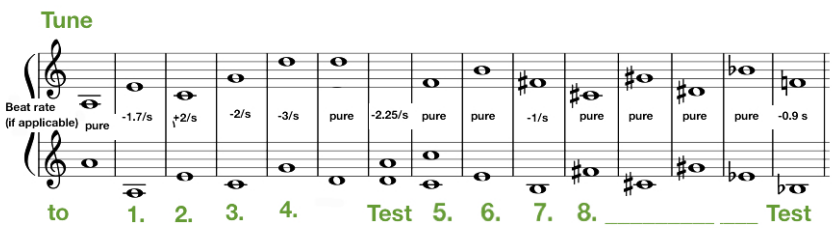
Semitones	Cent figures for each semitone distance
Distance	Distance in Cent from note C or from A respectively
Dev. f.	The difference between the frequency of a given note in the Sauer organ and its pendant in the Utopa Baroque Organ
ø	Average of all differences
Deviation	Tone of the Utopa Baroque Organ as given
Max/Min	Maximum/minimum deviation between a note in the Sauer organ and its counterpart in the Utopa Baroque Organ (only in the specified octave)
Stand. Dev.	Standard deviation

Tuning Procedure

An amazingly simple way to tune this temperament by ear emerges from table 2 for the pitch of a1 = ca. 415.3 Hz. The a1 can be taken from a tuning fork or a suitable electronic device. If you start with c1, the tuning fork or device should be set to c1 = ca. 248.1 Hz. If one doesn't have a metronome ready to control the beat speeds, a watch will do perfectly.

Setting C-G-D-A-E beginning with a1

Orgelpark Temperament: Tuning Procedure from a1



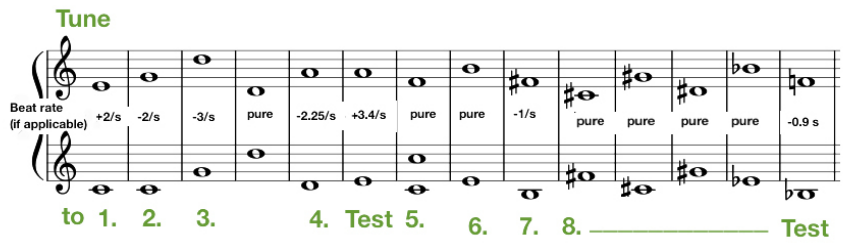
Tune the octave a0 to a1.

1 Tune e1 smaller than pure to a0. The beat rate is slightly faster than 3 beats in 2 seconds (ca. 100 MM).
2 Tune c1 to e1 slightly larger than pure. The beat rate is 2/second. Tune the octaves c0 and c2.
3 Tune g1 to c1 slightly smaller than pure. The beat rate is 2/second. Make sure, that c1 - g1 and c1 – e1 beat with the same speed!
4 Tune d2 to g1 slightly smaller than pure. The beat rate is 3/second. Tune the octave d1 to d2.

Test: The beat rate of d1 - a1 is only slightly faster than that of c1 - g1 (step 3).

Setting C-G-D-A-E beginning with c1

Orgelpark Temperament: Tuning Procedure from c1



Tune c1's octaves c0 and c2.

1 Tune e1 to c1 slightly larger than pure. The beat rate is 2/second.
2 Tune g1 to c1 slightly smaller than pure. The beat rate is 2/second. Make sure, that c1 - g1 and c1 - e1 beat with the same speed!
3 Tune d2 to g1 slightly smaller than pure. The beat rate is 3/second. Tune the octave d1 to d2.
4 Fit a1 in between d1 and e1 so that the beat rate of a1 with d1 is only slightly faster than the 5th c1 - g1.

Test: The 4th e1 - a1 is larger than pure and should beat slightly faster than g1 - d2 (step 3).

Continuation after setting C-G-D-A-E

Tune the octaves of all tuned notes between c0 and c2, and continue to do so until the whole temperament is set. With all notes in these two octaves already tuned, one can immediately test the temperament with triads in all keys in root position or as sixth chords.

5 Tune f1 pure to c1 (or to c2).
6 Tune b1 pure to e1.
7 Tune f# to b0 slightly smaller than pure. The beat rate is 1/second (tendency: slightly slower).
8 Tune the following 5ths and 4ths pure:
c#1 - f #1 g#1 - c#1 d#1 - g#1 b♭1 - e♭1

Test: The 5th bb0-f1 is smaller than pure and should beat slightly (nearly unnoticeably) slower than b0-f#1 (step 7).

Abstract

To find a suitable temperament for the Utopa Baroque Organ was a task that had to fulfill a number of requirements. These include that it should be possible to have the organ join and or accompany an ensemble; that the organ includes mutations including pure 3rds and 5ths which should not conflict too strongly with any tempered 3rds and 5ths; that it should be possible to play the organ together with most of the other Orgelpark organs; that it should be possible to play (most of) Johann Sebastian Bach's organ music. Therefore, the temperament should be fully circulating; yet not too close to equal temperament; give as much "harmony" to the major 3rds as possible; and render each of the four 5ths C-G-D-A-E smaller than pure by (about) the same amount. The result is the "Well-tempered tuning Ortgies/Orgelpark 2". It contains four 5ths smaller by 1/5 Pythagorean comma: C-G-D-A-E; two 5ths smaller by 1/10 Pythagorean comma: B♭- F and B - F#; the remaining six 5ths are pure. The structure of the circle of 5ths is symmetrical with a symmetry axis D - A♭ (G#): major keys with the same amount of accidentals each have the same major 3rd. The quality of major 3rds increases stepwise from the only Pythagorean major 3rd F#- A# to the close-to-pure 3rd C - E. The major keys on the flat side of the circle of 5ths, however, enjoy purer 5ths. Minor keys are similarly symmetrically arranged, from A - C and E - G as best minor 3rds down to Pythagorean minor 3rds on B - D♭ and E♭ - G♭.

Ibo Ortgies

Ibo Ortgies is a musicologist and music historian. His PhD-thesis on the tuning and temperament of seventeenth- and eighteenth-century organs received international acclaim. His research has contributed to new views on the keyboard music of the North German Baroque, especially Dieterich Buxtehude and his contemporaries but also Bach. From 1992 to 1999, Ortgies was the co-initiator and consultant of the organ building project in Bremen-Walle, Germany. In 1999, he joined the staff of the Göteborg Organ Art Center GOArt. As a member of the Reference Group of the Utopa Baroque Organ project at the Orgelpark, Ortgies designed the temperament of the organ, as well as the structure of the Cymbelstern. Furthermore, he located and mapped all relevant documents regarding the art of organ builder Zacharias Hildebrandt.

XIII

Ibo Ortgies - A Star is Born: The Tonal Design of the Cymbelstern

The organologist Ulrich Dähnert noted in his monograph on Zacharias Hildebrandt, that the latter never built a Cymbelstern. The only example of the stop in an organ by Hildebrandt is to be found in his large organ in Naumburg, because he retained the stop from the previous organ by Zacharias Thaÿßner.[1] The reason is unknown, but it seems reasonable to assume that the Cymbelstern was used at this time in Naumburg and that the organist and the church elders wanted to keep it.

Cymbelsterns could take various tonal shapes in Hildebrandt's time. The main distinction seems to have been whether the small bells were tuned to particular pitches or not. In the former case they were usually tuned as a chord, for example in C major, G major, E major etc. or a combination of chords. In Naumburg, for example, the bells consisted of the pitches of both C major and G major: g, b, c1, d1, e1. Despite the chordal design, the effect is somewhat dissonant due to the inharmonicity inherent in the sound of small bells.[2]

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1 In *Der Orgel- und Instrumentbauer Zacharias Hildebrandt* (Leipzig: Breitkopf & Härtel, 1962), Ulrich Dähnert remarks (105): "Concerning accessories Hildebrandt built four check valves ["Sperrventile"] besides the Tremulant for the Rückpositiv and the Windkoppel [coupler using an extra palletbox] that was missing in none of his organs, but [he] retained the Cymbelstern, contrary to the principles of Silbermann and his school." Original German text: "An Nebenzügen baute Hildebrandt außer dem Tremulanten zum Rückpositiv und der Windkoppel, die in keiner seiner Orgeln fehlte, vier Sperrventile ein und behielt, entgegen den Grundsätzen Silbermanns und seiner Schule, den Zimbelstern bei."

2 The Naumburg Cymbelstern can be heard in a video of Bach's chorale prelude "Nun freut euch, lieben Christen g'mein" (BWV 734): https://www.youtube.com/watch?v=c2JSgs6uUdQ

On the one hand, the Utopa Baroque Organ is modeled on Hildebrandt's organs, and on the other hand it is an instrument that looks forward into the twenty-first century. Therefore I came quickly to entertain the idea of a Cymbelstern that may be used as an inharmonious spice when performing historical music and which takes its inspiration from the twentieth century. Jacob Adlung's 1758 description of the Cymbelstern stop is enlightening:[3]

> Cymbel, often read as "Zymbel" in Praetor[ius], is the star stop whereby some cymbals cast from bell metal make a pleasant yet untidy sound when the wind wheel sets them into motion. Formerly each tower of the

(from the recording: *Bach at Naumburg / Robert Clark playing the Hildebrandt Organ, St. Wenzel's Church, Naumburg, Germany*. Ithaca, NY: Calcante Recordings, 2001. Identifier: 49496221).

3 Jacob Adlung. *Anleitung zu der musikalischen Gelahrtheit*. Erfurt: J. D. Jungnicol, 1758 (digital edition available at https://play.google.com/store/books/details?id=ryc9AAAAcAAJ). The quotes is from § 145 (408-409): "Cymbel, wofür oft Zymbel gelesen wird bey Prätor[ius] ist bisweilen der Sternzug wodurch einige von Glockenmetall gegossene Cymbeln ein angenehmes, doch unordentliches Geräusch zusammen machen, wenn durch den eingelassenen Wind das Windrad dieselbigen in Bewegung setzt. Vorzeiten hatte bey mir jeder Thurm des Rückpositivs dergleichen, welche 3 zusammen 24 Cymbeln hielten, aber das Glockenspiel hat dieselben verdrängt (w). Timpani in der jenaischen Orgel bedeutet eben das; tympanum aber ist etwas anders. Zimbelglöcklein schreibt Prätorius S. 190. Glöckleinton siehe § 159. Heut zu Tage wollen auch die Bauren an deren Stelle lieber den Accord C* oder G* von gegossenen Glocken hören, weil die mehresten Chorale können aus diesen Tonarten gesungen werden (x). An einigen Orten hat man beyde Accorde zugleich. Doch weil mich mehr vergnügte solche Accorde durch alle Stufen der Höhe und Tiefe haben zu können, oder wie andere reden, durch 12 Durarten, auch wohl durch alle 12 Mollarten, so mußte ich auf eine Erfindung denken, wie es möglich würde, und doch weniger kostete, als die gemeine Anlage. Ich habe es glücklich entdeckt, und wie es möglich gewesen, wird besser verstanden, wenn § 158, 159 vom Glockenspiele gehandelt worden.
w) Die verguldeten Sterne dienen zum Zierrath. Von einer prächtigen Anlage des Sterns zu S. Gertrud in Hamburg giebt Mattheson Nachricht. Von der Sonne zu Giebichenstein s. § 188. Eine laufende Sonne ist zu unser lieben Frauen zu Halle im Oberpositiv.
x) Niedt nennt die Sterne absurd, (ungereimt) im 44sten Cap. des 3ten Th."

Rückpositiv of my [organ] contained such [bells], which three [towers] together held twenty-four cymbals, but they were replaced by the carillon [Glockenspiel] (w). Timpani in the Jena organ means just this [i. e. a Cymbelstern]; but tympanum [{kettle}drum] is something different. Praetorius writes ["]Zimbelglöcklein["] on p. 190.[4] For the [flue stop] Glöckleinton cf § 159. Instead, the peasants today prefer to hear the chord C * or G* from cast bells,[5] because the majority of chorales can be sung in these keys (x). In some places one has both chords [sounding] at the same time. But because I found more delight in having such chords in all keys, high or low, or as others say "through twelve major keys," and arguably through all 12 minor keys, I had to think how an invention like this could be possible and yet cost less than the usual mechanism. I have discovered it happily, and how it has been [made] possible, will be better understood when the carillon [Glockenspiel] has been dealt with in § 158 [and] 159.
w) The gilded stars serve as ornament. Mattheson provides news about a magnificent arrangement of star at St Gertrud's in Hamburg.[6] About the Sun [stop] in Giebichenstein cf. § 188. A rotating sun is to be found

4 Stop list by Michael Praetorius (1571-1621) of the organ in the castle chapel of Schöningen, built in 1617 by Gottfried Fritzsche (1578-1638) in Michael Praetorius. *Syntagmatis Musici Tomus Secundus. De Organographia.* Wolfenbüttel, 1619. Facsimile ed.: Wilibald Gurlitt. *Documenta Musicologica* I/14. Kassel: Bärenreiter, 1958 (5th ed.: 1980). 190. Actually Praetorius spells the stop as "Zimbelglöcklin". The term appears as "Stern Zimbelglöcklin" in one of Praetorius's model stop lists on p. 193 of the same volume.

5 A Cymbelstern with bells playing the chords of C-major and G-major in Chorton (D-flat major resp. A-flat major in modern chamber pitch) is present in the organ in Waltershausen (1724/25-1730) by Tobias Heinrich Gottfried Trost (1680-1759). Cf. Felix Friedrich. *Der Orgelbauer Heinrich Gottfried Trost. Leben, Werk, Leistung*. Leipzig: VEB Deutscher Verlag für Musik, 1989. 46–47. According to Friedrich it is unclear though whether the bells are original.

6 Cf. Johann Mattheson. "Von den Dispositionibus etlicher LX (mehrenteils) berühmter Orgel-Wercke itziger Zeit". In Friedrich Erhard Niedt, *Musicalische[r] Handleitung Anderer Theil* (ed. by Johann Mattheson). Hamburg: Benjamin Schillers Wittwe and Joh. Christoph Kißner, 1717. 181.

in the Rückpositiv in Our Lady's [Marktkirche Unser Lieben Frauen] in Halle in the Oberpositiv.
x) Niedt calls the stars [i. e. Cymbelsterns] absurd, ([i. e. in German] ungereimt) in the 44th chapter of the 3rd part. "[7]

Adlung's description of the "untidiness" of the Cymbelstern and its more or less dissonant character allowed us to try to join the apparently diverging historical lines. The planning of the Cymbelstern of the Utopa Baroque Organ went, however, through different stages. I entertained, at first, ideas like departure from Igor Stravinsky's *Rite of Spring* (1913), a cornerstone piece of modernity which has even been called an "Avatar of Modernity."[8] One of its famous features is the chord at number 13 of the score (*The augurs of spring / Dances of the young girls*): It consists of an E-flat major seventh chord (E-flat major triad with an added D♭) and an E-major chord:

e♭ - g - b♭ - d♭ - e - g# - b [9]

An interesting aside is that the two chords in themselves form the two extremes of the usable chords in the classical meantone temperament: E major and E-flat major - and even the tone D♭ in Stravinsky's chord is a near to perfect 7:4 when tuned as a meantone C#.

7 According to Adlung this passage should be found in chapter 44 of Friedrich Erhard Niedt. *Musicalische Handleitung dritter und letzter Theil* (ed. by Johann Mattheson; Hamburg: Benjamin Schillers Erben, 1717). I wasn't able to detect it - this third volume contains seven chapters. Niedt provides, however, short, but neutral descriptions of the Cymbelstern in the first two volumes of *Musicalische Handleitung, oder Gründlicher Unterricht* (Hamburg: Benjamin Schillern, 1710, not paginated [page 13 of chapter 12) and in *Musicalische[r] Handleitung Anderer Theil* (ed. by Johann Mattheson; Hamburg: Benjamin Schillers Wittwe and Joh. Christoph Kißner, 1717. 110-111).

8 Hermann Danuser and Heidy Zimmermann (eds.). *Avatar of Modernity. The Rite of Spring Reconsidered*. London: Boosey & Hawkes, 2013.

9 The bells of the Cymbelstern sound in the octaves between c4 and between ca. 2950 Hz and 4450 Hz.

One important feature of the Cymbelstern should be that the sequence of tones would be rhythmically balanced and not form a too regular pattern. An impression of certain regularity, however, is in my view near to inevitable. We experimented with some patterns derived from the *Rite of Spring*,[10] but explored other series of tones as well: Hans Fidom suggested using a whole tone row, and I experimented with octatonic rows i. e. eight alternating semitones and whole tones in an octave, and with a series of successively widening intervals as well (for example a1 - g#1 - b1 - g1 - c2 - f1 - d2 - e1).

At the same time the number of bells was another interesting factor in the design. At some point in the discussion we asked ourselves whether a B-A-C-H related pattern would work. I explored the idea to combine it with the well-known Bach number 14. Fourteen bells seemed too exorbitant, though.

10 A regular version with an ascending and descending sequence of eight tones (transposed) f1-a2-c2-e♭2-f#2-c#2-a#1-f#1:

play stop

A version, interleaved in thirds and sixths (transposed) c2-e♭2-f#2-a#1-c#2-a1-f2:

play stop

Hans Fidom suggested to add one note (here the g), which resulted in the following series: d2 - f2 - g#2 - b2 - g2 - e2 - c2 - a2 (at the end of the sound example the series breaks up into an irregular pattern):

play stop

I changed this version to another pattern d2 - f2 - g#2 - b1 - g2 - e2 - c2 - a2. Here both the upper notes, a-g#-g, and the lower notes d- b-c form each a rhythmical pattern 3-3-2, but out-of-phase:

play stop

Yet, it was too tempting to try a pattern that included B-A-C-H. Despite my skepticism, whether such a pattern would work, I tested several versions with fewer bells and came up quickly with the following series:

b♭1 - a1 - c1 - b1 - g#1 - c#2 - g1 - d2

The rhythmical sequence of the notes can be heard in various ways, depending on the focus and the position of the listener, and the chromaticism serves to cloud possible tonal effects.

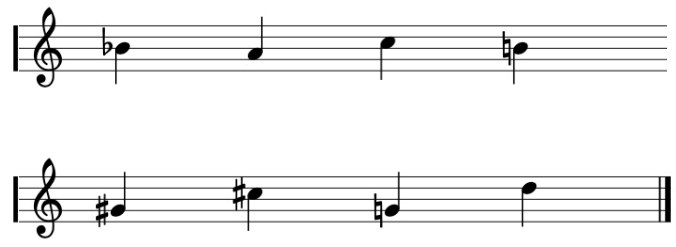
The sequence, a wedge between the fifth g - d, contains also the following intervallic frames, starting from d

d- b♭2 - a	major 3rd + diatonic semitone	=	4th
c-b-g#	diatonic semitone + minor 3rd	=	major 3rd
g-c#			augmented 4th

All these possible connections served the design rather than that they should be recognizable while listening. It should be kept in mind that the baroque Cymbelstern was only an accessory enhancing the organ's sound from time to time with a sparkling luster.
But since the new Cymbelstern is adjustable in its speed the individual sounds of the bells will be audible at times, more audible than in a traditional Cymbelstern, and its sequence of tones might even inspire an interplay with the stops of the organ in future improvisations and compositions.

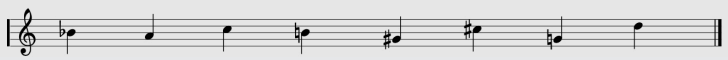
UTOPA BAROQUE ORGAN CYMBELSTERN

Number	*Note name (pitch a1 = 415.3 Hz)*	*Frequency (Hz)*	*Note name pitch (a1 = 440 Hz)*	*German note names*	
1	b♭4	3533,5	a4	b4	> B
2	a4	3322,4	g#4	a4	> A
3	c5	3969,8	b4	c5	> C
4	b4	3727,6	b♭4	h4	> H
5	g#4	3140,9	g4	g#4	
6	c#5	4187,8	c5	c#5	
7	g4	2969,3	f#4	g4	
8	d5	4441,9	c#5	d5	



Abstract

Zacharias Hildebrandt never built a Cymbelstern in any of his extant organs, but he retained such a stop when he built a new organ (1743-1746) into the case (1695-1697/98) of the organ rebuilt in 1695-1705 by Zacharias Thaÿßner in Naumburg. Cymbelsterns having a somewhat dissonant character, it was possible to develop a design for the Utopa Baroque Organ in the Orgelpark that allowed joining the apparently diverging historical lines together. Several possibilities were explored, a.o. departing from the famous chord in the section "Augurs of spring/Dances of the young girls" of Stravinsky's *Rite of Spring*, as well as whole tone rows, octatonic rows, and designs including B-A-C-H (English note names B♭-A-C-B). All of these designs being attractive, we decided after some testing to go for the a series of eight tones:



The rhythmical sequence of the notes can be heard in various ways, depending on the focus and the position of the listener, and the chromaticism serves to cloud possible tonal effects. The speed of the Cymbelstern in the Utopa Baroque Organ is adjustable which is hoped to inspire interplay with the stops of the organ in future improvisations and compositions.

Ibo Ortgies

Ibo Ortgies is a musicologist and music historian. His PhD-thesis on the tuning and temperament of seventeenth- and eighteenth-century organs received international acclaim. His research has contributed to new views on the keyboard music of the North German Baroque, especially Dieterich Buxtehude and his contemporaries but also Bach. From 1992 to 1999, Ortgies was the co-initiator and consultant of the organ building project in Bremen-Walle, Germany. In 1999, he joined the staff of the Göteborg Organ Art Center GOArt. As a member of the Reference Group of the Utopa Baroque Organ project at the Orgelpark, Ortgies designed the temperament of the organ, as well as the structure of the Cymbelstern. Furthermore, he located and mapped all relevant documents regarding the art of organ builder Zacharias Hildebrandt.

XIV

Ibo Ortgies - Towards a Digital Hildebrandt Archive

In 2015 the Orgelpark commissioned the digitalization of a larger part of archival material relating to Zacharias Hildebrandt and his work. The purpose was to lay the foundation of a Digital Hildebrandt Archive (DHA) that aims to

- be a strong knowledge resource for all research regarding the Utopa Baroque Organ, now and in the future
- generate research possibilities
- help safeguarding and preserving valuable historical documents

The cover of the account book "Rechnung der Kirche St.=Jacobi in Sangerhausen. 1737", photographed on April 4, 2016, in the "Ev. Pfarramt', next to a ruler and a color chart. In the Digital Hildebrandt Archive, the original photes will be accessible, as well as cropped versions.

In order to lay the foundation for the DHA I was entrusted with the task of surveying the known archival material and design a viable way to photograph as many documents as possible, taking in account the restrictions by the available time and the necessity of carrying out the photographing process while on travel.
A balance had to be reached in terms of quality, efficiency, and time: The photos must allow full readability and - as much as possible - printing. The quality is dependent on the photographing equipment, the photographing technique and the quality of the photos in and of themselves, the speed, the quality of archival material, and outer circumstances of the facilities in which the photographs are taken, for example lighting, or possible photographing restrictions by the archive.

Archives

In order to assess the possible scope the most important and thorough study of Hildebrandt's life and work was mined: Ulrich Dähnert's monograph *Der Orgel- und Instrumentbauer Zacharias Hildebrandt* (Leipzig: Breitkopf & Härtel, 1962). It mentions archival material about ca. 40 places related to Hildebrandt, which are held in about 30 municipal and other public archives as well as in ecclesiastical archives (local and regional). The surviving archival material is today still preserved by far in the region in which Hildebrandt was active as organ builder, that is the southern parts of Eastern Germany, nowadays the federal states of Saxony, Thuringia, and Sachsen-Anhalt.
As the digitalization at this stage was to serve to support the research for and the completion of the Utopa Baroque Organ, it was necessary to find a balance that allowed photographing as many documents possible with in the time frame. From the literature survey it could be assessed that the following archives would hold most relevant material that was relevant:

- Naumburg, Stadtarchiv (municipal archive) / 400-800 pages
- Sangerhausen, Ev. Pfarramt (church archive) / 300-500 pages
- Leipzig, Stadtarchiv (municipal archive) / 250-400 pages
- Leipzig, Bach-Archiv (public research inst. and archive) / ca. 30 pages
- Dresden, Stadtarchiv (municipal archive) / 500-900 pages

The amount of material was assessed as much as possible from Dähnert's publication. The lower figure indicates the material he quoted or referred to. The larger figure was my cautious lowest estimate of the amount of pages that would have to be photographed, as the rule is, to photograph every document in question completely, including blank pages. Internally I calculated with even higher figures. There is always a certain likeliness that important information will show up "on the way", which might lead to further digitalization needs on the spot (or possibly in the future). On site with the actual archival material in front of the camera, this precaution quickly proved to be essential to keep the time frame and to carry out the task with diligence.
The number of photos wound up to ca. 2800. In Naumburg and Sangerhausen it was possibly to photograph nearly the complete organ history of the town since (at least) Hildebrandt's time. With few exceptions the photographing process did not pose particular difficulties. Many a photo is in focus down to the structure of the paper surface.Due to that the municipal archives in Dresden and Leipzig do not allow photographing as a matter of principle, I was restricted to examine the material (at least ca. 1300 pages) for Hildebrandt references, to assess which material might be most valuable and to excerpt as much as possible in the limited opening hours of the archives. This resulted in excerpts from

- ca. 140 pages, Leipzig, Stadtarchiv (municipal archive)
- ca. 100 pages, Dresden, Stadtarchiv (municipal archive)

Documents from the time before Hildebrandt established his own workshop were excluded at this stage. About twenty smaller church archives in Germany were also excluded after having received further information about their holdings. This is due to the fact, that many historical church archives have been moved to central archives of their respective regional church, that facilitate storing and preservation of the material.

Database

In the future it is planned to put all material into a database to handle the large amount of images and information. The database will be dedicated to

handle archival documents related to historical documents, especially organ and organ related-matter as for example extensive data on the instruments, historical documents incl. transcription, photographs and literature.

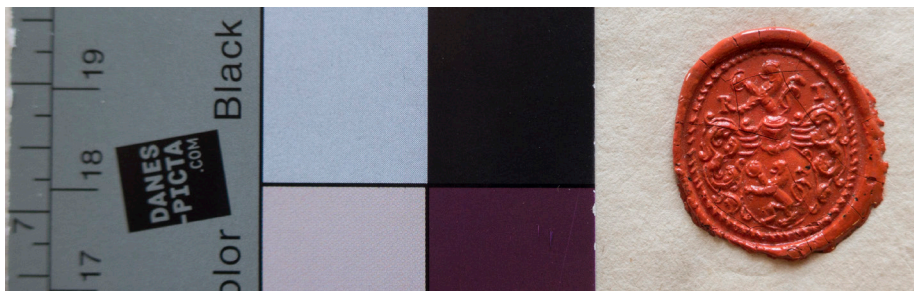
Photographing

The equipment used:

- 1 camera: Panasonic Lumix DMC LF1
- 3 rechargeable battery packs: Panasonic DMW-BCN10E
- 1 color checker card incl. a cm/inch-scale

The photos were stored on a laptop computer and immediately on a separate hard disk drive. Photos were taken in RAW-format and (partly) in JPG-format. Despite some concerns about losses in data compression in JPG-files, the JPG-photos proved to have a sufficient quality in terms of reproduction and resolution. JPG has the advantage of a significantly reduced file size compared to RAW format.
Of course, the color rendering depends on the light: scattered, indirect, bright daylight is best, but it varies of course. Artificial light may lead to a regular illumination of the whole area that is photographed, but it may also result in discoloration by the light itself. Therefore, a color checker is photographed by default, which depicts standardized color values, so that any discoloration (also due to reflective colors, e.g. wall paint or wall paper in the reading room) can be adjusted later. A cm/inch-scale is also included, to allow assessing the size of the photographed object.
The main premise during photographing is that the documentation process is carried out with greatest care. Any damage of documents - except of inevitable wear and tear of use - has to be avoided by all means. This includes for example reducing or avoiding stress by handling, pressure, and flashlight. Traveling and the necessity of photographing in the reading rooms of the public accessible archives, which are frequented by other users, means that flashlight could not be and was not used. Glass plates to hold down paper were not used either, partly for the practical reason of being unwieldy when traveling (heaviness and/or risk of breaking). To photograph documents especially when bound into a volume, may lead to

Objects that have three-dimensional properties, have usually been photographed from above and from the four main directions to make features more prominent, which are not so clearly visible from above. Naumburg, Stadtarchiv: Letter "Anstellung Altnikols betr." in cardboard box "Orgel" / no signature.



that the focus in parts of a photo is not quite optimal due to and depending on the natural curvature of the material. In general I have found no particular problems, but in case of doubt, I took two photos or a detail shot. When letters disappeared in the binding, I always took detail photos. The effect of disappearing letters was another reason to abandon glass plates to hold down paper: Pressure of glass plates frequently will not achieve much more visibility. It is easier and more effective in revealing hidden writing to draw the binding open - of course with utmost caution - and to photograph focusing on the level of the binding only. The disadvantage is of course that a user will have to use two or more photos to get a as complete as possible information from the page in question. Considering that such complete information in many cases only be provided in this way, should reduce concerns.

Objects that have three-dimensional properties, e.g. seals with coats of arms and inscriptions, have usually been photographed from above and additionally obliquely from the four main directions to make features more prominent that are not so clearly visible from above (see the example on the previous page).

The sequence of photos always has to correspond to the sequence within the original documents. Everything is being photographed from A to Z, of course including front and back of all material, all blank pages, envelopes, and archival cardboard boxes (as delivered to the reading room as well as opened).

A typical sequence is for example:

- Signature
- “Benutzernachweis” (the register of users, usually a separate sheet of paper on which the user registers her-/himself)
- Outer appearance of the entire source (file/envelope/volume)
- Outer appearance with signature
- Spine (with label)
- Envelope/cover (outside)

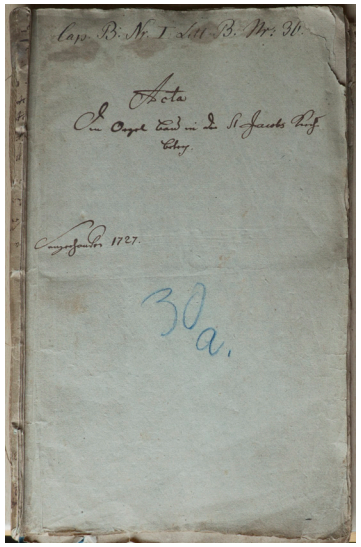
[repeated:]

- Double page spread
- Left page only
- Right page only

[until:]

- Back of the entire source (file/envelope/volume)

Close-ups of details such as archival signatures, personal signatures, stamps, and seals are taken after the respective full photo of the entire (single) page. Depending on the remaining space in a close-up and the angling of the material the color checker card could not always be used. In these cases a user is referred to the full shot of the entire page.



Sangerhausen

Drawings of the organ by Valentin Schwarzenberger

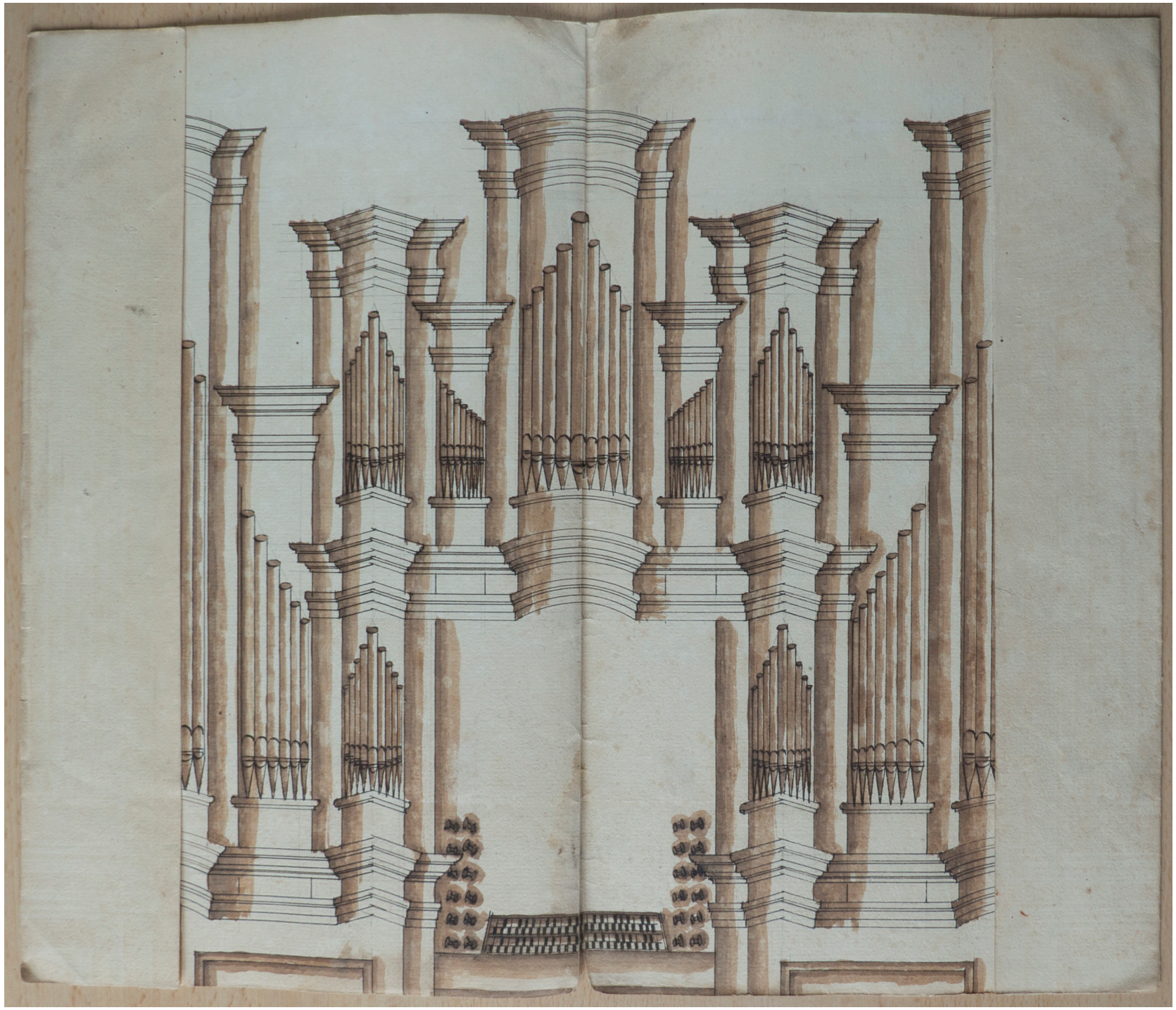
Sangerhausen, Ev. Pfarramt
Cap. B: Nr. I Litt. B Nr. 36
Den Orgel Bau in der St. Jacobs Kirche
betr.
Sangerhausen 1727

Sangerhausen

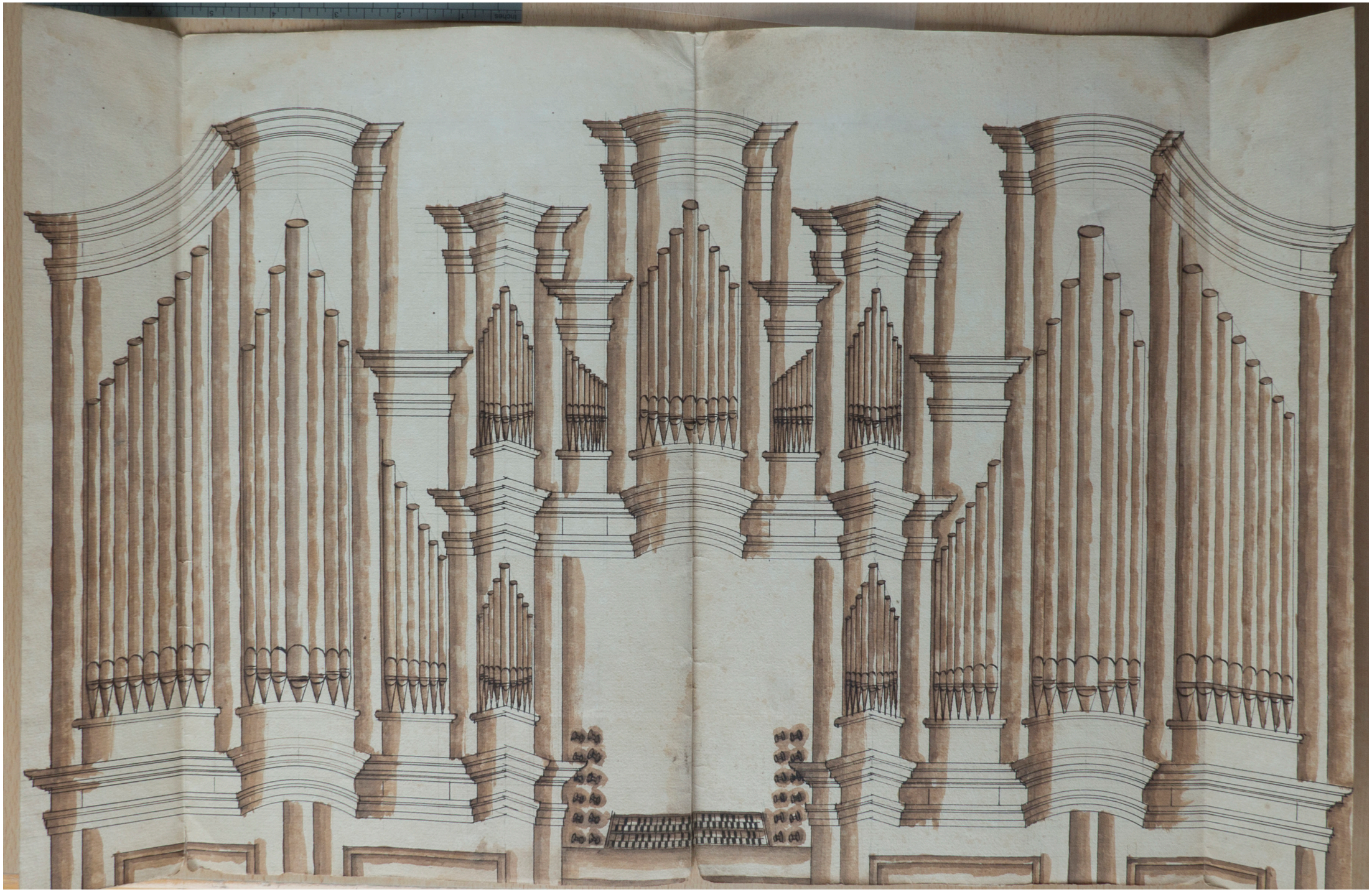
Ev. Pfarramt: undated drawing of the organ by J.C. Mocker (not executed; note the resemblance of the central part of the organ with the organ in Naumburg).
Two pieces of paper (originally one sheet).
No signature.

NB

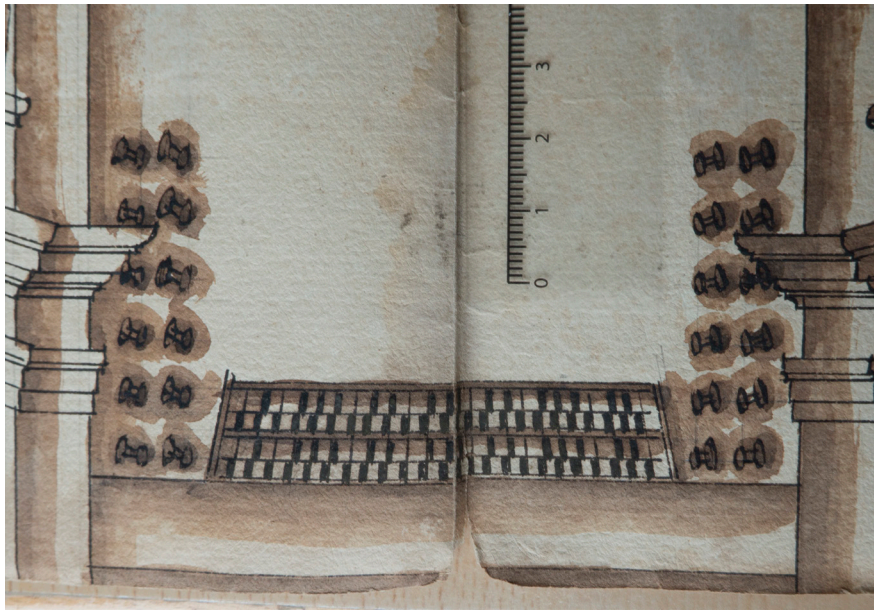
This book is the paper version of the original e-book, downloadable on www.orgelpark.nl. In the e-book, the drawings on these and the next pages can be viewed without a fold in the middle.

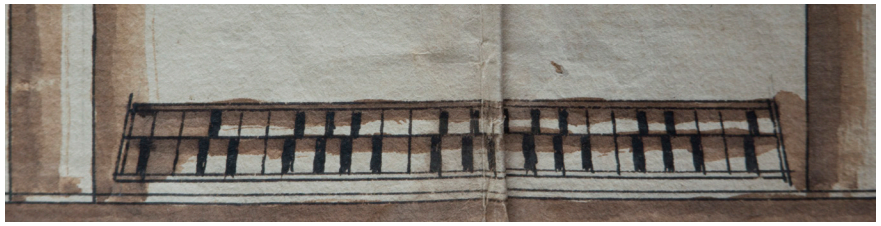


The larger piece, folded

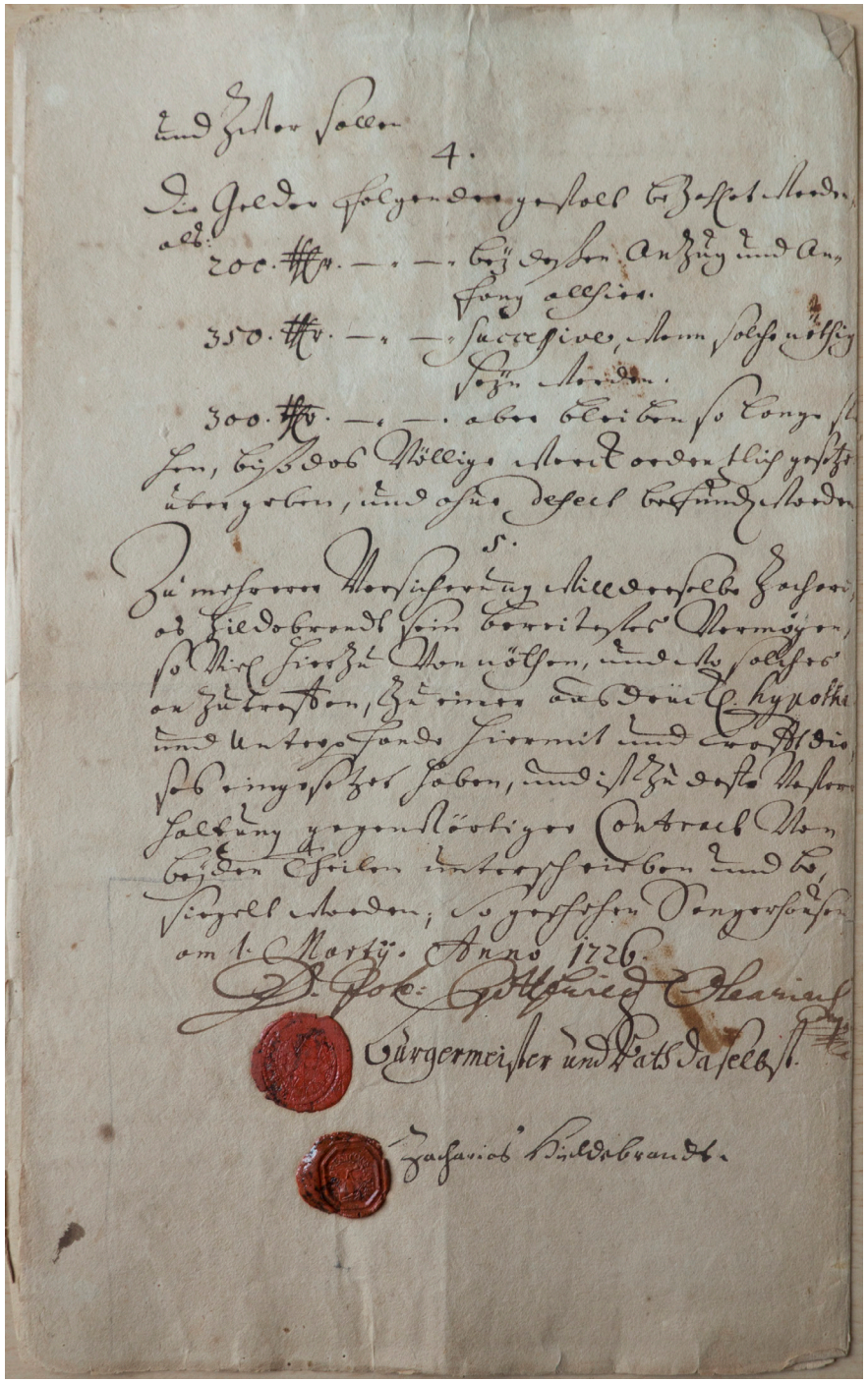


The larger piece, unfolded





Details of the drawing: unfolding the lower part reveals the pedal board (below); a detail of the pedal board drawing is shown above. Note that the key C# was not planned for, as was usual in Hildebrandt's time and region.



Siegel werden; So geschehen Sangerhausen
am 1. Martÿ. Anno 1726.
D. Joh: Gottfried Hearius
Bürgermeister und Rath daselbst.
Zacharias Hildebrandt.

Sangerhausen

Ev. Pfarramt: Hildebrandt's seal with his coat of armsletter in the organ building contract from March 1, 1726.

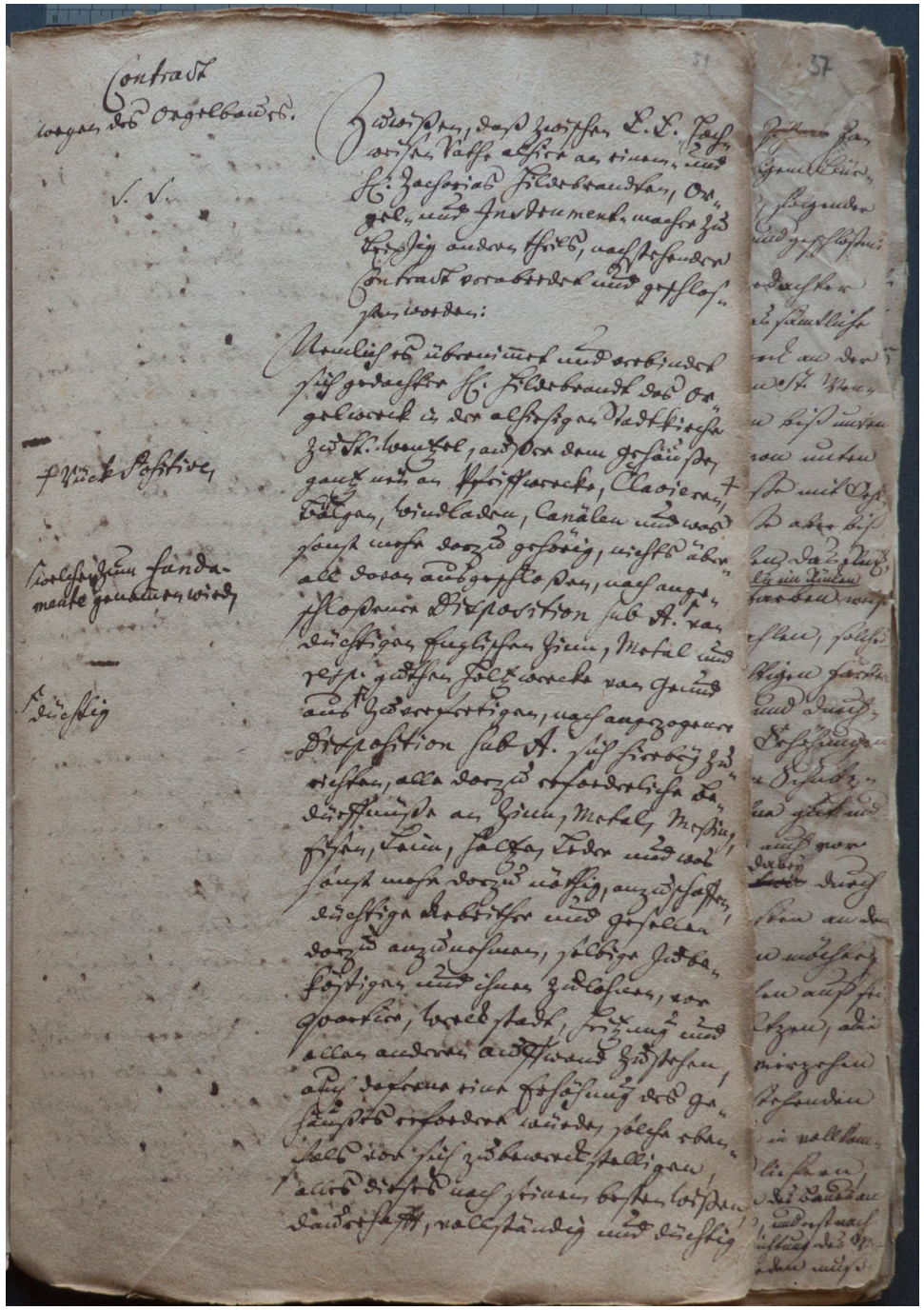
Naumburg, St Wenzelskirche

Draft of the contract: "Contract wegen des Orgelbaues", August 27, 1743 (fol. 51-56).

Naumburg, Stadtarchiv
File: "Die Reparatur der Orgel in St. Wenzel 1695-1787"
Signature: GA Loc 64, No 53.
Scribe: probably Zacharias Hildebrandt
Transcription: Ibo Ortgies, 2016

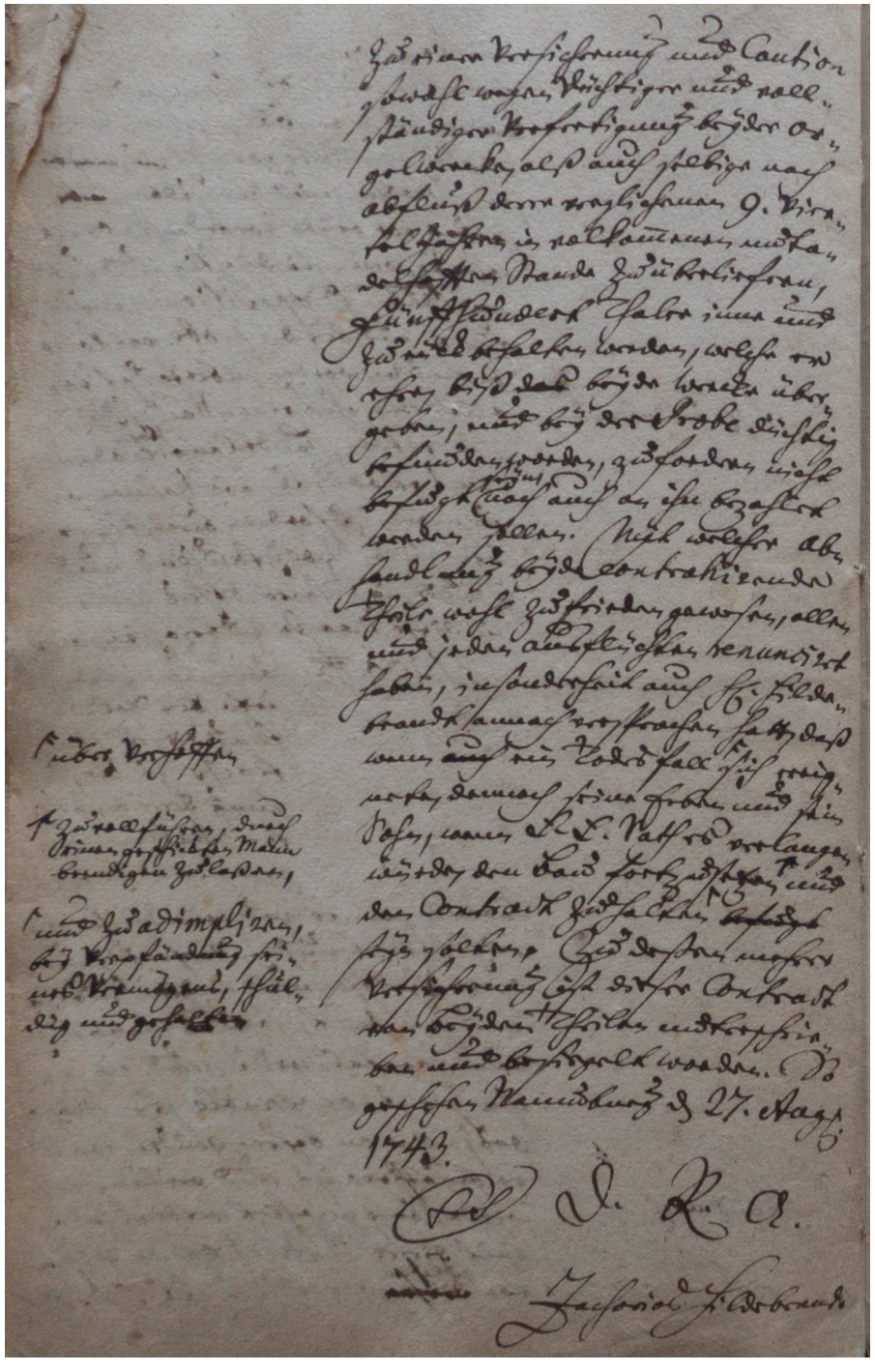
Fol. 53-55 contain the planned specification for the new organ in St Wenzel, Naumburg: "(Anhang) A".
"Anhang B", fol. 56. specifies Hildebrandt's specification for the organ of the "Marien Kirche am Wayßenhause" ("St Mary's near the orphanage").

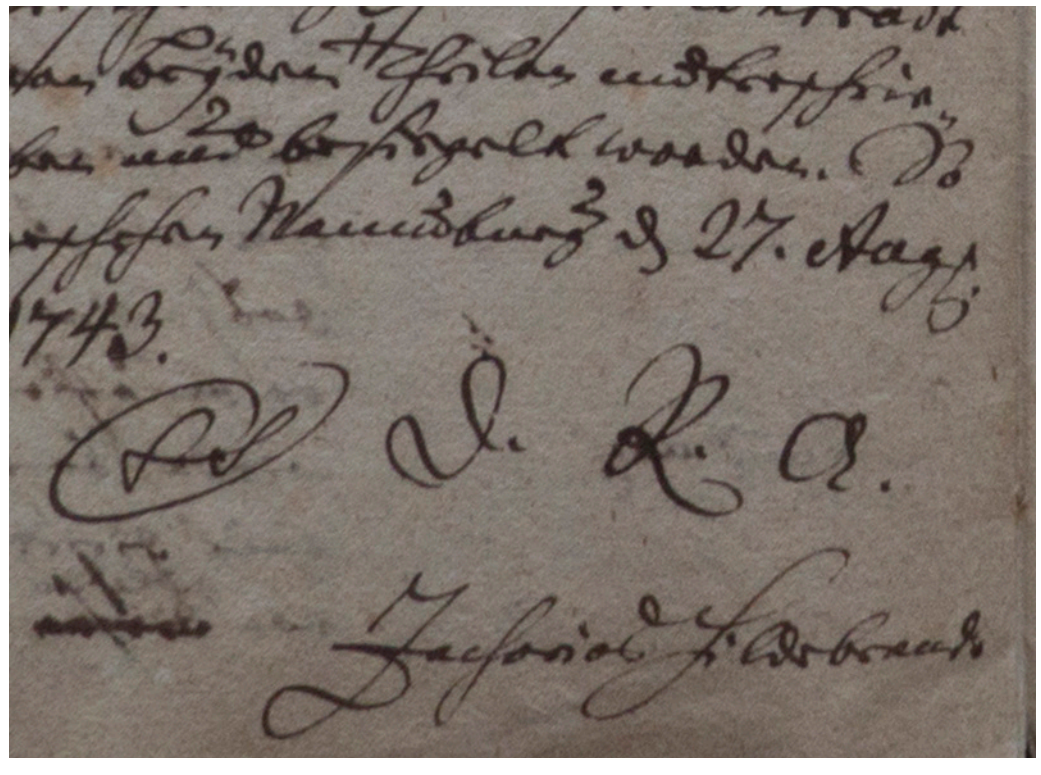
The spelling of the stop names of the Utopa Baroque Organ is taken from this draft.

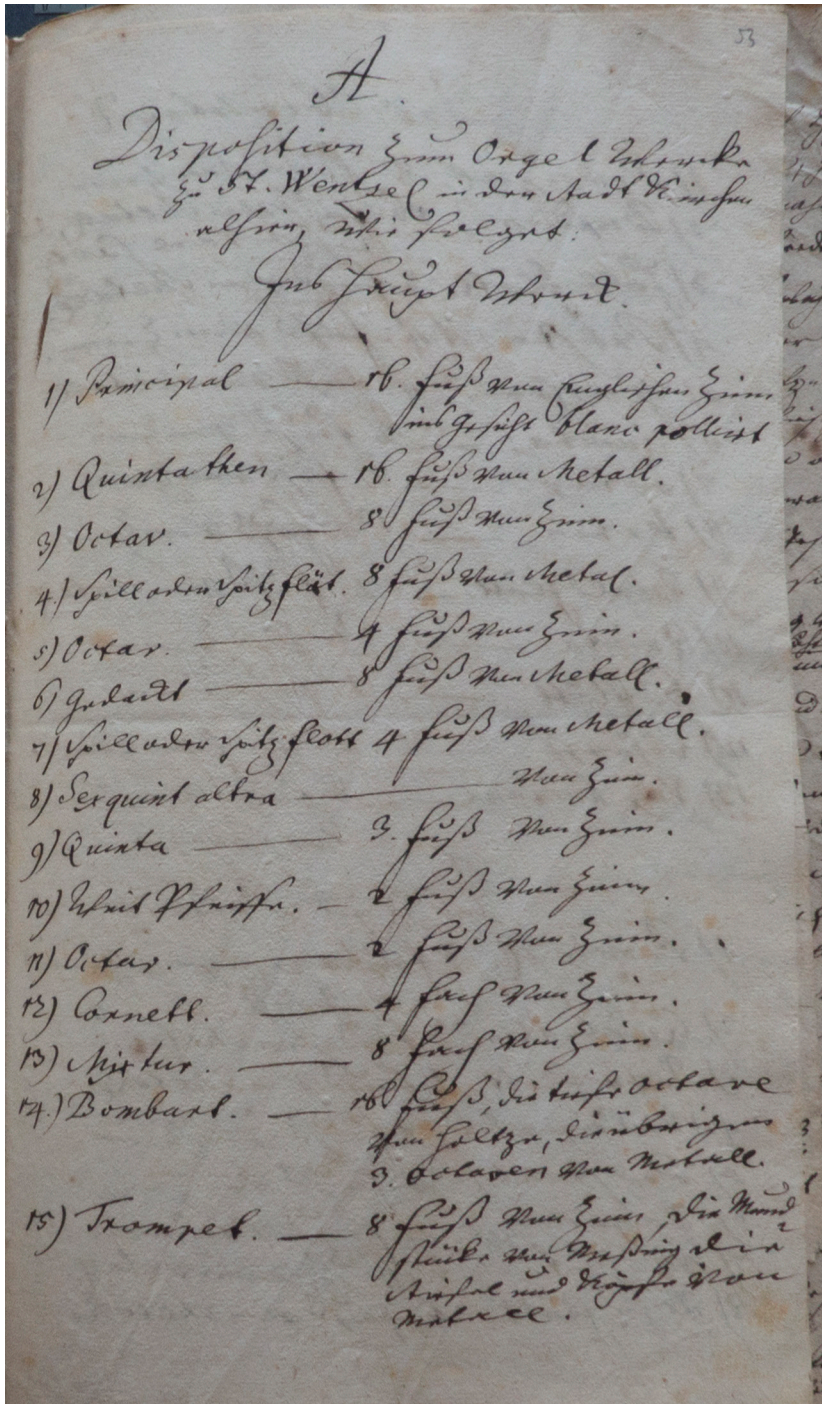


zuverfertigen, auch
den Anfang damit zumachen, und ca
das gantze werck binnen Neun Vier-
teljahren, von gedachter Zeit anzu-
rechnen, völlig zu absolviren, auch
mit Ausgang dieser Frist die neue
Orgel vollkommen fertig, düchtig
und guth, nach vorhergegangener
Disposition zur Probe zu übergeben; hierüber verspricht auch er,
welcher Herr Hildebrandt eine ~~neu~~
neue Orgel an Gehäuse, Pfeiff-
wercke, windladen, bälgen, Cla-
vier und allen andern Zubehörun-
gen, nach beygehefteter Disposi-
tion sub A. in die neue Marien
Magdalenen Kirche zuverfertigen,
alles düchtig zumachen, ~~und~~ bin-
nen denen gesetzten Neun Viertel-
jahren zu absolviren und völlig
auffzusetzen, auch vor alle darzu
nöthige Bedürffnüße an Zinn,
Metall, Holtz und allen andern
Zubehörungen, wie sie Nahmen
haben mögen, zu stehen und solches
alles anzuschaffen, auch sodann
nach verfloßener obbenannter
Frist vollkommen düchtig und guth
[zur probe] zu übergeben. Dargegen verspricht
E. E. Hochweiser Rath alhier, denen-
selben Hildebrandten das gesamb-
te Pfeiffwerck an Zinn, Metal,
hölzernen [und blechernen] Pfeiffen, bälgen, windla-
den und allen andern zum Orgel-

[aus der alten Orgel]
wercke gehörigen Inbegriffen, zu über-
laßen, auch das Lager und die
Leuten zu denen bälgen in der Marien
Magdalenen Kirche vor sich ~~zu machen~~
anzuschaffen, und demselben ~~über-
haupt~~ vor beyde vorgedachte Orgel-
wercke, wenn sie düchtig und guth
nach ~~obigen~~ [aufgegebenen] Dispositionen gefer-
tiget und bey der probe vollkommen
befunden worden, überhaupt vor
[Dem H. Hildebrand] alles weg, ohne einen Nachschuß,
Discretion, Handlanger Lohn, oder
sonst etwas, es habe Nahmen wie
es möge, zu fordern berechtiget
seyn solle, Zwey tausend und
fünffzig Thaler, bahres geldes
in dieser Maasse zu bezahlen, also
200. Thlr. sollen ihm gleich
itzo bey Vollzie-
hung dieses Con-
tracts zu Anschaf-
fung derer benöthig-
ten Materialien
gezahlet werden,
Sodann, wenn er zur würcklichen Ar-
beit kommet und in Verfertigung
derer Pfeiffen und andern Zubehö-
rungen stehet, sollen ihm monadlich
auch Quartal-weise, und wie es
ihm sonst convenable seyn möchte,
dasjenige an bahren gelde, was
er benöthiget ist und verlangen
wird [nach und nach], baar gezahlet werden, jedoch
mit dieser Restriction, daß ihm
von ~~diesen~~ [solchen] accordirten 2050. Thlr.







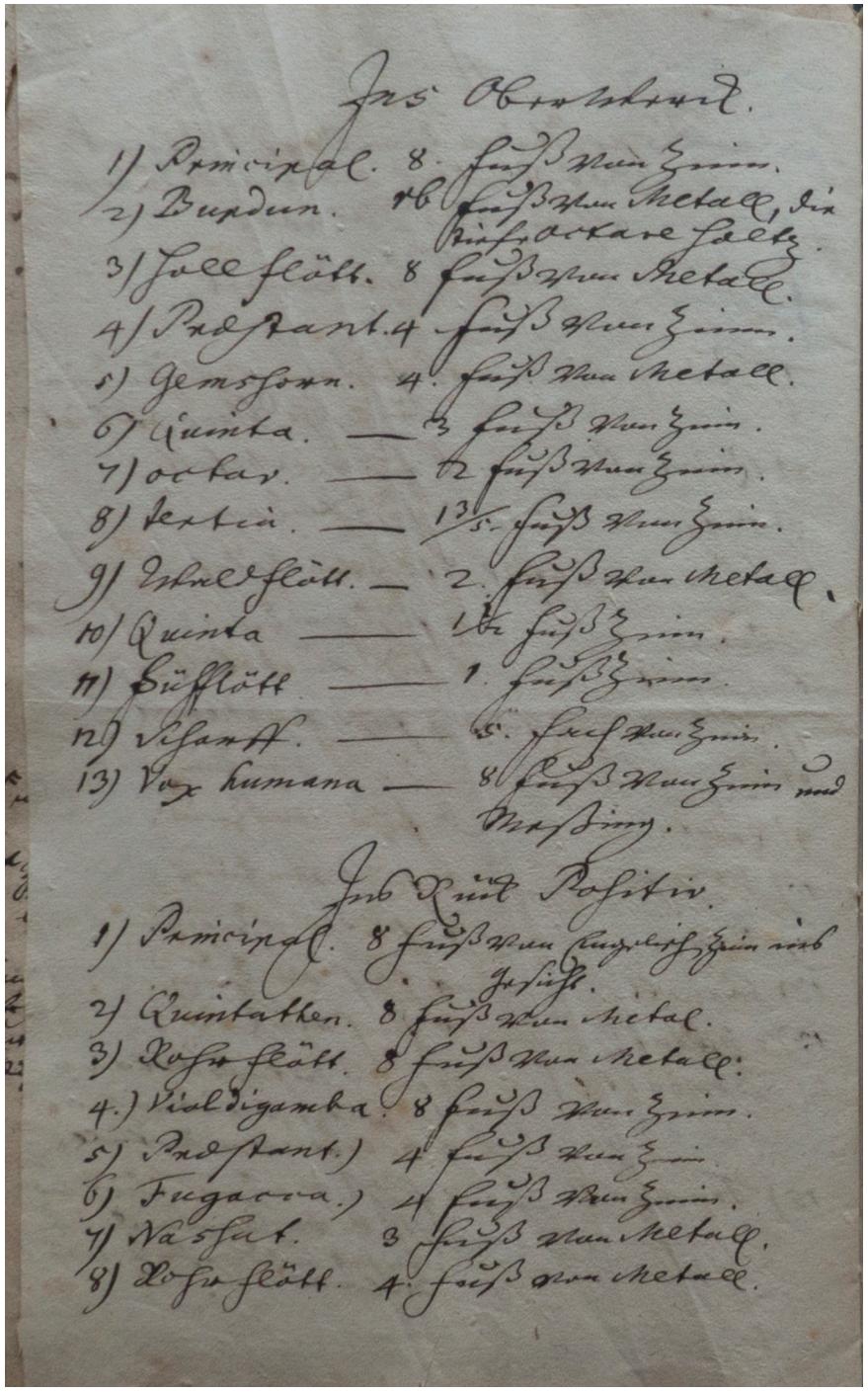
[fol. 53r] A.

Disposition zum Orgel Wercke
zu St. Wentzel in der Stadt Kirchen
alhier, wie folget:

Ins Haupt Werck.

1) Principal	16.	Fuß von Englischen Zinn ins Gesicht blanc pollirt
2) Quintathen.	16.	Fuß von Metall.
3) Octav.	8	Fuß von Zinn.
4.) Spill oder Spitzflöt.	8	Fuß von Metal.
5) Octav.	4	Fuß von Zinn.
6) Gedackt	8	Fuß von Metall.
7) Spill oder Spitzflott	4	Fuß von Metall.
8) Sexquint altra		von Zinn.
9) Quinta	3.	Fuß von Zinn.
10) Weit Pfeiffe.	2	Fuß von Zinn.
11) Octav.	2	Fuß von Zinn.
12) Cornett.	4	fach von Zinn.
13) Mixtur.	8	fach von Zinn.
14.) Bombart.	16.	Fuß, die tiefe Octave von Holtze, die übrigen 3. Octaven von Metall.[1]
15) Trompet.	8.	Fuß von Zinn, die Mund= stücke von Meßing die Stiefel und Köpfe von Metall.

1 The lower loop of the f in "8 fach" in the line above seems to just make one point behind the 16 barely visible. Compare this to the Octav. 8, where a loop from the line above also extends to the corresponding location and no thickening of the line can be detected, which might be recognizable as a point.



Ins Oberwerck.

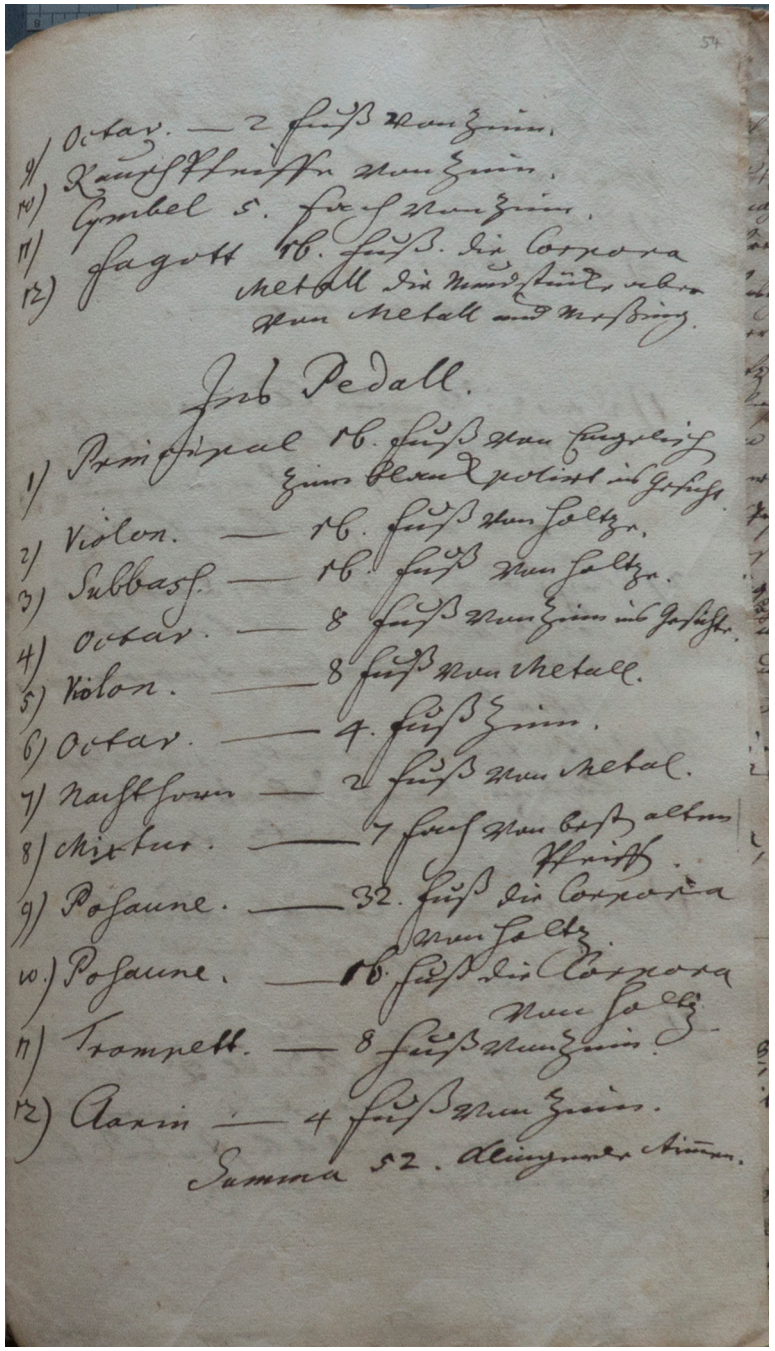
1) Principal.	8.	Fuß von Zinn.
2) Burdun.	16	Fuß von Metall, die tiefe Octave Holtz.
3) Hollflött.	8	Fuß von Metall.
4) Præstant.[2]	4	Fuß von Zinn.
5) Gemshorn.	4.	Fuß von Metall.
6) Quinta.	3	Fuß von Zinn.
7) Octav.	2	Fuß von Zinn.
8) Tertia.	1 3/5	Fuß von Zinn.
9) Waldflött.	2.	Fuß von Metall.
10) Quinta	1 1/2	Fuß Zinn.
11) Süfflött.	1.	Fuß Zinn.
12) Scharff.	5.	fach von Zinn.
13) Vox humana	8	Fuß von Zinn und Meßing.

Ins Rück Positiv.

1) Principal.	8	Fuß von Englischen Zinn ins Gesicht.
2) Quintathen.	8	Fuß von Metal.
3) Rohrflött.	8	Fuß von Metall:
4.) Violdigamba.[3]	8	Fuß von Zinn.
5) Præstant.)	4	Fuß von Zinn.
6) Fugara.)	4	Fuß von Zinn.
7) Nassat.	3	Fuß von Metall.
8) Rohrflött.	4.	Fuß von Metall.

2 The “æ” could also be transcribed with “ae”, although the ligature-like “æ” probably corresponds better to the handwritten face. The spelling “Prestant” is excluded as a comparison with the -re- in “Tremulant” reveals.

3 A transcription “Viol digamba” is also possible.



[fol. 54r]

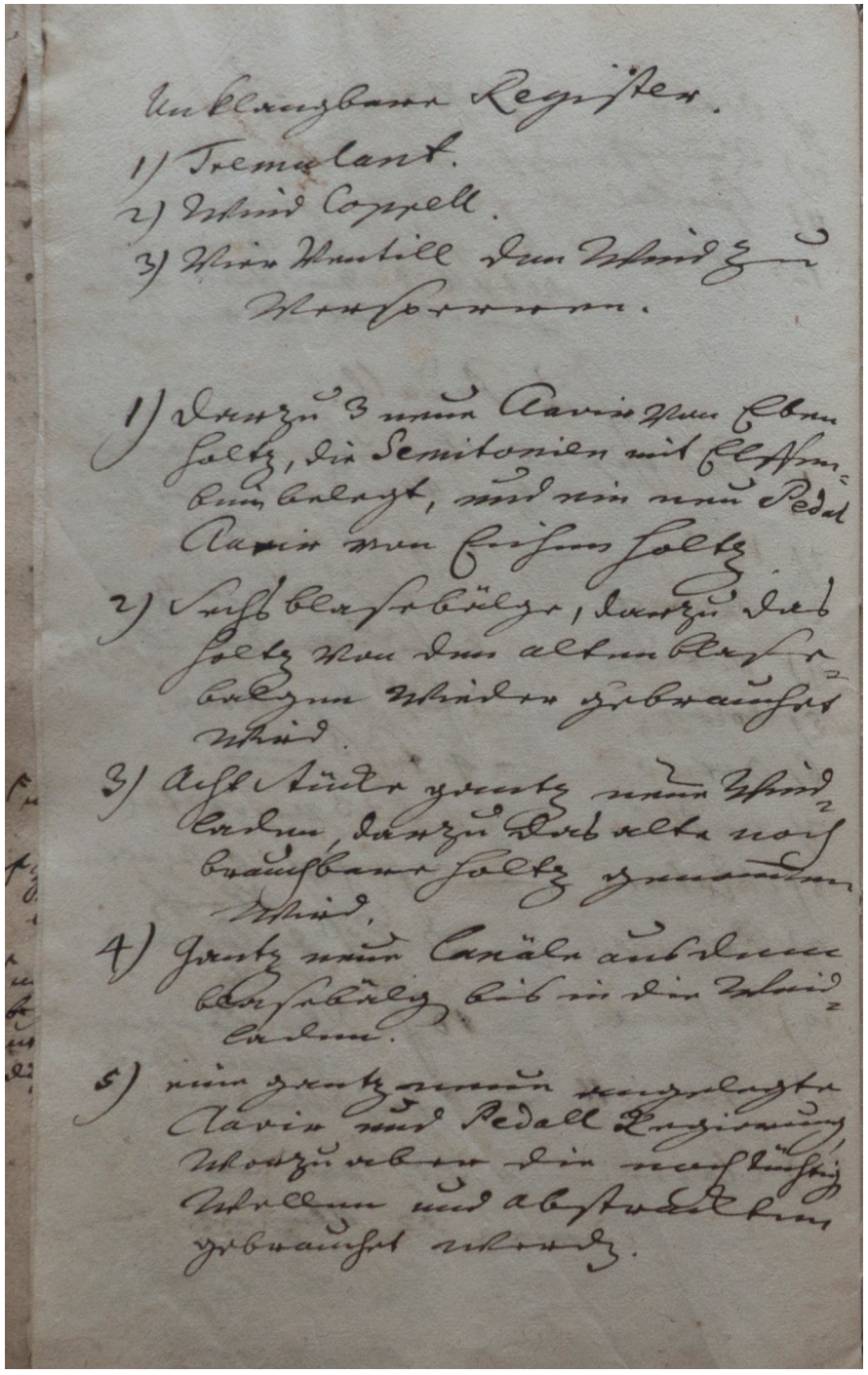
9) Octav.	2	Fuß von Zinn.
10) Rausch Pfeiffe		von Zinn.
11) Cymbel	5.	fach von Zinn.
12) Fagott	16.	Fuß. Die Corpora Metall die Mundstücke aber von Metall und Meßing.

Ins Pedall.

1) Principal	16.	Fuß von Englischen Zinn blank polirt ins Gesicht.
2) Violon.	16.	Fuß von Holtze.
3) Subbass.	16.	Fuß von Holtze.
4) Octav.	8	Fuß von Zinn ins Gesichte.
5) Violon.	8	Fuß von Metall.
6) Octav.	4.	Fuß Zinn.
7) Nachthorn	2	Fuß von Metal.
8) Mixtur.	7	fach von besten alten[4] Pfeiffen.
9) Posaune.	32.	Fuß die Corpora von Holtz.
10.) Posaune.	16.	Fuß die Corpora von Holtz.
11) Trompett.	8	Fuß von Zinn.
12) Clarin	4	Fuß von Zinn.
	Summa	52. klingende Stim[m]en.[5]

4 To the right of "alten" vertical line appears, 12-13 mm long, probably in pencil and inserted later.

5 "St" in Stimmen. Cf. "Stadt Kirche" at the beginning of the document (fol. 51r).



[fol. 54v]

Unklangbare Register.

1) Tremulant.
2) Wind Coppell
3) Vier Ventill den Wind zu
versperren.

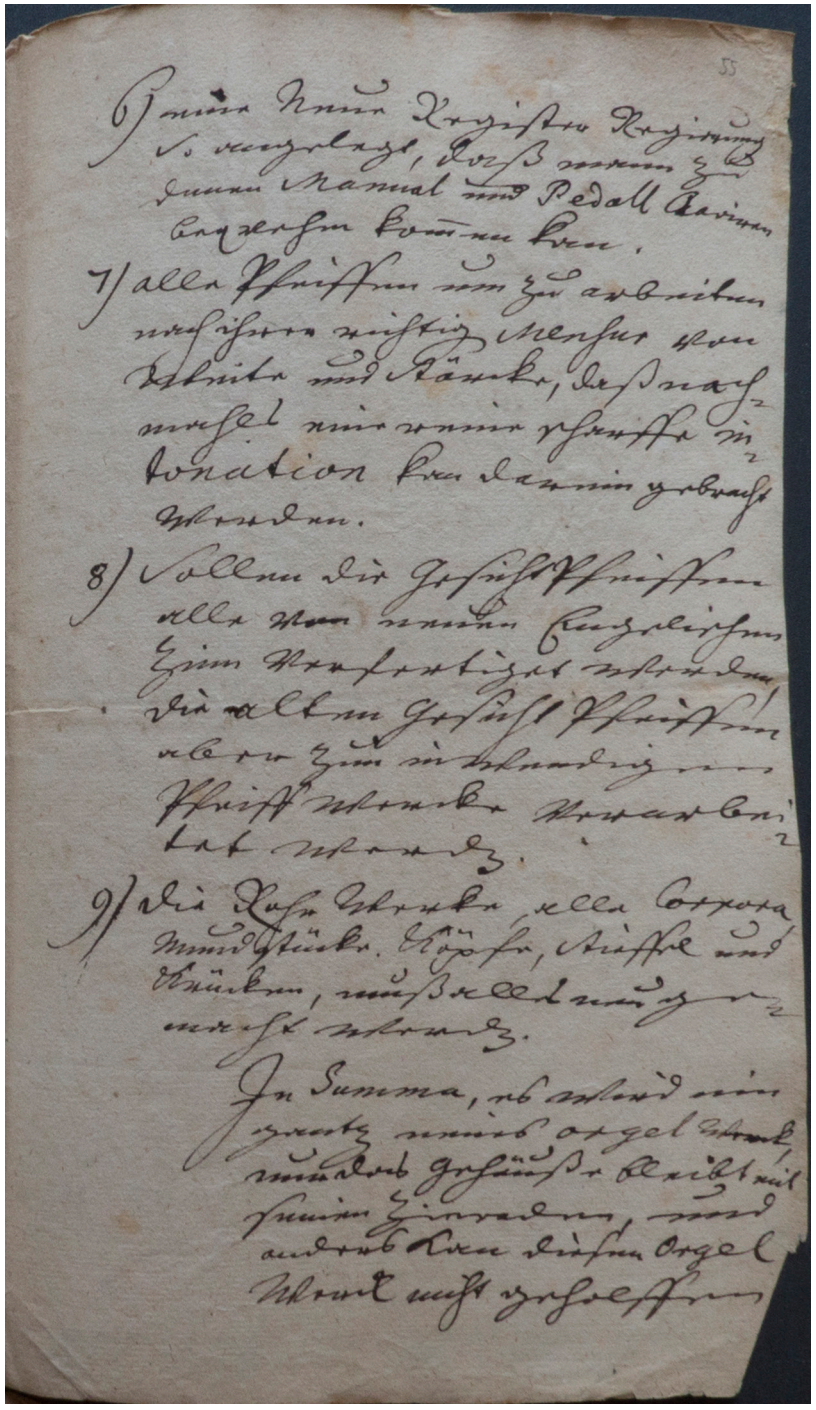
1) Darzu 3 neue Clavir von Eben Holtz, die Semitonien mit Elffen= bein belegt, und ein neu Pedal Clavir von Eichen Holtz.

2) Sechs Blasebälge, darzu das Holtz von den alten Blase= balgen wieder gebrauchet wird.

3) Acht Stücke gantz neue Wind= laden, darzu das alte noch brauchbare Holtz genom[m]en wird.

4) Gantz neue Canäle aus denen Blasebälgen bis in die Wind= laden.

5) eine gantz neue angelegte Clavir und Pedall Regierung, worzu aber die noch tüchtigen Wellen und Abstrackten gebrauchet werden.



[fol. 55r]

6) eine neue Register Regierung
so angelegt, daß mann zu
denen Manual und Pedall Claviren
beqvehm kom[m]en kan.

7) Alle Pfeiffen um zu arbeiten
nach ihrer richtigen Mensur von
Weite und Stärcke, daß nach=
mahls eine reine scharffe In=
tonation kan darein gebracht
werden.

8) Sollen die Gesicht Pfeiffen
alle von reinen Englischen
Zinn verfertiget werden,
die alten Gesicht Pfeiffen
aber zum[6] inwendigen
Pfeiffwercke[7] verarbei=
tet werden.

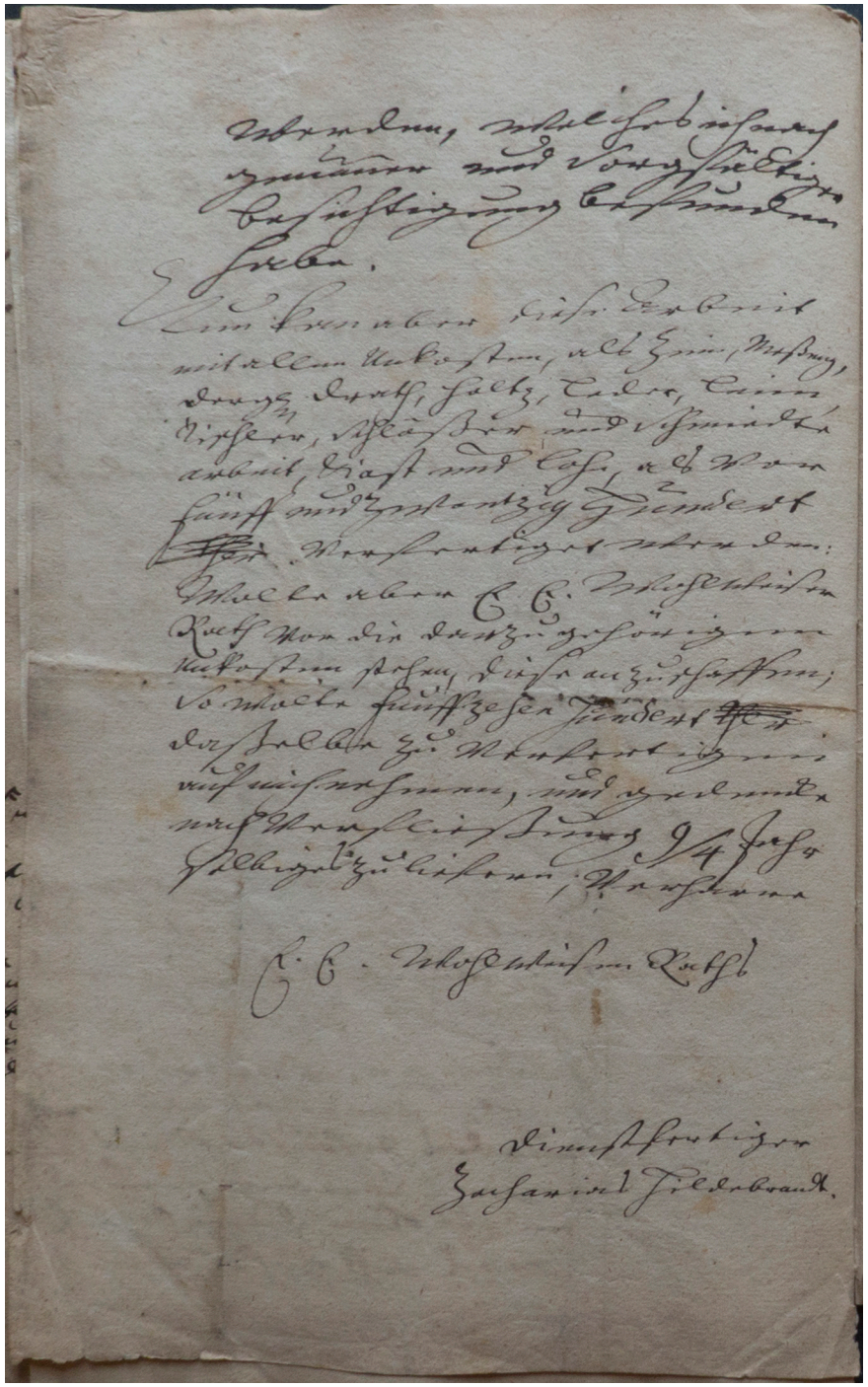
9) Die Rohr Werke[8], alle Corpora,
Mundstücke. Köpfe, Stieffel und
Krücken, muß alles neu ge=
macht werden.

In Summa, es wird ein
gantz neues Orgel Werck,
nur das Gehäuße bleibt mit
seinen Zieraden, und
anders kan diesen Orgel
Werck nicht geholffen

6 Could be read as “zun” (“zu den”).

7 Could be read possibly as “Pfeiff Wercke”, but the “w” corresponds precisely with the small “w” in “werden” in the next line below.

8 “Werke” stands clearly separated, with capital “W”. Notable is the spelling -rk-. Usually the spelling as in “Pfeiffwercke” two lines above. Cf. the copy of the contract on p. 33.



[fol. 55v]

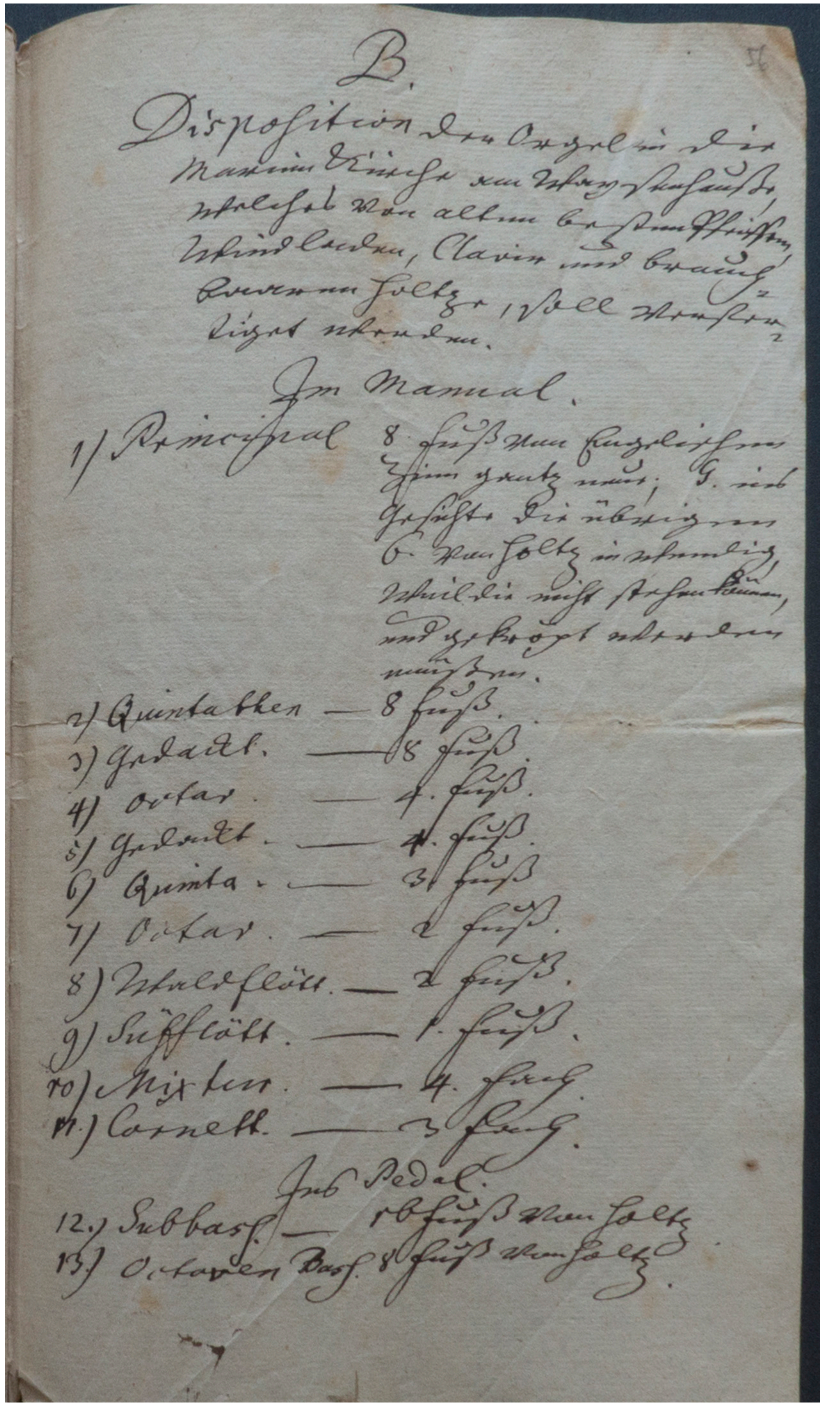
werden, welches ich nach
genauer und sorgfältiger
Besichtigung befunden
habe.

[The following is written with different ink and in a hand with different characteristics]

Nun kan aber diese Arbeit
mit allen Unkosten, als Zinn, Meßing,
dergl[eichen] Drath, Holtz, Leder, Leim,
Tischler, Schlößer, und Schmiedte
Arbeit, Last und Lohn, als vor
fünff und zwantzig Hundert
Thlr. verfertiget werden:
Wolte aber E. E. Wohlweiser
Rath vor die darzu gehörigen
Unkosten stehen, diese auszuschaffen;
so wolte fünffzehen Hundert Thlr.
daßelbe zu verfertigen
auf mich nehmen, und gedencke
nach Verfließung 9/4 Jahr
selbiges zu lieffern; verharre

E. E. Wohlweisen Raths

dienstfertiger
Zacharias Hildebrandt.



B.

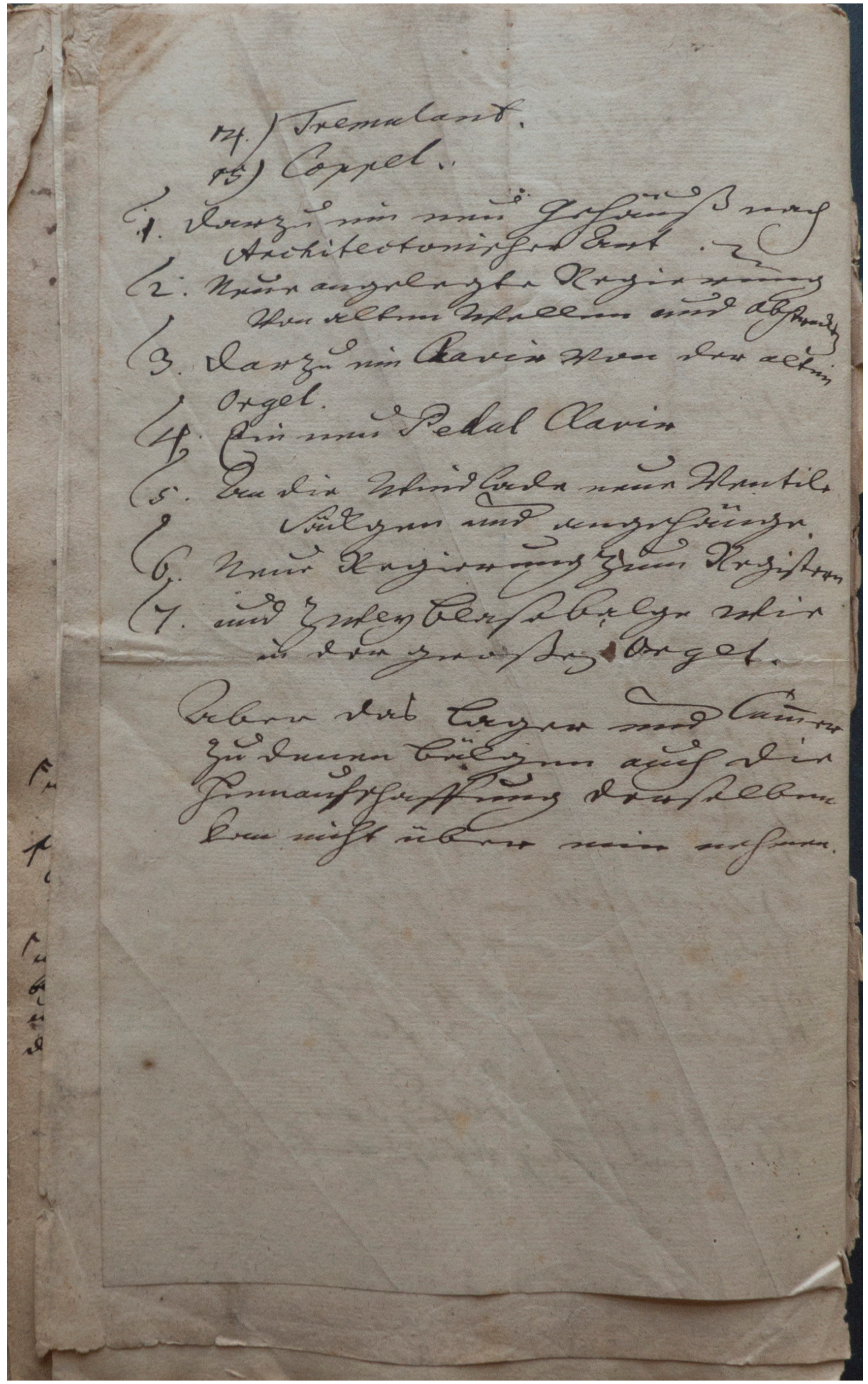
Disposition der Orgel in die Marien Kirche zu [illegible], welches von alten bestimmt Stücken, Windladen, Clavir und brauchbaren Holtze, soll verfertiget werden.

Im Manual.

1) Principal 8 fuß von Englischem Zinn gantz neu. G. [illegible] Gesichte die übrigen [illegible] von Holtz inwendig, weil die nicht stehen können, und gebrogt werden müssen.
2) Quintathen — 8 fuß.
3) Gedackt. — 8 fuß
4) Octav. — 4. fuß.
5) Gedackt. — 4. fuß.
6) Quinta. — 3 fuß
7) Octav. — 2 fuß.
8) Waldflött. — 2 fuß.
9) Sufflött. — 1. fuß.
10) Mixtur. — 4. fach.
11.) Cornett. — 3 fach.

Im Pedal.

12.) Subbass — 16 fuß von Holtz
13.) Octaven Bass. 8 fuß von Holtz.



14.) Tremulant.
15.) Coppel.

1. Dazu ein neu Gehäuse nach Architectonischer Art.
2. Neue angelegte Regierung von alten Wellen und Abstracten
3. Dazu ein Clavir von der alten Orgel.
4. Ein neu Pedal Clavir
5. Da die Windlade neue Ventile, Stöcke und [illegible]
6. Neue Regierung zum Registern
7. und zwey Blasebälge wie in der grossen Orgel.

Ueber das Logier und Kosten zu denen brauchen auch die Herausschaffung derselben kan nicht über mich nehmen.

Naumburg, St Wenzelskirche

Copy of the contract from August 27, 1743. "Vertrag d. Stadt mit Orgelmacher Z. Hildebrandt 27.8.1743", (fol. 4-8).

Archive: Naumburg, Stadtarchiv
Signature according to Dähnert: GA Loc 64, No 49. Neither the cardbord box (labeled "Orgel"), nor the document or the envelope states the signature. The foliation in the document itself (in red ink) matches, however, with Dähnert's specifications in detail.[1]
Transcription: Ibo Ortgies, 2016

The original contract - probably in at least two copies - from 1743 is not preserved. The scribe of the original contract is not known. Almost certainly it was written by a town clerk according to the above-mentioned draft but including negotiated changes. The notarization from November 25, 1752 on fol. 8v allows only to state that the original still existed at that date.[2]
This implies that Hildebrandt's signature on the document must be in copy, too, and in consequence also his seal with his coat of arms is missing, which would be expected on an official contract.

Fol. 4r–7v contain the planned specification for the new organ in St Wenzel, Naumburg, "(Anhang) A."
"Anhang B", fol. 8 specifies Hildebrandt's specification for the organ of the "Marien Kirche am Wayßenhause" ("St Mary's near the orphanage").

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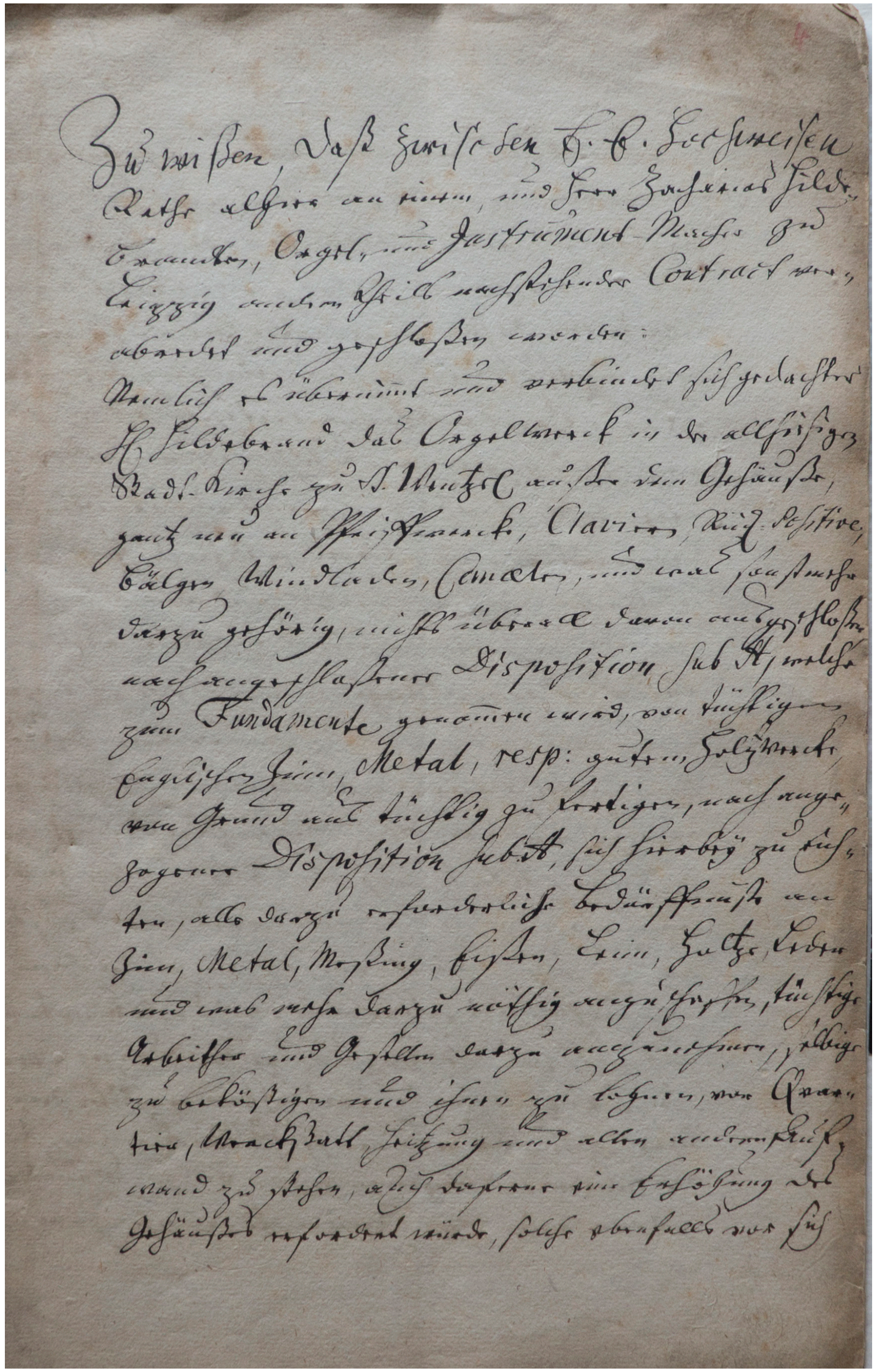
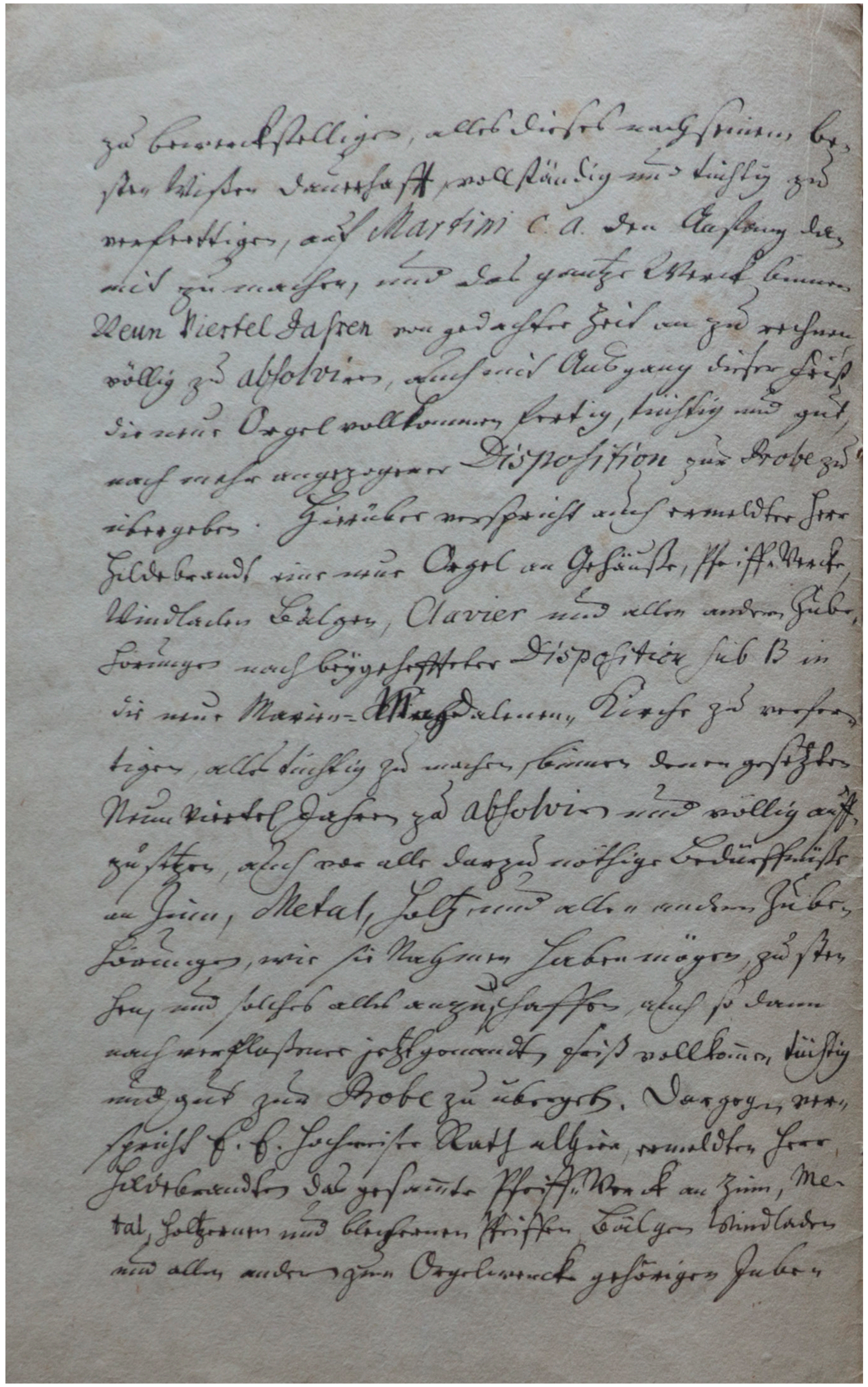
1 Cf. Dähnert 1962, 90-95, 102-103 and the endnotes 430-433 (229) and 479 (230).

2 Transcription of the notarization:

> Daß diser abschrifftliche Contract nebst den
> Beylagen sub A et B., welche denen Originalien,
> welche zu denen Belegen derer Naumburgischen Raths-
> Rechnung ult[imo] Aprilis 1744 beschl[ossen?], sub no 738b ge-
> nom[m]en worden, nach gehaltener Collation in
> allen gleichlautend und conform befunden
> worden, wird von mir Endt benandten hierdurch
> bezeuget. Zeitz den 25ten Novembr[is] 1752
> Johann Christian Kühn
> Not[arius] publ[icus] Caes[areus] jur[atus] in Saxonia
> Elect[orali]
> exam[inatus] et legit[imatus] et immatr[iculatus]



Zu wißen, daß zwischen E. E. Hochweisen
Rathe alhier an einem, und Herrn Zacharias Hilde-
brandten, Orgel- und Instrument-Macher zu
Leipzig andern Theils nachstehender Contract ver-
abredet und geschloßen worden:
Nemlich es übernimmt und verbindet sich gedachter
H. Hildebrand das Orgelwerck in der alhiesigen
Stadt-Kirche zu S. Wentzel außer dem Gehäuße,
gantz neu an Pfeiffwerck, Clavier, Ruck-Positive,
Bälgen, Windladen, Cancellen, und was sonst mehr
darzu gehörig, nichts überall davon ausgeschloßen
nach angeschlaßener Disposition sub A, welche
zum Fundamente genommen wird, von tüchtigen
Englischen Zinn, Metal, resp: guten Holtzwerck,
von Grund aus tüchtig zu fertigen, nach ange-
zogener Disposition selbst, sich hierbey zu such-
en, alle darzu erforderliche Bedürffnüße an
Zinn, Metal, Meßing, Eisen, Leim, Holtz, Leder
und was mehr darzu nöthig anzuschaffen, tüchtige
Arbeiter und Gesellen darzu anzunehmen, selbige
zu beköstigen und ihnen zu lohnen, vor Quar-
tier, Wachs, Licht, Heitzung und allen andern Auf-
wand zu stehen, auch dafern eine Erhöhung des
Gehäußes erfordert würde, solche ebenfalls vor sich



zu bewerckstelligen, alles dieses nach seinem be-
sten Wißen dauerhafft, vollständig und tüchtig zu
verfertigen, auf Martini c. a. den Anfang da-
mit zu machen, und das gantze Werck binnen
Neun Viertel Jahren von gedachter Zeit an zu rechnen
völlig zu absolviren, auch nach Ausgang dieser Frist
die neue Orgel vollkommen fertig, tüchtig und gut,
nach mehr angezogener Disposition zur Probe zu
übergeben. Hierüber verspricht auch ermeldter Herr
Hildebrandt eine neue Orgel an Gehäuße, Pfeiff-Werck,
Windladen Bälgen, Clavier und allen andern Zube-
hörungen nach beygehefteter Disposition sub B in
die neue Marien-Magdalenen Kirche zu verfer-
tigen, alles tüchtig zu machen, binnen denen gesetzten
Neun Viertel Jahren zu absolviren und völlig auf-
zusetzen, auch vor alle darzu nöthige Bedürffnüße
an Zinn, Metal, Holtz und allen andern Zube-
hörungen, wie sie Nahmen haben mögen, zu ste-
hen und solches alles anzuschaffen, auch sie dann
nach verfloßener festgesetzten Frist vollkommen tüchtig
und gut zur Probe zu übergeben. Dargegen ver-
spricht E. E. Hochweise Rath alhier, ermeldten Herrn
Hildebrandten das gesamte Pfeiff-Werck an Zinn, Me-
tal, Holtzernen und bleyernen Pfeiffen, Bälgen Windladen
und allen andern zum Orgelwerck gehörigen Zube-

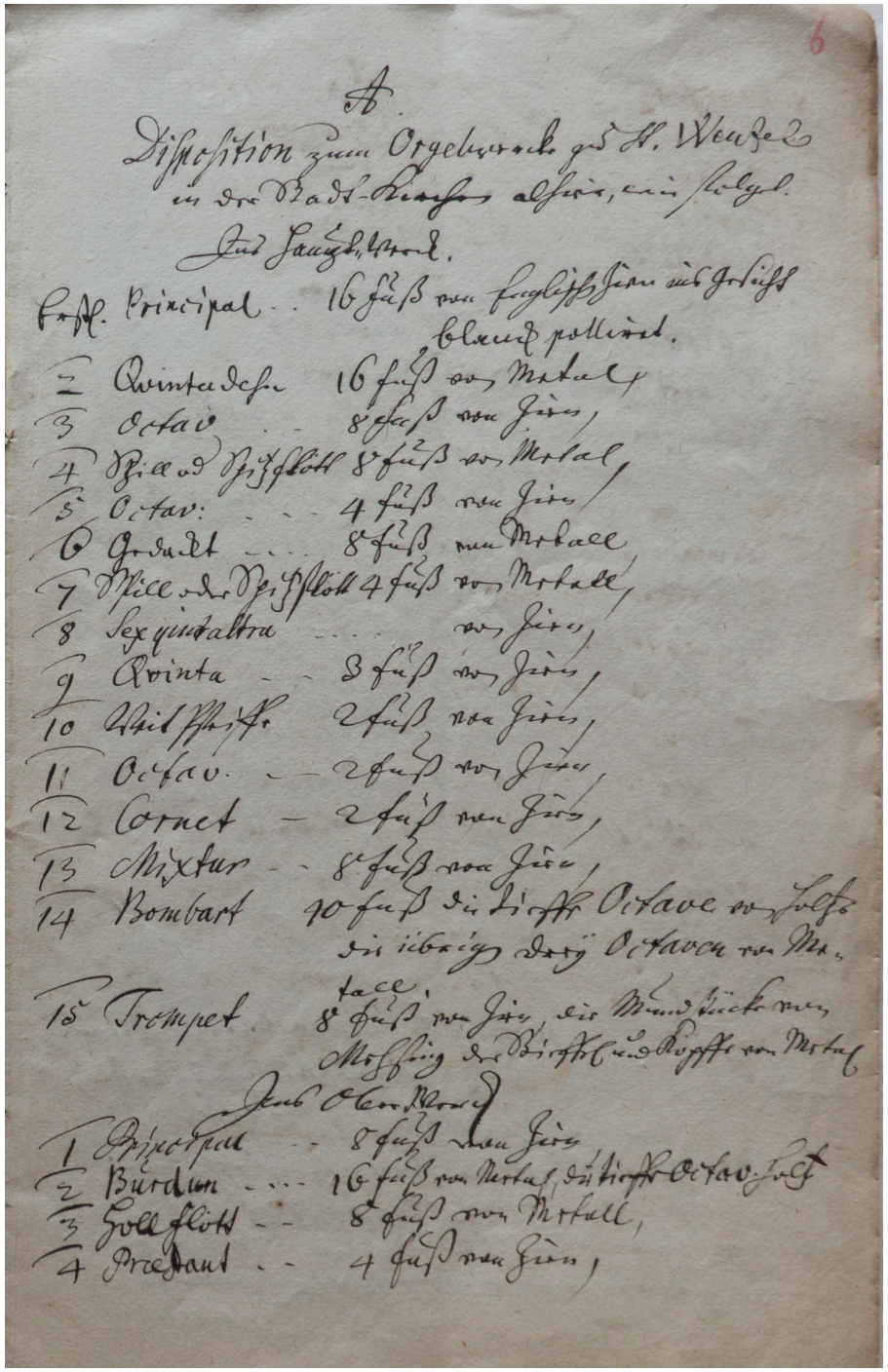
5

pfeiffen aus der alten Orgel zu überlassen, auch
das Lager und die Kammer zu denen Bälgen in
der Marien-Magdalenen Kirche vor sich anzuschaf-
fen, und denselben vor beyde gedachte Orgel-
werke, wann sie tüchtig und gut, nach denen an-
gezogenen Dispositionen gefertiget, und bey der
Probe vollkommen befunden worden, überhaupt vor
allerdings, ohne daß Herr Hildebrandt einen Nach-
schuß, Discretion, Handlanger-Lohn, oder sonst
etwas, es habe Nahmen wie es möge, zu fordern
berechtiget seyn solle, Zwey Tausend und Funfzig
Thaler, baares Geld in dieser Maaße zu bezahlen,
als: 200 thl. sollen ihm gleich jetzo bey Vollziehung
dieses Contracts zur Anschaffung derer benöthigten
Materialien gezahlet werden. So dann, wann er
zur würckl. Arbeit kommt, und in Verfertigung derer
Pfeiffen und anderer Zubehörungen stehet, soll ihm
monatlich auch Quartal-Weise, und wie es ihm sonst con-
venable seyn möchte, dasjenige an baarem Gelde, was
er benöthiget ist und verlangen wird, nach und nach
baar bezahlet werden, jedoch mit dieser Restriction
daß ihm von solchen accordirten 2050 thl. zu
seiner Versicherung und Caution sowohl wegen tüchti-
ger und vollständiger Verfertigung beyder Orgel-
Werke, als auch selbige nach Abfluß derer ver-
glichenen 9. Viertel Jahren in vollkommenen Stande,

fertigen Stande zu überliefern, Fünffhundert
Thaler innen- und zurückbehalten werden, wel-
che er eher, bis beyde Werke übergeben, und bey
der Probe tüchtig befunden worden, zu fordern
nicht befugt seyn, noch auch an ihn bezahlet
werden sollen. Mit welcher Abhandlung bey-
de contrahirende Theile wohl zufrieden ge-
wesen, allen und jeden Ausflüchten renuncirt
haben, insonderheit auch Herr Hildebrandt an-
noch versprochen hat, daß wenn ein Todesfall
über Verhoffen sich ereignete, demnach seine
Erben und sein Sohn, wann H. H. Rath es ver-
langen würde, den Bau fortzusetzen und zu
vollführen, durch einen geschickten Mann been-
digen zu lassen, und den Contract zu halten,
und zu adimpliren bey Verpfändung seines Vermö-
gens schuldig und gehalten seyn sollen. Zu dessen
mehrerer Versicherung ist dieser Contract von bey-
den Theilen unterschrieben und besiegelt worden.
So geschehen Naumburg d. 27 Augt. 1743.

L. S. Der Rath alhier

Zacharias Hildebrandt
Orgel- und Instrumentmacher.



[fol. 6r]

A.

Disposition zum Orgelwercke zu St. Wenzel
in der Stadt-Kirchen alhier, wie folget.

Ins Haupt=Werck.

Erstl. Principal	16 Fuß	von Englischen[1] Zien ins Gesicht blanck polliret.
2)[2] Quintadehn	16 Fuß	von Metal,
3) Octav	8 Fuß	von Zien,
4) Spill oder Spitzflött	8 Fuß	von Metal,
5) Octav:	4 Fuß	von Zien
6) Gedackt	8 Fuß	von Metall,
7) Spill oder Spitzflött	4 Fuß	von Metall,
8) Sexquintaltra		von Zien,
9) Qvinta	3 Fuß	von Zien,
10) Weit Pfeiffe	2 Fuß	von Zien,
11) Octav.	2 Fuß	von Zien,
12) Cornet	2 Fuß	von Zien,
13) Mixtur	8 Fuß	von Zien,
14) Bombart.	10 Fuß	die tieffe Octave von Holtzs[3] die übrigen dreÿ Octaven von Me= tall.[4]
15) Trompet	8 Fuß	von Zien, die Mundstücke von Messing die Stieffel und Köpfe von Metal

Ins Ober Werck

1) Principal	8 Fuß	von Zien,
2) Burdun	16 Fuß	von Metal, die tieffe Octav. Holtz
3) Hollflött	8 Fuß	von Metall,
4) Præstant[5]	4 Fuß	von Zien,

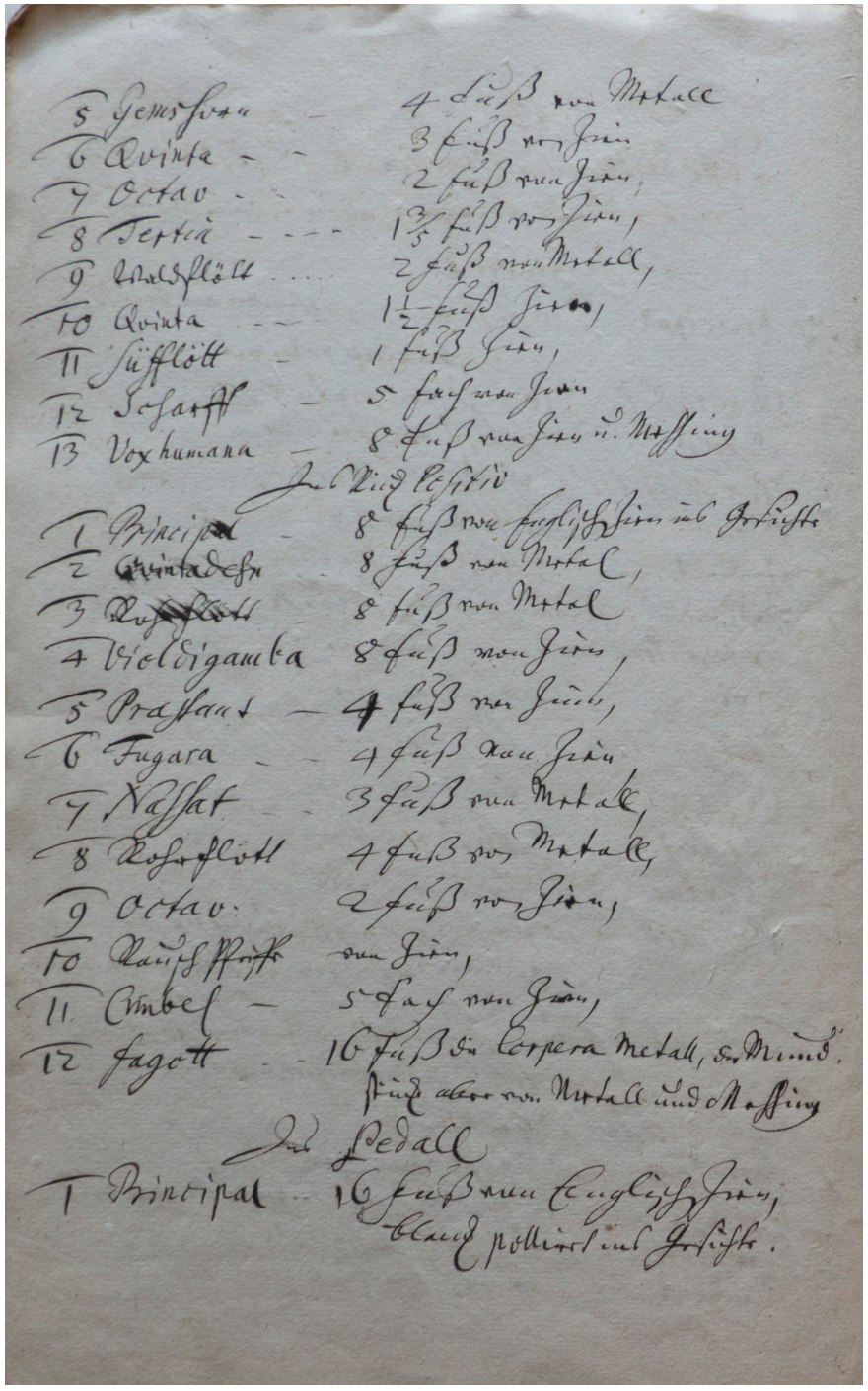
1 The -en in “Englischen” is written as an abbreviated slur and appears elsewhere in this form. This is not specifically marked by [en] in this transcription.

2 Instead of a bracket, a fermata-like symbol is placed above each no.

3 A correct genitive “Holtzes” is grammatically impossible in this phrase. Possibly a mistake. The intended word might have been “Holtze”.

4 It is impossible to read the 0 as a 6.

5 The spelling “Prestant” is excluded as a comparison with the -re- in “Tremulant” reveals.



[fol. 6v]

5) Gemshorn	4 Fuß	von Metall
6) Qvinta	3 Fuß	von Zien
7) Octav	2 Fuß	von Zien,
8) Tertia	1 3/5 Fuß	von Zien,
9) Waldflött.	2 Fuß	von Metall,
10) Qvinta	1 1/2 Fuß	Zien,
11) Süfflött.	1 Fuß	Zien,
12) Scharff	5 fach	von Zien
13) Vox humana	8 Fuß	von Zien u. Messing

Ins Rück Positiv.

1) Principal	8 Fuß	von Englischen Zien ins Gesichte
2) Quintadehn	8 Fuß	von Metal,
3) Rohrflött	8 Fuß	von Metal
4) Violdigamba.[6]	8 Fuß	von Zien,
5) Præstant[7]	4 Fuß	von Zien,
6) Fugara	4 Fuß	von Zien,
7) Nassat	3 Fuß	von Metall,
8) Rohrflött	4 Fuß	von Metall,
9) Octav:[8]	2 Fuß	von Zien,
10) Rausch Pfeiffe		von Zien,
11) Cimbel	5 fach	von Zien,
12) Fagott	16 Fuß	die Corpera Metall, die Mund-stück aber von Metall und Messing

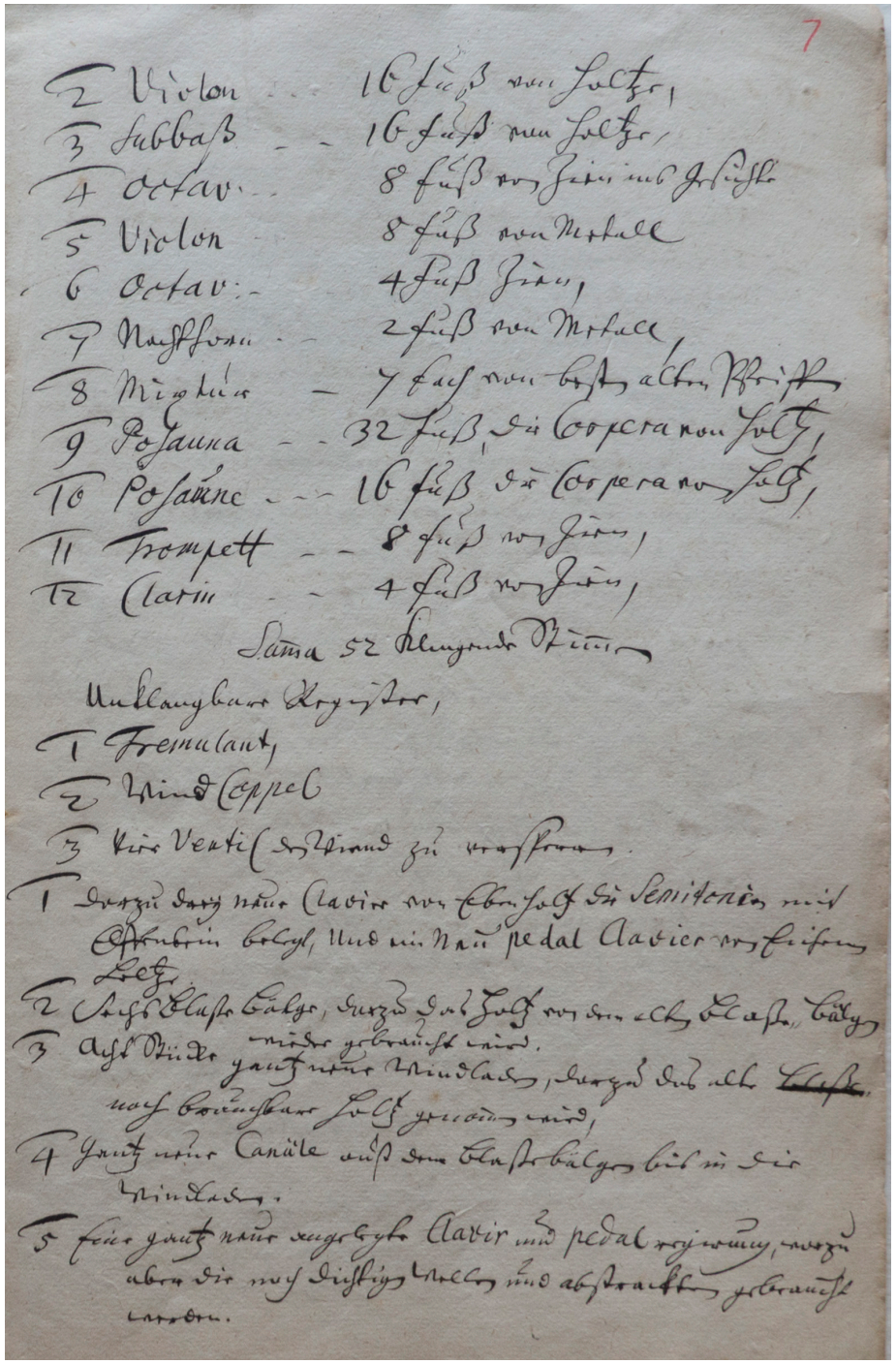
Ins Pedall.

1) Principal	16 Fuß	von Englischen Zien, blank polliret ins Gesichte.

6 A transcription "Viol digamba" is also possible.

7 The appearance of the -æ- comes close to an -a-, but a spelling "Prastant" can be excluded.

8 The colon might indicate an abbreviation, though it is unclear why one would write "Octav:" instead of plain "Octava" or "Octave". The use of colons and full stops, however, appears to be inconsistent.



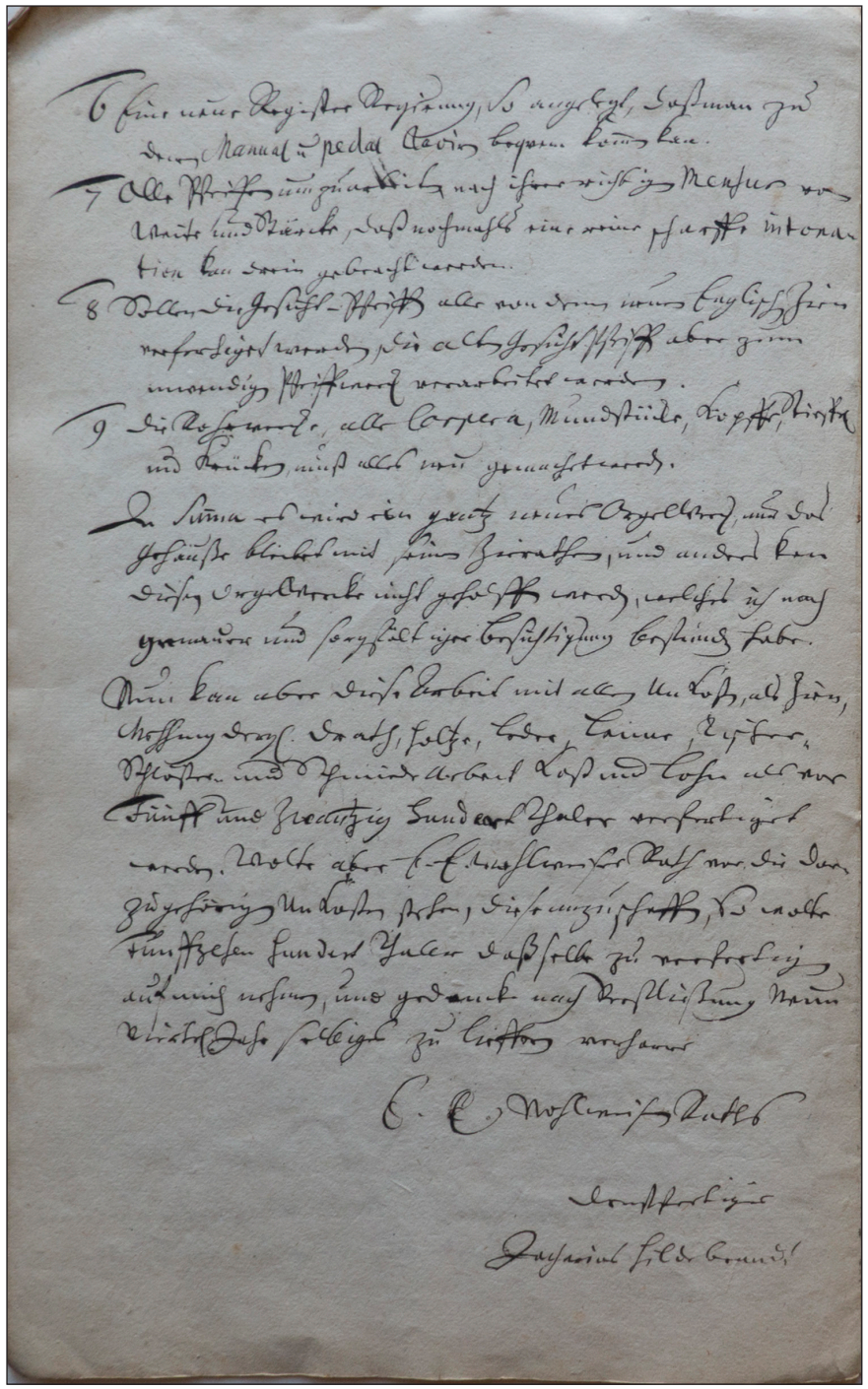
[fol. 7r]

2) Violon	16 Fuß	von Holtze,
3) Subbaß	16 Fuß	von Holtze,
4) Octav.	8 Fuß	von Zien ins Gesichte
5) Violon	8 Fuß	von Metall
6) Octav:	4 Fuß	Zien,
7) Nachthorn	2 Fuß	von Metall,
8) Mixtur	7 fach	von besten alten Pfeiffen
9) Posauna	32 Fuß,	die Corpera von Holtz,
10) Posaune	16 Fuß	die Corpera von Holtz,
11) Trompett	8 Fuß	von Zien,
12) Clarin	4 Fuß	von Zien,
	Sum[m]a	52 klingende Stim[m]en

Unklangbare Register,

1) Tremulant,
2) Wind Coppel
3) Vier Ventil den Wind zu versperren
1) Darzu dreÿ neue Clavir von Ebenholtz die Semitonien mit Elffenbein belegt, und ein neu Pedal Clavier von Eichen Holtze
2) Sechs Blasebälge, darzu das Holtz von den alten Blaße=Bälgen wieder gebraucht wird.
3) Acht Stücke gantz neue Windladen, darzu das alte Blaße= noch brauchbare Holtz genom[m]en wird,
4) Gantz neue Canäle auß dene[n] Blaßebälgen bis in die Windladen.
5) Eine gantz neue angelegte Clavir und Pedal Regierung, worzu aber die noch dichtigen[9] Wellen und Abstrackten gebraucht werden.

9 The adjective “dichtig” cannot denote “tight” here. It is probably a local form of “tüchtig”, meaning “[still] usable”.



[fol. 7v]

6) Eine neue Register Regierung, so angelegt, daß man zu denen Manual u Pedal Claviren beqvem kom[m]en kan.

7) Alle Pfeiffen um zuarbeiten, nach ihrer richtigen Mensur von Weite und Stärcke, daß nochmahls[10] eine reine scharffe Intona= tion kan darein gebracht werden.

8) Sollen die Gesicht-Pfeiffen alle von dem neuen Englischen Zien verfertiget werden, die alten Gesicht-Pfeiffen[11] aber zum inwendigen Pfeiffwerck[12] verarbeitet werden.

9) Die Rohrwercke, alle Corpera, Mundstücke, Köpffe, Stieffel und Krücken, muß alles neu gemachet werden.

In Sum[m]a es wird ein gantz neues Orgelwerk, nur das Gehäuße bleibet mit seinen Zierathen, und anders kan diesen Orgelwercke nicht geholffen werden, welches ich nach genauer und sorgfältiger Besichtigung befunden habe.

Nun kan aber diese Arbeit mit allen Unkosten, als Zien, Messing dergl[eichen] Drath, Holtze, Leder, Leime, Tischer= Schlößer= und Schmiede Arbeit, Last und Lohn als vor Fünff und zwantzig Hundert Thaler verfertiget werden. Wolte aber E. E. Wohlweiser Rath vor die dar= zu gehörigen Unkosten stehen, diese anzuschaffen, so wolte Fünffzehen Hundert Thaler daßselbe zu verfertigen auf mich nehmen, und gedencke nach Verfließung Neun Viertel Jahr selbiges zu lieffern verharre

E. E. Wohlweisen Raths
dienstfertiger
Zacharias Hildebrandt

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10 Read “nachmahls”, meaning “later”.

11 It is unclear whether the tiny dash between the two words is a hyphen or just unintentional.

12 Could be read possibly as “Pfeiff Wercke”, but the “w” corresponds precisely with the small “w” in “werden” in the next line below.

B.

Disposition der Orgel in die Marien Kirche am Wenzelskirchhofe, welche von alten besten Pfeiffen, Windladen, Clavier und brauchbaren holtze soll verfertiget werden.

Im Manual

1 Principal 8 fuß von Englischem Zinn gantz neu 9 ins Gesichte, die übrigen 6 von Holtz inwendig, weil die nicht stehen können, und gekröpft werden muß.

2 Quintadehn - 8 fuß

3 Gedackt - - - 8 fuß

4 Gedackt - - - 4 fuß

5 Octav - - - 4 fuß

6 Quinta - - 3 fuß

7 Octav - - - 2 fuß

8 Waldflött - - 2 fuß

9 Süfflött - - 1 fuß

10 Mixtur - 4 fach

11 Cornet - - 3 fach

Im Pedal

12 Subbaß - 16 fuß von Holtz

13 Octavenbaß 8 fuß von Holtz

14 Tremulant

15 Koppel

1 Wegen ein neu Gehäuße, nach Architectonischer art

2 Neue angelegte regierung von alten Wellen und Abstrakten

3 Dazu ein Clavier von der alten Orgel

4 ein neu pedal Clavier

5 An die Windlade neue Ventil, Federn und Angehänge.

6 Neue regierung zu registern

7 und zwey blaßbälge wie in der großen Orgel

Aber daß Lager und Cammer zu denen bälgen auch die Hin aufschaffung derselben kan nicht über mir nehmen.

Daß dieser abschrifftliche Contract nebst denen beylagen sub A et B., ~~mit~~ denen Originalien, welche zu denen beylagen derer Naumburgischen Raths-Rechnung ult: Aprilis 1744 befindl: sub no 738 6 genommen worden, nach gehaltener Collation in allen gleichlautend und conform befunden worden, wird von mir Endes benandten hierdurch bezeuget. Zeitz den 25ten November 1752.

Johann Christian Kügell
Not: publ. Caes: jur. in Saxonia Elect:
exam: et legit: immatr:

Abstract

In 2015 the Orgelpark commissioned the digitalization of a larger part of archival material relating to Zacharias Hildebrandt and his work. The purpose was to lay the foundation of a "Digital Hildebrandt Archive" (DHA) that aims to

- be a strong knowledge resource for all research regarding the Utopa Baroque Organ, now and in the future
- generate research possibilities
- help safeguarding and preserving valuable historical documents

By way of a preview, this articles presents documents that were particularly relevant to the development of the Utopa Baroque Organ concept, including transcriptions of some of these documents. They include the draft for the specification of the Naumburg Hildebrandt organ, which was the source for the spelling of the stop names of the Utopa Baroque Organ.

Ibo Ortgies

Ibo Ortgies is a musicologist and music historian. His PhD-thesis on the tuning and temperament of seventeenth- and eighteenth-century organs received international acclaim. His research has contributed to new views on the keyboard music of the North German Baroque, especially Dieterich Buxtehude and his contemporaries but also Bach.

From 1992 to 1999, Ortgies was the co-initiator and consultant of the organ building project in Bremen-Walle, Germany: A newly built organ in early baroque style in meantone temperament and with split keys (inauguration 2002). In 1999, he joined the staff of the Göteborg Organ Art Center GOArt. As a member of the Reference Group of the Utopa Baroque Organ project at the Orgelpark, Ortgies designed the temperament of the organ, as well as the structure of the Cymbelstern. Furthermore, he located and mapped all relevant documents regarding the art of organ builder Zacharias Hildebrandt.

XV

Randall Harlow - Hyperorgan Mediation Technology for New Acoustic Music Ecologies

This paper will examine some of the history of so-called "Hyperorgan" design, discuss potential applications for Hyperorgan technology in the Utopa Baroque Organ at Orgelpark, and place these current and future avenues of contemporary organ design in the context of contemporary mediation technology. However, I would like to start this paper by looking back at the origins of the organ and subsequent modern history of mediating technology for musical expression.

Origins

When in the third century BCE Ctesibius of Alexandria first mounted valve-actuated syrinxes on top of a chamber of pressurized air, he did more than simply create another musical instrument. Rather, he created a category of instruments new to human history. For perhaps the first time, sound creation was divorced from pitch selection. As such, the Hydraulis and its later bellows-driven cousins represent the first technologically mediated musical instruments. The Greek term "organon" expresses this defining feature: the instrument was simply known as "the device."

The organ remained the only instrument to use technological mediation to separate sound creation from pitch selection until the beginning of the electrical age. During a time when organ builders explored how electrical mediation could shape new organ design, other inventors sought ways to create new instruments through purely electrical means. Early examples include Thaddeus Cahill's "Telharmonium," a precursor to the Trautonium and Hammond Organ, and Maurice Martenot's and Leo Theremin's eponymous instruments. Interest in music mediation technology increased dramatically after the Second World War, following the advent of electronic

synthesis and modulation, magnetic tape, and reliable self-contained keyboard-interfacing electronic instruments such as the Hammond Organ and later synthesizers by Robert Moog and others.[1] With the transition to the digital age in the 1980s, accompanied by the Moore's Law acceleration of computer processing power, composers and performers turned, and continue to turn, to the microprocessor and software as the fulcrum of music mediation technology.

Hyper-acoustic instruments: an overview

Since the 1980s, some composers and instrument designers have sought to blend computer hardware, software, or live-electronic processing directly into acoustic instrument design. Beginning with his early creation of such instruments at the MIT Media Lab, Tod Machover coined the prefix "hyper-" to describe such acoustic instruments with integrated and artistically mediated electronic output (e.g. "Hyperviolin," or "Hyperbow"). Other terms have been used for these instruments, but I will use Machover's hyper prefix for the purpose of this paper.

While some hyper-instruments such as Machover's early Hyperviolin and Hypercello utilize mediation technology for the generation of electronic sounds or live electronic manipulation of acoustic sounds, other hyper-instruments use mediation technology for purely acoustic sound production. However, this latter category is hardly new. Early mechanical instruments such as the organ clock, Michael's Welte's Orchestrion in the 19th century, and later Welte and Aeolian recording and player pianos and organs could be described as such. For clarification, I will refer to instruments which utilize purely acoustic sound production but use variable mediation technology for pitch selection as "hyper-acoustic instruments" (as opposed to the traditional pipe organ which utilizes mediation technology for sound production but not pitch selection, with the arguable exception of stop selection). Let us turn our attention now to several recent hyper-acoustic instruments incorporating electronic mediation technology.

1 Trevor Pinch and Frank Trocco. *Analog Days: The Invention and Impact of the Moog Synthesizer.* Cambridge, Massachusetts: Harvard University Press, 2004.

The Disklavier

The Yamaha Disklavier, an acoustic grand piano with a piggy-back solenoid-driven action may at first seem like merely an update of the early player piano. However, the digital versatility of its MIDI interface invited new avenues for acoustic performance. Almost since its release in the mid-1980s, composers have utilized these new MIDI-actuation capabilities for artistic means. Such uses include performance directly from a computer, permitting acoustic textures and complexity beyond human capabilities, much like Nancarrow's earlier use of mechanical piano rolls. Composers have utilized the Disklavier's MIDI interface as a means for enhancing the capabilities of the pianist (for example, Tod Machover's *Jeux Deux*, a concerto for Hyperpiano and Orchestra). In 2009 Stanford University researchers Jaroslaw Kapuscinski and Javier Sanchez interfaced a Disklavier with a digital drawing pad for real-time collaborative performance between a pianist and sketch artist.[2] Melodic lines performed by the pianist would generate graphic gestures on the drawing pad, and gestures drawn by the artist would reciprocally perform melodic gestures on the piano. Andrew McPherson's Magnetic Resonator Piano permits the performer to sustain strings indefinitely, crescendo from silence (bypassing hammer actuation), achieve harmonic tones, modulate timbre, and bend pitch, all fully acoustically and through gestures idiomatic to traditional piano technique.[3]

2 Jaroslaw Kapuscinski and Javier Sanchez. "Counterlines: Studies in Interfacing Graphic and Melodic Lines." *Proceedings of the International Computer Music Conference (*Montreal, Canada, August 2009). Michigan: Michigan Publishing 2009.

3 A. McPherson and Y. Kim. "Augmenting the acoustic piano with electromagnetic string actuation and continuous key position sensing." *Proceedings of the 2010 International Conference on New Interfaces for Musical Expression* (Sydney, Australia, 2010). Also: A. McPherson. "The magnetic resonator piano: electronic augmentation of an acoustic musical instrument." *Journal of New Music Research* 39/3 (2010): 189–202.

Trendsetting Organs

Throughout the first decade of the 21st century, several organ builders began integrating hyper-acoustic technology into new instruments. In addition to the extraordinary mixtures, reeds and spectral percussion on the late Peter Bares' landmark 2004 organ at St Peter's "Kunststation" in Cologne, the instrument features on-the-fly wind pressure adjustment for "denaturing" the tone and MIDI in/out interfacing.[4] Resident organist Dominik Susteck has invited composers to perform the organ directly from a computer, much in the manner of the Disklavier compositions just discussed, but multiplied by the vast tonal resources of Bares' unique organ.

Other instruments in more traditional styles have in recent years also been equipped with MIDI in/out interfacing allowing similar computer-driven performance, including the Fokker Organ in Amsterdam, with its series of "Pimp My Organ" concerts.

Modulorgue

The Modulorgue developed by Daniel Birouste and Mickaël Fourcade, first installed in Aspiran France in 2007, features digital step valves housed in a unit chest to realize what they call "Individual Pipe Control" (IPC).[5] Using an interface at the console the organist is able to set the depth of valve motion of individual ranks and designate the key velocity thresholds at which the valves in these ranks are triggered, permitting percussive pipe speech effects and the ability to solo out a melody within a contrapuntal texture on only one manual. Their Individual Pipe Control model can also be used to create unheard-of mutations or mixture combinations, or, through MIDI interfacing with a computer, can be programmed to perform special effects such as flutter-tongue or computer-driven or enhanced performance. Fourcade has also invented a device called the "Stido" to allow persons whose physical disabilities prohibit them from playing traditional acoustic musical instruments to play a MIDI interfacing pipe organ using means

4 Gassmann, Boll, and Danch, eds. *Werkzeuge der Stille*; Michael Gassmann, ed., *Werkzeuge der Stille II: Die neuen Orgeln in Sankt Peter zu Köln.* Cologne: Fries Printmedien, 2007.

5 http://www.modulorgue.com/technologie.html.

tailored to their individual range of motion.[6] Fourcade has developed at least sixteen capture devices, measuring input through motion of the limbs and head, or air expelled from the lungs. The Stido allows players to have control over certain parameters of preprogrammed pieces, but could also enable composition and performance using, for example, Hyperscore software, much like Tod Machover's famous TED demonstration with Dan Ellsey, but performed fully acoustically.[7]

Piteå

The most recent organ to be completed with extensive hyper-acoustic capabilities is of course Gerald Woehl's instrument in the Studio Acusticum in Piteå, Sweden. This fully mechanic organ encompassing several stylistic identities features a redundant, proportional electric stop and key action which when complete could potentially permit console control over pallet depth and windchest pressure, as well as nearly unlimited control over and enhancement of the organ action through external computer interfacing.

The Woehl organ marks the beginning of a significant step in the development of Hyperorgan design: the divorcing of mediation technology from organ stylistic identity. I contend that this is no less significant than the divorcing of sound production from pitch selection in the Hydraulis two millennia earlier. No longer must an organ's mediation technology (i.e. the action and console interface) be bound to its tonal identity to avoid sacrificing historical authenticity. Hyperorgan technology need not imply a "modern" organ identity, such as the Modulorgue and St Peter's, Cologne. Nor does it necessarily mark a return to the electrically mediated massive symphonic organs of the early 20th century. With current advances in digital valve and proportional, redundant electric action technology an organ such as the Utopa Baroque Organ at the Orgelpark can be constructed strictly according to historical techniques and tonal aesthetics, yet offer the capability for Hyperorgan mediation technology.

6 http://www.plaisancedugers.com/5_patrimoine/patrimoine_urbain/orgue/orgue.html.

7 http://www.ted.com/talks/tod_machover_and_dan_ellsey_play_new_music.

Hyperorgan mediation technology: new frontiers for performance

Let us next examine in more detail the potential new possibilities for performance using hyper-acoustic mediation technology, using the Utopa Baroque Organ at the Orgelpark as an example. Depending on the design of the chest and placement of electric valves, a performer could potentially utilize Hyperorgan technology even when playing the mechanical console. However, since most of the new performance possibilities will be accessible only from the digital-action modern console I will limit the present discussion to performance possibilities from the modern console and through non-keyboard interfacing.

Console

In addition to traditional stop selection, through tabs, knobs, or touch screens, as well as a modern combination action and memory, the modern console could incorporate some or all of the following features:

- Sostenuto: Active or reversible foot and/or finger triggers for sustain of cumulatively added or already depressed keys, a feature present on an increasing number of current organs. However, new triggering possibilities organic to the organ's traditional mediation apparatus could be explored, perhaps utilizing in-key sensors similar to Andrew McPherson's Touchkeys.[8]
- Looping: Active or reversible foot and/or finger triggers to loop a span of performance on a given manual or pedals. This would permit techniques such as those developed using live electronics by, for example, Pauline Oliveros or Fred Frith, or the multilayered textures of Terry Riley's electronic organ compositions.

8 Discussed in: A. McPherson and Y. Kim, "Design and applications of a multi-touch musical keyboard." *Proceedings of the 8th Sound and Music Computing Conference* (Padova, Italy, 2011). Internet: http://andrewmcpherson.org.

- Sperventil Actuators: A swell pedal and continuous controllers mounted near the manuals could be mapped to operate a Sperventil for wind and pitch modulation. In addition, kick-studs could actuate small bellows for real-time vibrato control (Peter Kraul has devised a fully mechanical means for this, but it could be done electrically).[9]
- Dynamic Mixtures: Integrated touchscreens can be used to build chromatic and variable mixtures. Performers can quickly select pitches for a custom mixture (as on the Modulorgue and St Peter's, Cologne), select a "generalized interval" mixture (David Lewin concept, intervals in defined pitch spaces), or draw with a finger a graphical representation of a variable composition mixture, the latter having been integrated into the new interface created by Sinua for the church of St Peter and Paul in Ratingen, Germany.
- Complete Touchscreen Remapping: An intuitive interface for quick, customizable, on-the-fly remapping of pitch and stop modalities.

A successful console will not be overcrowded with buttons and features, but will be intuitive for a competent non-specialist organist. I propose that such a console could utilize modular, use off-the-shelf technology and an open software architecture. Rather than integrate dedicated touchscreens with proprietary software, docks could house removable, commercially available touchscreens such as the iPad or Surface, with customizable Apps available to the performer for controlling the above functions. Performers would then have the opportunity to create and modify the organ's interface away from the instrument, saving valuable practice time and inviting more sophisticated modifications. This setup would have the added benefit of being easily upgradable as computer hardware and interfacing advances.

Non-keyboard interfacing

In addition to the traditional mechanical and modern electric consoles, a Hyperorgan organ must also be remotely playable through MIDI, Open

9 Eidenbenz, Glaus, and Kraul, eds. *Fresh Wind: The Research Organs of Bern University of the Arts*. Saarbrücken, Germany: PFAU-Verlag, 2006.

Sound Control, or other protocol, as with the Disklavier and Hyperorgans described earlier. This would permit even more enhanced techniques for the solo performer at the console as well as computer-driven performance. It would also present exciting new possibilities for collaborative and non-organist live performance, including:

- Cross-instrument modulation with other live musicians, where performance decisions by other musicians affect the organ's pitch, stop or sperventil action.
- Multi-modal collaboration with dance or visual artists, as in the Disklavier and drawing pad example discussed above, or utilizing video or motion sensors to manipulate the organ. Depending on the type of digital valves utilized in the instrument, a dancer in a haptic suit could play the organ and actually "feel" the wind resistance in the pallet as she moves her body.
- Live DJ remixing. One could interface the organ with a digital DJ controller to create a live, fully acoustic remix of standard organ repertoire.
- Performance over the internet could permit masterclasses and intercontinental collaborations.
- Audience participation through smart phone Apps.[10]
- Programs for Children utilizing a variety of mapping devices, such as those developed at the MIT Media Lab, to allow children to play the organ, solo or collaboratively, learning the value of acoustic music making.[11]
- Programs for the Mobility Impaired: Uniting Machover's and Fourcade's work described earlier, the organ could provide a vehicle for both therapy and artistic expression among individuals for whom acoustic music performance would otherwise be inaccessible.

10 A. van Troyer. *Hyperaudience: Designing Performance Systems for Audience Inclusion*. Master of Science Thesis (MIT Media Laboratory, 2012).

11 http://opera.media.mit.edu/toysymphony/vision.html.

Augmented Reality and the Ecology of Acoustic Performance

Now that we have explored the exciting potential for acoustic performance on this new instrument, I would like to conclude by discussing the cultural ramifications of hyper-acoustic music mediation technology. I argue that the ability of hyper-acoustic instruments to engage in technologically mediated creation of purely acoustic music is analogous to the wider movement in consumer electronics commonly called "Augmented Reality." You have probably all seen the demonstrations of Augmented Reality: hold your phone and its camera up to the real world and view an overlay of a restaurant's reviews, the location of a friend approaching around the corner, or an immediate translation of a sign in Mandarin. The Layar company here in the Netherlands has been a leading innovator in augmented-reality mobile phone technology, while Google's early head-mounted display, "Google Glass" integrated augmented reality more seamlessly into our everyday lives. It has become clear that augmented reality is our future in this increasingly hyper-connected, hyper-informed society. The noted mobile technology expert Tomi Ahonen has coined augmented reality as the "8th Mass Media" in the history of humanity.[12]

More than a nifty feature for imparting additional information about the real world around us, augmented reality offers us new affordances with which to interact with the world - not a virtual world, but the real world. In a sense it is the beginning of a new human ecology, created by humans in human-scale metrics for enhanced interaction with the real world. In the same way, hyper-acoustic music presents us with new ecologies for musical expression. However, hyper-acoustic instruments, and Hyperorgans in particular, must be carefully designed so as to present intuitive and corporeally relevant ecologies for performance. Rather than present the performer, be it an organist on the organ bench or artist interfacing remotely with the instrument, with a blank slate of unlimited capabilities, mediation technology must be thoughtfully designed, such as using interchangeable tablets and Apps as discussed earlier. In short, the organ's structural hardware should be designed to maximize the potential for diverse and

12 http://tedxtalks.ted.com/video/TEDxMongKok-Tomi-Ahonen-Augment.

constrained plug-and-play technological mediations. As such, a Hyperorgan such as the Utopa Baroque Organ could offer not only two musical ecologies, one mechanical and the other modern and electric, but could be a platform for the creation of an unlimited number of distinct, constrained and focused, technologically mediated acoustic music ecologies. Marc Leman offers a list of four qualities to strive for when using mediating technology to create a corporeally meaningful musical ecosystem:

Multisensory feedback corresponding to action-relevant cues.
Any rich combination of aural, visual, or haptic feedback which connects the action upon the device with the resulting sound production. That is, the performer should sense an immediate feeling of playing an instrument, as opposed to simply triggering disembodied programming scripts which result in sound being initiated at some indeterminate time.

Gestalt-based relationships between sound structures.
The performer should sense some correlational and causal relationship between the actions on the instrument and the resulting sonic timbres and textures. A simple example is the connection between the labeled stop knobs and timbres of the pipe organ. Early synthesizers lacked such gestalt relationships, leading to an inherent aleatoric quality which some musicians found disorienting.[13]

Ontologically relevant relationships between physical and musical gestures.
The physical gestures of the performer should map upon the resulting music gestures in some meaningful manner, or such mappings should at least be compellingly importable by the performer. For example, the tension and release felt in the rising and falling line in the opening bars of Ein Heldenleben is compelling because it perfectly maps the effort it takes for the horn players to play the passage. The effect would be lost on both performer and listener if the passage was simply plunked out on the dense grid of buttons on an electronic monome.

13 See note 1: Pinch and Trocco, 120.

Constraints relevant to cultural conventions.
Musical meaning is to a large part perceived through the filter of cultural convention. Musical instruments are similarly designed with such conventions in mind. One need not built a blank slate, an instrument equally at home in every musical style. Design within the parameters of specific conventions and styles may lead, paradoxically, to a musical ecology with richer potential for artistic creativity.[14]

Conclusion

In conclusion, through the divorcing of mediation technology from stylistic identity, the Hyperorgan restores meaning to the organ's original title: "Organon," the device. With the cultural technological shift toward augmented reality, the organ, through hyper-acoustic mediation technology, is poised to regain its position as the musical instrument par excellence, a center for social and artistic music making. Exciting projects such as the Utopa Baroque Organ at Orgelpark take us one step further along this path. Through careful attention to modular, variable digital design, such an organ can maximize the potential for the creation of an unlimited number of focused, corporeally-relevant acoustic music ecologies for performance. Finally, let us use this project to look even further afield into the future of hyper-acoustic technology. There are hundreds of pipe organs sitting in concert halls, university auditoriums, and other public gathering places around the world. Imagine turning all of these into fully interactive, networked Hyperorgans. Let the Utopa Baroque Organ and its handful of peers be the first step toward a global network of Hyperorgans engaging and enriching the lives of expert performers and composers, amateur musicians and lay citizens, children and the mobility impaired alike through music, both old and new - becoming immersed in new acoustic music ecologies.

14 Marc Leman. *Embodied Music Cognition and Mediation Technology.* Cambridge, Massachusetts: MIT Press, 2008. 166–168.

Abstract

Since its invention in the third century BCE), the organ remained the only instrument to use technological mediation to separate sound creation from pitch selection. Since the 1980s, some composers and instrument designers have sought to blend computer hardware, software, or live-electronic processing directly into acoustic instrument design. In the realm of the organ, the Fokker Organ (Amsterdam) and the Organ at the Kunstation in Cologne, were trendsetters; followed, in the early 21st century, by, for example, the French Modulorgue (developed by Daniel Birouste and Mickaël Fourcade), and the Woehl Organ at Piteå, Sweden. The Utopa Baroque Organ represents the next step: it is constructed strictly according to historical techniques and tonal aesthetics, yet offers Hyperorgan mediation technology, including Non-keyboard interfacing. The ability of hyper-acoustic instruments to engage in technologically mediated creation of purely acoustic music is analogous to the wider movement in consumer electronics commonly called "Augmented Reality." Let the Utopa Baroque Organ and its handful of peers be the first step toward a global network of Hyperorgans engaging and enriching the lives of expert performers and composers, amateur musicians and lay citizens, children and the mobility impaired alike through music, both old and new - becoming immersed in new acoustic music ecologies.

Randall Harlow

Concert organist and research scholar Randall Harlow has long dodged conventional expectations. A specialist in contemporary music, Harlow was the first organist to be awarded a New Music USA Project, in support of his upcoming debut recording, featuring more than twenty world premiere recordings of works by major American composers, from Samuel Adler to John Zorn. As a scholar Randall Harlow's interests range from empirical performance-cognition research, with a focus on gesture and ecological theories, to hyper-acoustic instruments and performance technology. In 2015 he was awarded a Diesterweg Fellowship and served as a guest professor at the University of Siegen, Germany, researching hyperorgan technology in theory and practice. He was a keynote speaker at the 2015 Orgelpark symposium in Amsterdam, and has presented at conferences at Cornell, Harvard, and Oxford Universities, Göteborg International Organ Academy in Sweden (GOArt), the Westfield Center, and Eastman Rochester Organ Initiative Festival (EROI). His organ teachers have included Hans Davidsson, Timothy Albrecht and Christopher Young, and William Porter in improvisation. Randall Harlow is currently Assistant Professor of Organ and Music Theory at the University of Northern Iowa.

XVI

Peter Williams - Bach and the Organ

The heading of Bach's so-called *Obituary* is "Der im Orgelspielen Weltberühmte HochEdle Herr JSB" ("The Hon. JSB B[ach], worldfamous in organ-playing") and only then does it list his positions as "Hof-compositeur and Musikdirector" ("Composer to the Court [in Dresden] and Director of Music [in Leipzig]").[1] There is no mention here of his being cantor. In eye-witness reports it was as an organist (or in Potsdam, a pianist) that he had featured - probably less often than Sweelinck in Amsterdam, but even allowing for exaggeration, to have been called world-famous in organ-playing must indicate more public appearances than we know about and in a greater number of places than was usual for most city organists and cantors of the time. Even then, however, day by day he surely played the harpsichord or, *faute de mieux*, the clavichord at least as much as organ, and as we know, he never in his life presided regularly at a major instrument by a world-class builder.

The Obituary

I want to ask a few questions that begin to deconstruct certain kinds of evidence about Bach, such as how reliable Carl Philipp Emanuel's presentation of him in the *Obituary* is, what organs are relevant, how the music relates to them, and what unknowns we should not be papering-over. Better left for discussion on another occasion, perhaps, are not only the two new valuable editions of Bach's organ works,[2] but also such practical or

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1 "Obituary" is the usual English term used today, as "Nekrolog" is the usual German. However, Mizler's original term in 1754 was "Denkmahl" or "Memorial" (see *Bach-Dokumente* III, 92), which implies something less than a *curriculum vitae*.

2 See, for example, my review of the first four volumes by Breitkopf & Härtel and the first two

performance-related questions as: In what respects is the source reliable? What is the most suitable organ-type for Bach? What is the appropriate fingering or pedaling or registration or tempo? Is it ever right to change manuals in a fugue? Is it always wrong to change stops in a piece? Well, in the immortal words of a former US President, it all depends on what you mean by "is".
We can recognise, I think, that Emanuel Bach's agenda in placing his father within German tradition, specifically the German Protestant organtradition, led to a sidelining of major influences on his education and his life's work. Buxtehude, Pachelbel, Reincken, Bruhns, Böhm - worthy composers, no doubt, but only one element in a lifetime of accumulated musical experiences. Whether in his maturity he copied or even played their music is quite uncertain, and it was not from them that he learnt the greatest achievements of his organ music, three of which one might describe as

- creating sophisticated harmonic tension
- structuring sophisticated ritornello movements
- compiling sophisticated collectionplans

At least the second of these must have come from intimate knowledge of contemporary music from outside Germany, particularly Italian concertos. Most strikingly, Emanuel doesn't name the "old good Frenchmen" his father admired: not De Grigny, who would have been a revelation to any Thuringian organist of the time; not Louis Marchand, whose status made the abortive Dresden competition so significant, certainly to Bach himself; not Boyvin or Couperin or anyone else. (As for Rameau, Emanuel, in his own book, mentions him only to criticise him.) Nor does Emanuel acknowledge what must have been a life-changing experience for his father, a paradigm shift, you could say, for a man in his twenties – the moment he got to know Vivaldi's *L'estro armonico*.
There is a case to be made that ever since the *Obituary*, Bach biography has been skewered towards a provincial emphasis not wholly true to the composer.

by Wayne Leupold Editions in *The Organ Yearbook* 41 (2012): 183–212.

How useful it would be if Kirsten Beisswenger's book on Bach's library had a sequel called "What else does Bach's music suggest he was intimately acquainted with?"[3] What could have prompted, say, the astonishing Harpsichord Partita in B♭; or the big E minor Prelude for organ; or "Domine deus" in the Mass? Conversely, local music can often serve to underline his unique achievement: for instance, a glance at Daniel Vetter's book of *Chorales through the church year* (1713) only heightens one's sense of what it was that Bach accomplished in the *Orgelbüchlein* at about the same time.
Now the one foreign organist Emanuel did mention is Frescobaldi, and I have wondered why. Had his father been speaking about him in recent years, in the 1730s and 1740s, a period when he was often busy with, even possibly performing, Italian Renaissance vocal music? Is it a coincidence that, if *Clavierübung III* was conceived or begun soon after the 1735 publication of *Clavierübung II*, it would have been exactly at the centenary of Frescobaldi's *Fiori musicali*? The two books certainly have much in common. Not in Germany would Bach have found such a comparable volume-plan, and nor in France (and not often in Germany) would he have found such deft counterpoint. There are other possible allusions by Bach to the *Fiori* that need to be explored elsewhere,[4] and they all suggest how responsive he was in his maturity to organ-music originating far from Hamburg or Leipzig, even unto *The art of fugue* itself.
Emanuel's report that his father visited Hamburg "from time to time" as a teenager says nothing about what he learnt of the city's opera and concerts, or whether he returned home simply because of being short of money. Very soon Handel was there in the same city, precisely for the opera.
But such things were not what the *Obituary* spoke about. Yet whatever his love of organs far and near, his first recorded job was as a court musician, a useful musical assistant, no doubt, and drawn perhaps as much to the violin and its music as his own father had been. When the famous "Moonlight"

3 Kirsten Beisswenger. *Johann Sebastian Bachs Notenbibliothek.* Kassel, 1992. Especially valuable in this book is the view it gives of a quite unprovincial sphere of knowledge.

4 Peter Williams. "Frescobaldi's Fiori musicali and Bach". Recercare 24/1 and 24/2 (2012): 95–108.

manuscript was confiscated by his brother, was Christoph trying to discourage him away from keyboard music? In the first cantata after appointment as Weimar Concertmeister (Palm Sunday, 1714), did Bach play the opening violin solo himself? When the *Clavierbüchlein WF Bach* begins with a scale and a G-clef headed "Violino", despite the usual soprano clef for keyboard music, was Friedemann too being encouraged as a violinist? It's a good guess that Emanuel's remark "no-one knew the art of registration so well as he" (startling other organists with his stop selection) refers at least in part to Bach's knowledge of the French repertory and its stop-combinations, especially the *Grand jeu*, the en taille textures and the various duos. The Preface to Jacques Boyvin's *Premier livre*, which he probably knew, gave any young organist a mouth-watering description of these French colours, and surely the composer of "Allein Gott" (BWV 663a) knew about the tierce en taille even if he did not adopt all its features.

Is it also possible that Emanuel praised his father's "art of registration" for a more prosaic reason: because organists purchasing *Clavierübung III* had grumbled that it had no registrations, unlike Kauffmann's set of chorales recently published in Leipzig that did and was very instructive in this regard? That so little organ music was printed in Germany explains the idiosyncrasy of all three of Bach's published volumes: they had no real precedents, and one wonders whether he planned to publish his other collections - the six sonatas, the so-called "Leipzig" chorales, the Advent & Christmas fughettas, even the *Orgelbüchlein* (the only one now to have a publishable title page). Why he continued to compose organ music at all is a question with several possible answers: for recitals; for teaching; for practice; for publication; to do his duty by his Maker; to satisfy the creative urge; and, last but not least, because he was a keen organist. A yet bigger question is why his output generally was so much more original and complex than it need have been. I suggest two possible reasons for this: he understood the notion of supererogation (believers do more than is obligatory for their salvation) and he knew intimately the parable of the talents (believers repay with interest the talents given them by their Maker). Both of these clearly have religious impetus, suggesting that Bach's frequent imprecations - "Jesu juva! Soli deo Gloria!" - were no empty formulas. He meant it.

Knowledge of organs

The *Obituary* stresses Bach's practical skills, such as planning and examining organs, understanding acoustics, arranging orchestras, inventing new instruments, reading complicated scores, directing choirs, tuning and quilling harpsichords. (I don't know whether Mozart could releather a piano hammer, or if he did, whether he would have been praised for it.) One imagines that at Arnstadt, the teenage Bach presented himself as one already familiar with the great and well-known organs of Hamburg and Lüneburg. Hamburg after all was so respected that Andreas Werckmeister himself had Schnitger write a commendation for his book, the Orgel-Probe.[5] And surely, a little later, at Mühlhausen, Bach, like any young organist, took credit for having visited Lübeck and played its organs? It's hard to suppose Johann Sebastian Bach ever being modest about his CV.

The Mühlhausen rebuilding scheme is usually taken as a sign of Bach's expertise, and yet it and its stoplist are very much within Thuringian traditions as summarised by Werckmeister. Bach requires adequate winding for the plenum - but who would not? Does specifying the percentage of tin in certain pipework really reflect expert knowledge or merely follow convention? More to the point, I think, is that much of what Bach does say expresses musical priorities rather than technical knowledge: it is for the music he wants a 16-foot Fagotto, presumably for continuo work; a Viola da gamba and Nasat (even a row of bells) for colourful chorales; an 8-foot Schalmei in the case-front for trumpet solos; a Tierce to make a Sesquialtera (solo stop for melodies); and, especially for accompanying recitatives, a soft 8-foot Gedackt. He doesn't say how a new Brustwerk would affect the playing-action - was he less anxious about such things than we are? The Mühlhausen organ already had a Chair Organ before its rebuild, and Bach says that it may remain - a point of interest, since Werckmeister had said that organists no longer put up willingly with Chair Organs, as indeed we see in their absence from the big contemporary organs in Eisenach, Halle

5 Andreas Werckmeister. *Orgel-Probe, oder kurtze Beschreibung wie und welcher Gestalt man die Orgel- Wercke von den Orgelmachern annehmen, probiren, untersuchen*. Frankfurt & Leipzig, 1681 / revised edition 1698.

and Freiberg. Organ building was curiously regional, and it is striking that when planning their instruments, neither Bach in Mühlhausen nor Zachow in Halle pressed for the array of manual reeds Buxtehude had had at his disposal in Lübeck. Written largely on the basis of Werckmeister too was Kuhnau's report of the new Halle organ, co-signed by Bach. Again, some requirements are obvious, such as there must be no ciphering or wavering (well, of course not!); and some technicalities are a little vague (what was meant by a passable temperament? That it was merely suitable or that it allowed one to pass between keys?). When the report refers to the still missing accessories including Tremulants, one need not assume Bach cared for such things himself, but of course maybe he did, like the specially made row of brass bells in Weimar.

The examination of the Leipzig University Church organ in December 1717, a commission that Bach surely owed to Johannes Kuhnau, his predecessor at St Thomas's, gives a better insight into his expertise. Nevertheless, how practical at that stage his advice was, is doubtful - for instance, on reducing the key-weight and key-fall. It sounds as if he was accompanied during the examination by the builder - a mistake, in my opinion, for he seems to have accepted Scheibe's excuses uncritically. Or - and this is a distinct possibility, I think - Bach was by nature more on the side of craftsmen than of university officials, supporting them in various ways, as he later did the builder Zacharias Hildebrandt in Leipzig. Incidentally, the Paulinerkirche's old-fashioned array of cantus firmus stops suggests that the organists of Germany's largest university continued to observe older, conventional musical genres.

There are clearer signs of a professional's grasp of organ technicalities in a report of 1724 by Bach's distant relative Johann Gottfried Walther, for a modest organ in Buttstädt.[6] In it, Walther itemises bellows, wind pressure, chests, action, tuning damage, and malfunctioning pipes; he obviously inspected every pipe. Only occasionally in the Bach documents is there any detail comparable to Walther's, though it's possible, of course, that in

6 Hans Schmidt-Mannheim. "Die Peter-Heroldt-Orgel in Buttstädt". Acta organologica 28 (2004): 155–188.

private Bach did reveal all kinds of expertise. But we can take this only on trust. The Naumburg organist's complaint that he and Silbermann had not done a thorough job in their examination of the organ in 1746, is hardly to their credit - nor perhaps is it to Bach's that the small and old quire organ in St Thomas's was discarded in 1740, whatever the reason for this was. One would like to know the full story in both of these cases.

Kinds of organ appropriate for Bach

In my lifetime I have seen several claims for The Best Bach Organ, often made with a kind of pontifical confidence: in the 1950s, it was Cappel, Steinkirchen, Alkmaar; then Haarlem, Hamburg Jakobi before and after restoration; then Lahm in Itzgrund, Dresden Hofkirche, Naumburg, Altenburg, Waltershausen, Grauhof, and so on. Each German province at the time had its own traditions in organ design, and for each there could be an "ideal".

Even the homely instruments surviving today around Erfurt illustrate the background to Bach's taste for string-tone stops and heavy basses, whether or not he played them on later visits to Erfurt, such as Adlung mentioned.[7] Now none of the great organs I've just mentioned is my favourite: a subjective view, of course, but it suggests an important factor I don't often see raised: different tastes in beautiful sound. Considering his sensitivity to tone-colour, his appreciation of good voices and good instruments, and especially a certain musical cosmopolitanism, it's hard to believe that for Bach, organ tone itself was secondary. Admiration for reeds and bigger bass stops need not mean that in his maturity he was especially drawn to the Hamburg and Lübeck organs, whatever today's usual assumptions. One clue to his mature tastes is that whatever prestige Lübeck and Hamburg have amongst organists and authors today, especially in Germany and the USA, Bach did not continue to produce the kinds of music for which these organs were made – long sectional chorale-fantasias, hymn-variations, sectional praeludia, passacaglias and so on. One could rather think that both

7 On the Naumburg connection, see *Bach-Dokumente* II, 429–431; on the Erfurt connection, see, for example, *Bach-Dokumente* III, 185–186.

his intimate chorales and his mature ritornello movements are more at home on the single-case organ and what I might call a "more southerly warmth".[8] A second organ-type to consider is Gottfried Silbermann's. It is certainly curious that Bach seems never to have been invited to test a Silbermann organ, or to write in its honour as several pupils including Friedemann Bach did, often in celebratory verse, the so-called carmina. Curious, especially considering that both the builder and the composer came to hold royal titles to the same court of Saxony. Nevertheless, whatever their personal relationship, and despite certain practical problems for the player, it seems to me that Bach's cosmopolitanism is best served by Silbermann's cosmopolitanism.

I should declare an interest here. When I began fieldwork in the late 1950s for the book *The European organ*,[9] I just didn't find Steinkirchen or Marienhafe in the North as winsome as, say, Ottobeuren or Bologna or Saint-Maximin-en-Var in the South, even given their then current condition.

But when I first played and listened to the Freiberg Silbermanns, I was bowled over and thought, "Yes, the best music deserves the best organ". Just Prinzipal 8′ + Oktav 4′ makes a perfect semi-chorus for, say, the Vivaldi concertos; the various 8-foot stops are ideal for the Sonatas; and the French colours are near-perfect, with an especially fine *Grand jeu* (requiring four stops only) at the Petrikirche, Freiberg. You can see the logic for me: Frescobaldi at Bologna, Louis Marchand at Saint-Maximin, Bach at Freiberg, even if in each case direct links between composer and organ are simply not there.

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8 Perhaps a focus on Northwest Germany in the second half of the 20th century came about in part from historical accident: in 1945 Marshall Zhukov came in from the East, General Patton from the West, but for understanding Bach, it would have been more useful the other way around. The difficulty in getting visas for the Russian zone including Bach's Saxony and Thuringia meant relatively little attention given to it by West German organists and even organ builders for many decades.

9 *The European organ / 1450–1850*. London, 1966. On the Silbermann carmina, to which Friedemann but not Sebastian Bach contributed, see Christian Ahrens & Klaus Langrock. *Gepriеßner Silbermann! Gereimtes und Ungereimtes zur Einweihung von Orgeln Gottfried Silbermanns* Altenburg, 2003.

As a third organ type of interest, I'd like to mention one that has been more or less totally neglected: the Bohemian. On his visits to Carlsbad (in present-day Czech Republic), did Bach show no interest in the local Habsburg organs? - elegant, handsome, distinctive, well-made, fulltoned with colourful flue stops, plus a pedal Trumpet for the chant. These organs would be perfectly suitable for Frescobaldi and his imitators, not to mention the Weimar Chorales, the *Magnificat* Fugue, and the Pentecostal *Fantasia*.

Some musical observations

Of course, connections between particular works and particular occasions are elusive. An inauguration, as at Kassel, might bring forth a new or a specially revised work. An audition, as at Hamburg, might include improvisation on a favourite hymn.[10] In Leipzig, recitals could have followed the services, as Handel's did at the same period in St Paul's, London. It's a reasonable guess that *Clavierübung III* idealises a recital programme, but it seems clear to me (though I know not to others) that the lesser choralesettings are harpsichord music and, like the *Four duets*, certainly not organ music in the sense that the E♭ Fugue is. If the duets from *Clavierübung III* are organ-music, why are the fugues from *The art of fugue* not? For Bach, the big preludes and fugues must have been a self-given creative challenge. How original each one is! What amazing dynamic drive they have! Compare them with attempts of the time by Vincent Lübeck or Walther or even Krebs: well, of course there is no comparison, either in strategy or tactics. They stood out in their period even more than they might today. At least because they are so very different from each other, we cannot begin to imagine what we have missed when potential works never got written down. What other creative avenues never got explored? I've wondered whether this loss was what motivated somebody to transcribe, compile and publish the late Schübler Chorales - as a compensation? The chance existence of major works in this or that version (i.e. as they have come down to us) makes it

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10 By the way, I think the reason why "By the waters of Babylon" was a popular piece for organists' auditions was that it is the only wellknown chorale-text actually to mention the organ. Unfortunately, that's due to a mistranslation of Psalm 137!

hard to grasp the chronology. Take the copy of the G major Prelude and Fugue apparently made for Friedemann's audition in Dresden in 1733: had his father previously played the piece himself in the Sophienkirche, and if so from another copy differing in what respects? At the Sophienkirche could be found the first of the new, top-class organs in Dresden, and one understands why Bach wanted to go over and play it.

Also, it becomes clear why the earlier Marchand competition had had to be on harpsichord, not because Marchand couldn't handle German pedals but because there was no fine organ available.[11] That he makes supererogatory efforts with such music could be literally true: they are works beyond the call of duty, made or revised for special occasions - special enough to inspire the composer to new heights. For instance, the E minor could well have saluted Dresden, with a massive Prelude like a wonderfully stylised polonaise and a fugue in a massive Aria form; or the B minor for the late Electress, which as well as its elegiac elements has a startling series of final pedal entries in the Fugue, likewise unique. Also specifically appropriate to Dresden are the Sonatas, an unusual term for organ music and deliberately alluding to Italian music. The Sonatas suited both Friedemann's Silbermann organ in the Sophienkirche and chamber organs of the type such wealthy patrons as Anna Amalia had in Berlin, broadly similar to Silbermann's and still playable.

On what I take to be the *Orgelbüchlein*'s clear connection with the jobapplication in Halle in 1713-14, there has been some misunderstanding: in suggesting that the book was begun for the Halle application I was thinking of a motive for starting the compilation itself, not necessarily for composing every chorale.[12] The Halle Liebfrauenkirche (well known to Handel) was about to have a massive new west-end organ, and the Pietist clergy - apprehensive, as clergy are, of what an organist might do with it - specified

11 Incidentally, I've wondered whether the newspaper report of Bach's recital(s) in Dresden in September 1725 was solicited by Bach himself. On works that never got written down, see the Obituary's remark in *Bach-Dokumente* III, 88. On Dresden recitals and verbal similarities in the newspaper reports, see *Bach-Dokumente* II, 150 and 214.

12 For example, in *The organ music of J.S. Bach*, second edition (Cambridge, 2003). 233–234.

in writing what they required.[13] This fits in wonderfully with the modest dimensions and *Affekte* of the *Orgelbüchlein*, and it may also say something about why Bach left he project incomplete: because he did not take the job. I won't go into details now but there is an instructive coincidence seldom if ever noticed: the former pupil famously claiming that Bach taught him to express the *Affekt* of the words - a claim often cited in the literature today - said this when he was applying for a job in the same church, 30 years later.[14] The chance reference in a copy of the "Dorian" *Toccata* (BWV 532) to the Kassel inauguration in 1732 is an invaluable hint of how the major works, new or old, must sometimes - even normally, perhaps - have been used: for such public events. At Kassel, dialoguing of the kind found in the *Toccata* was particularly appropriate, for unusually, both Hauptwerk and Rückpositiv had an 8-foot Prinzipal. (Organists note: that is all you need for effective and stereophonic dialoguing!) This raises an interesting question: did Bach take steps to learn about such details of the organs beforehand and search his library for a suitable piece? Notice that the *Fugue* too can be easily scored for two manuals whether or not it was so played on this same occasion, or indeed played at all. (Was it?) There's no hint of two manuals in the Fugue copies, but it is unusually easy to change manuals between thematic entries and canonic episodes, with their extraordinary catalogue of stretti. What results is a fascinatingly different kind of dialogue - and one that explains those unique chopping chords at the end of the Fugue, i.e. they are for two manuals.

I personally have a relaxed view about changing manuals in fugues because the composer himself showed us how to do it: I mean in the harpsichord fugue of *Clavierübung II* (the B minor/C minor Ouverture). Some changes of manual he makes there might even not have occurred to us, and it is a great pity that organists so seldom become (or seem to have become) deeply familiar with this of all harpsichord suites.

Suggestions about the Prelude and Fugue in E♭ are that it salutes the Trinity; that it reacts to Mattheson's remark about organists being unfamiliar

13 *Bach-Dokumente* II, 50–51.

14 *Bach-Dokumente* II, 423. This was for the job that went to Friedemann Bach in 1746.

with the key; that it is connected with the visit to Altenburg in 1739; that it illustrates the *Golden Section* with bar numbers in multiples of three; and that the whole volume is a response to Scheibe's criticisms of the composer.[15]
There's another possibility: virtually on the very day that *Clavierübung III* seems to have been published, at Michaelmas 1739, a spectacular new royal Protestant church was inaugurated in Dresden, a personal gift of the king to whom Bach was Hofcompositeur and whose birthday he was about to celebrate with the Leipzig Collegium, which he had recently taken up again. The church's unusual dedication is to the Three Kings (reminding one of all the threes that have been found in *Clavierübung III*), and its 30-stop organ was specially renovated on the occasion. Dresden: where Bach's beloved son was organist, where he doubtless would have liked an appointment himself, and where he had visited just as the church and its organ in Dresden-Neustadt were taking shape. If he was to salute the king's new Court church with the "Great Catholic Mass", as has been suggested, did he now salute the king's new Garrison church with Orthodox Lutheran chorales? Had he even delayed publication to commemorate the occasion? Now even if the Dresden archives were exhaustively researched, which they are not yet, seldom can we tie any work to a place or an occasion. The G minor *Fantasia* sounds like an exhibition piece showing off two manuals, not to mention remote keys; but where? Was "Ein feste Burg" responding to the three manuals at Mühlhausen? If the *Toccata* in F was composed for Weissenfels and its long pedalboard, it seems odd that the copy nearest in date to a supposed visit doesn't use the famous top F. (By the way, am I alone in finding the second pedal solo of the Toccata in F less convincing harmonically than the first? Was it, by any chance, second thoughts?) Perhaps the 9/8 *Praeludium* in C major had something to do with the new Naumburg organ in 1746? – but that's only a guess. Sometimes I feel we know only enough to be more and more puzzled. Who would have thought

15 On Mattheson's possible influences, see Gregory G. Butler. "Der vollkommene Capellmeister as a stimulus to J.S. Bach's late fugal writing". In G.H. Buelow & H.J. Marx, eds., *New Matttheson studies* (Cambridge, 1983): 293-305. On Scheibe, see *Bach-Dokumente* II, especially286–87.

that one popular C major *Prelude and Fugue* would turn up quite soon in another country (England, of all places), in another key, and in another form? That the various C minor Preludes and Fantasias had or were to have various fugues attached to them does seem to suggest that different occasions led to different formats. A good development of our time, I think, has been that organists are content to play some of the big organ preludes without the fugues attached to them in the 19th-century editions: for one thing, this freedom helps to underline those pairings that are authoritative, in particular the mature Praeludia in E minor and B minor. Prelude-and-fugue couplings are problematic in various ways.
Perhaps this is a moment to point out that the *Well-tempered clavier* itself does not say (as the Neue Bach-Ausgabe does) "Prelude & Fugue in C major", "Prelude & Fugue in C minor", and so on. Many of the preludes first appeared without any fugue. Even in Books 1 and 2 of the *Well-tempered clavier* there is no compulsion to play the Fugue immediately after the Prelude: the idea of separating an apparent pair of movements has clear precedent in the only pair that Bach himself ever published (i.e. the organ *Prelude and Fugue* in E♭). When a fugue does follow straight on a prelude, as in *Clavierübung I, II* and *IV*, these are short frenchified overtures, not fully fledged ritornello preludes.
Another kind of speculation concerns keys - whether, for instance, the *Prelude and Fugue* in E♭ started life in D major. This is a key more comfortable to play, more conventional for frenchified ouvertures, and more likely for tonal reasons (the passage in E♭ minor is then in D minor). That there 's no extant evidence whatever for D major is not quite as compelling as it seems, since there's no evidence for the E♭ version either, except the isolated print. (Copies are post-publication.) One argument for an E♭ ouverture is that it was not so exceptional - Couperin had done it recently, and Bach's three subjects could certainly be registered in a French way: grand jeu, petit plein jeu, and plein jeu. (A registration of this kind is also plausible for the G major Pièce d'orgue - at least, in its three-section version.) In that case, however, being in E♭ might imply that it was specially transposed, and not the only piece to have been so.
On another question about keys: the transposed cantata parts raise another interesting possibility. In the early 17th century Praetorius had mentioned

organs having a Gedackt or Stop Diapason at a lower pitch, and there are many instances known in the following century (the Kammergedackt). There is no evidence that this was the case at the Thomaskirche - assuming, that is, that the organo part in a bundle of cantata parts really was literally or exclusively for this organ. (Was it?) But the tuning is a problem for which there seem several solutions: the big west-end organ was so tuned as to allow remote keys like D♭ in Cantata 140; or it was discreetly played; or people put up with it; or a Positive nearby was tuned appropriately. Another possibility is that a single Chair Organ Gedackt in the main organ was tuned in equal temperament, as may also have been the case in the Leipzig New Church. There's no record of this, but it would not be a major problem and would not need itemising in any written contract.

Agricola's remarks

That registrations in German organ music are so rare is puzzling until one realises that registration rules occur not where there was great variety between organs, as in Germany or Spain, but where there was very little, as in France, England or Italy. One of the complaints against Silbermann's organs was their "all too-uniform stoplists". Now, did J.F. Agricola hear Bach say this, as if such uniformity was un-German, in fact French (or Alsatian) - which it is? If Agricola heard Bach still expressing admiration for the Hamburg Catharinenkirche, it must have been around 1740, a little before Sorge reported that Bach declared Silbermann's temperament unsuitable "for today's practice". So there 's some inconsistency here - on one hand, he admired the old Hamburg organs; on the other, he wanted a more modern tuning than he could have found there?[16] Perhaps this question of varying preferences for types of organ and what kind of music is written for them would be a good point at which to start for someone plotting step by step (assuming that's possible) how Bach's practical tastes changed over 55 years. They surely did, not only in organs but in the various aspects of performance

16 For Agricola's various remarks, see *Bach-Dokumente* III, 88 and 191. On Silbermann's uniformity, see Agricola writing (?) in Jakob Adlung. *Musica mechanica organoedi*. Erfurt, 1768, I/212. For Sorge, see *Bach-Dokumente* II, 450.

- fingering, for example, or slurring. Too often, I think we claim something - about ornamentation, say, or pedal technique - as if it remained static, when it can not have done.

Agricola also said that Bach regretted never having "a really large and fine organ available for his constant use". Did he hear Bach complain that the Leipzig authorities wouldn't provide anything for their churches to match the organs of Dresden? Is this one of several reasons that Leipzig is barely mentioned in the *Obituary*? One of several frustrations? Perhaps Bach knew that Silbermann's new organ planned for the Dresden courtchurch was to cost two hundred times (!) what was spent on patching up the organ in St Thomas's. An expensive Silbermann organ was also what one of Bach's pupils, Ludwig Krebs, seems to have pressed for when taking up his post in Zwickau in 1737, again something quite likely to have been known to Bach.[17] Another possibility is that Agricola had heard him looking back ruefully on positions he never took up, as at Halle in 1713 and Hamburg in 1722 - or even on positions he would have taken up given a chance, in Dresden or Danzig. All four cities (three of which he knew intimately) had famous, major instruments.

In studying any historic figure, there are questions to be asked about the nature of evidence. People often say - when they discuss whether to sing one to a part, or whether to change manuals in a fugue - "Evidence shows that..". But, no, it does not. Evidence suggests often what one wants to believe. Evidence has an agenda which always needs studying, and I wish people endlessly arguing about Bach's choir size (for example) took this into account.

Of course, speculations have to start somewhere, and one would certainly like more evidence, however motivated, for many details in the biography. For example, when he reached the standard apprentice age of 15 and took himself off to Lüneburg, was Bach after an apprenticeship, possibly with Georg Böhm, only to be disappointed? No money, perhaps? Did this cause resentment, and was this why in effect Emanuel denied later that his father

17 Krebs's Zwickau project is covered in Werner Müller. *Gottfried Silbermann: Persönlichkeit und Werk*. Leipzig, 1982. 381–389.

was taught by Böhm? Then when he went to "hear" Buxtehude, was he looking for a job? I would like very much to know what the *Obituary* meant by the young Bach going "to hear" ("zu behorchen") Buxtehude: what exactly is Emanuel implying? Not that his father had lessons but, once again, taught himself chiefly by his own observations?[18] And a related question: did Bach in fact consciously reject the northern organ culture? After all, Handel did, and was soon off to Italy. Two early collections known to Bach and his brother, the Andreas Bach Buch and the Möller MS, suggest, to put it no stronger, that the brothers had very wide interests.

Another question: what did Bach know of the many organ monographs that were circulating at the time in Germany? Only here and there in Europe were organ monographs known - occasionally in Italy, for example. But for organists, they must have played a major part in their professional studies and even hobbies, and far exceeded publications of organ music itself. (This is a strange reversal of the situation for the French organist, who had so many engraved books of music available but little in the way of organ studies.) The appendix below lists those monographs that were circulating in Germany at the time and concerning organs associated in some way with Bach (Weissenfels, Görlitz, Rötha, Berlin Garnisonkirche, and three in Dresden).

What Bach knew can not be established, but one wonders whether he described the organ in Görlitz (so it was said on good authority)[19] as "a horse organ" not because he had played it himself but because he could guess that it had heavy action just from reading the booklet, as I think one could? And then, as the list shows, there were the many pamphlets on the famous Gröningen organ of the late 16th century, near Werckmeister's Halberstadt.

It seems to me that if Bach could have played Waltershausen *en route* to Kassel, as some have speculated, so he could have played Gröningen *en route* to Lübeck - or Kraslice *en route* to Carlsbad. On the other hand, I don't suppose he had much interest in a book on pure mathematics published in Leipzig in 1727, in which the ratios of organ pipe-lengths are precisely calculated - theoretical work of the kind that Lorenz Mizler, to Emanuel's (?) chagrin, said at the end of the *Obituary* that Bach did not care for.[20]

Now to mention Frescobaldi, Habsburg organs, Silbermann's *Carmina* and Boyvin's *Premier Livre*, is to suggest that focusing on a narrow background for Bach might divert us from what I have called his cosmopolitanism. This takes me to a possible, broader significance of the organ for him, how ever rooted it was in his earliest musical life. Now just as few medieval musicologists today seem aware of the crucial part played by the organ keyboard in western music and its evolving diatonicism, so few musicanalysts recognise the significance of Bach's organ music in the history of musical form. And yet - has there ever been a better example of combined genres than the great E minor's combination of fugue, ritornello and ABA? Or, is there an earlier example of a classical Sonata Form's Development Section than that in the C minor *Organ Sonata*? A clearer sense of controlled build-up in a single movement than the *Passacaglia*? More important even than form, perhaps, is the harmonic tension in the music. This is hard to define, but we can feel it in every bar of the *Orgelbüchlein* and *The art of fugue*. The F major *Toccata* is astonishing in its sense of direction, drive, key-plan, timing, phraseology and clever preparation of the final tonic, all on a huge scale in one movement, and punctuated by those dazzlingly new Interrupted Cadences. To my knowledge, there 's nothing at all comparable in pure instrumental music before - let us say Mozart's E♭ Symphony. There's an important point about Bach and the Organ here: as with the *Passacaglia*, what he has done in this *Toccata* is respond to a traditional genre, in this case the keyboard toccata, with a massive integrated structure which at the time only the organ could have realised. In no way, of course, do I question the equally

18 On Böhm, see *Bach-Dokumente* III, 288 and 290. On hearing Buxtehude, see *Bach-Dokumente* III, 82.

19 *Bach-Dokumente* II, 389.

20 The book on mathematics is Jacob Leupold. *Theatrum arithmetico-geometricum, das ist: Schau-Platz der Rechenund Mess-Kunst.* Leipzig, 1727. For Mizler's and Emanuel's remark, see *Bach-Dokumente* XXIII, 89 (Mizler) and 288 (Emanuel).

astonishing achievement of other solo works (the *Chromatic Fantasia* for harpsichord, the D minor *Chaconne* for Violin), but in a work like the F major *Toccata* I hear a distinct, passionate involvement in the organ, what medieval scribes called the "Instrument of Instruments".

Two questions

I leave you with two questions that speak for many of their kind. The first concerns authenticity - of course, the *soi-disant Toccata and Fugue* in D Minor (BWV 565). Now if you still consider this to be an early work of J.S. Bach, you need to explain its many exceptional though purely musical details. Here are two: it starts in open octaves and it ends with a minor plagal cadence. Now both, being without precedent, could just be explained as the work of a copyist or a transcriber. Other oddities are harder to explain, however, as when there is an unharmonised subject-entry in the key of the flattened leading-note minor. It is not the key here that is so odd - the E minor Fugue also has a subject-entry in the key of the flattened leading-note minor - but in its being unharmonised. Explain these and other oddities[21] in relation to fully authenticated music of Bach and I might believe it's not, say, the creation of a young, gifted musician, probably in Berlin, fascinated (as young organists often are) by the Diminished Seventh, and familiar (as Berlin organists became) with certain music of Bach.

And secondly, the speculation about numbers ("numerology") one comes across from time to time - quantities, symbols, gematria, bar-numbers and so on. In being sceptical about such things, I keep in mind a curiosity from a very different sphere - no less than the Old Testament's psalter. Now, as Psalm 46 is translated in the King James Bible of 1611, the 46th word from the beginning is "shake " and the 46th word from the end is "spear". In early 1611, Shakespeare was 46 years old, and he was born on 23 April, double which is 46. So what do you think? Chance or design?

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21 Though occasionally dismissed as a "pseudoproblem" ("Scheinproblem"), the work leaves many uncertainties, some outlined in my original article ("A Toccata and Fugue in D minor for organ by J.S. Bach?". *Early Music* 9 (1981): 330-337. and never, I feel, adequately answered.

This text is an edited version of the Keynote Addresses presented at the American Bach Society meeting at Eastman School of Music, University of Rochester, NY, in September 2012, and at the International Orgelpark Symposium, Amsterdam, in June 2014. It was published previously in Musical Times *(Spring 2014).*

Appendix

Books and booklets on organs familiar in the time and places of Bach's activities. Based on James L. Wallmann. "Reflections on 500 years of books on the organ: an essay and a checklist of titles, 1511-1855". The Organ Yearbook 40 (2011): 25–54.

- Anonymus. *Gründliche Beschreibung des kunstbaren Orgelwercks und grossen Fasses auff dem Hauß Grüningen.* Halberstadt: Andrea Kolwaldt, 1641. Other editions in 1643, 1646, 1650, 1652, 1662, 1683, 1695, 1700, 1705 [ed. A. Werckmeister], 1711.

- Johann Caspar Trost junior. *Ausführliche Beschreibung deß neuen Orgelwercks auf der Augustus-Burg zu Weissenfels.* Nürnberg: Wolfgang Moritz Endters & Johann Andreæ Endters Sel. Erben, 1677).

- Andreas Werckmeister. *Orgel-Probe, oder kurtze Beschreibung wie und welcher gestalt man die Orgel-Wercke von den Orgelmachern annehmen, probiren, untersuchen und den Kirchen liefern könne und solle*. Franckfurth & Leipzig: Theodorus Phil. Calvisius, 1681. Later edition 1698 etc.

- Johann Philipp Bendeler. *Organopoeia, oder: Unterweisung, wie eine Orgel nach ihren Hauptstücken, als Mensuriren, Abtheilung derer Laden, Zufall des Windes, Stimmung oder Temperatur &c, aus wahren mathematischen Gründen zu erbauen*. Frankfurt (Main) & Leipzig: Theodori Phil. Calvisii, [1690]). Later edition 1739.

- Tobias Kasske. *Kurtze Beschreibung der neuen Orgel, bey der Ober Kirche zur Franckfurt an der Oder, welche Anno 1695 am IIX. Sonntage nach Trinitatis [..] eingeweihet worden.* Franckfurt an der Oder: T. Schwartz, 1695; second edition 1695 or later.

- Christian Ludwig Boxberg. *Ausführliche Beschreibung der grossen neuen Orgel in der Kirchen zu St. Petri und Pauli allhie zu Görlitz.* Görlitz: Johann Gottlob Laurentio, 1704.

- [Johann Ulrich König.] *Beschreibung der neu-erbauten vortrefflichen Orgel in der Sophien- Kirche zu Dreßden, M.DCC.XX.* [Dresden:] Joh. Conrad Stößel, [1720].

- [Johann Christian Langbein.] *Kurtze Beschreibung der schönen Orgel, welche durch rühmliche Sorgfalt der Hoch-Freyherrl. Friesischen Herrschafft zu Rötha, in der St. Georgen-Kirche daselbst Anno MDCCXXI. gantz neu erbauet worden.* Leipzig: Gottfried Rothen, [1721].

- Johann Jakob Schübler. *Sechs nach dem wahren Ursprung eingerichtete neu-inventirte Hauß-und Kirchen-Orgeln.* [Nürnberg:] Jeremias Wolffs Kunsthändlers seel. Erben, [between 1724 and 1730].

- Johann Friderich Walther. *Die, in der Königl. Garnision-Kirche zu Berlin, befindliche neue Orgel, wie selbige, nach ihrer äussern und innern Beschaffenheit erbauet. Mit wenigem beschrieben, und nebst einer kurtzen Vorrede, vom Gebrauch, Kunst und Vortreflichkeit der Orgeln.* [Berlin:] Carl Gottfr. Möller, [1727].

- Jacob Leupold. *Theatrum arithmeticogeometricum, das ist: Schau-Platz der Rechenund Mess-Kunst.* Leipzig: Zunkel, 1727.

- Theodoro Christlieb Inholdt. *Einige zur Music gehörige poetische Gedancken bey Gelegenheit der schönen neuen in der Frauen- Kirche in Dreßden verfertigten Orgel*. Dresden: Gottlob Christian Hilschern, [1736].

- Johann Gottfried Donati.] *Einige Discurse zweyer Orgel-Freunde, welche bey Gelegenheit des von Tit. Herrn Gottfried Silbermannen [..], am I. Advent dieses 1742sten Jahres zu Fraureuth im Voigtlande verfertigten Schönen Orgelwercks geführet worden.* Greiz: Abraham Gottlief Ludewig, 1742.

Abstract

Thinking about Bach and the organ, a few questions need to be asked if only to begin to deconstruct certain kinds of evidence. How reliable is Carl Philipp Emanuel's presentation of his father in the *Obituary*? What organs are relevant? How does the music relate to them? What unknowns should we not be papering-over? At least, it seems wise not to exaggerate Emanuel's remarks. It is, for example. possible that Emanuel praised his father's "art of registration" for a quite prosaic reason: because organists purchasing *Clavierübung III* had grumbled that it had no registrations, unlike Kauffmann's set of chorales recently published. As for J.S. Bach's expertise on organ building, we need to assess our sources careful, too. His opinions and ideas betray an interested organist, whereas Johann Gottfried Walther shows much deeper knowledge. However, considering Bach's sensitivity to tone-colour, his appreciation of good voices and good instruments, and especially a certain musical cosmopolitanism, it's hard to believe that for him, organ tone itself was secondary. Admiration for reeds and bigger bass stops need not mean that in his maturity he was especially drawn to the Hamburg and Lübeck organs, whatever today's usual assumptions. To my ears, the Freiberg Silbermanns seem the best ones for Bach; but the Bohemian organ type of the time might be interesting too. What Bach knew can not be established; and we better be cautious, in order not to find ourselves overlooking the oddities in the *Toccata and Fugue* (BWV 565) or expecting answers from what is called "numerology".

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Peter Williams (1937-2016) was educated at St John's College, Cambridge: Bachelor of Arts, 1958; Bachelor of Music, 1959; Master of Arts, 1962; Ph.D., 1963. In 1962 he joined the faculty of the University of Edinburgh as a lecturer, subsequently becoming a reader (1972) and a professor (1982), where he held the first chair in performance practice in the UK. At Duke University in Durham, North Carolina, he was chairman of the music department (1985-1988), university organist (1985-1990), and director of the graduate center for performance practice studies (1990-1997). From 1996 to 2002 he was John Bird Professor at Cardiff University. From 1996 to 2006 he served as Chairman of the British Institute of Organ Studies, and he was Patron of the Cambridge Academy of Organ Studies.

Peter Williams ranks among the foremost authorities on the organ. In addition to his books and articles, he has served as general editor of the series *Biblioteca Organologica* and as founding editor of *The Organ Yearbook* (from 1969). He is also founder-general editor of the series *Cambridge Studies in Performance Practice* and of the Duke University series *Sources and Interpretation of Music*. He was also general editor of the *New Oxford J.S. Bach Edition*.