The ZKM Institute for Music and Acoustics up to 2002: Politics, context and foundations

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The overall concept for a Zentrum für Kunst und Medientechnologie in Karlsruhe positioned music as integral part of it from the very beginning in 1985. The following text does not list accomplishments by discussing individual works, productions and research projects; this report describes and contextualises what happened and how it happened, it talks of people and concepts, of politics and ideas. It tries to illuminate the complex path between politics and technology, individual interests and cultural perspectives that led to and shaped ZKM. The uniqueness of ZKM is not only that it comprises museums as well as institutes, which actively produce art. The uniqneness of ZKM also lies in that music was planned as an equally important partner in the original concept, and that the Institute for Music and Acoustics still holds a major position in the institution today even though ZKM as a whole shifted towards the dominance of visual media. The focus of this text is on how the Institute for Music and Acoustics forms an integral part of ZKM as a whole while evolving its own inner direction and dynamics.

1. ENTHUSIASM AND POLITICS – THE BEGINNINGS OF ZKM

Legend has it that in the mid-1980s a group of members of the city government, the city council and the university of the German city of Karlsruhe visited the MIT Media Lab. Upon their return, the group was totally enthusiastic and decided to build a similar institution in Karlsruhe. Karlsruhe is a mid-sized city of around 270,000 inhabitants, known for hosting the highest court in Germany and the federal prosecutor, and for having one of the leading technical universities in the country; it is a well-off city in one of the richest German states. A state-run funding programme for city development allowed this group to conceive, and to finally realise, Zentrum für Kunst und Medientechnologie.

As with many small and large projects, parenthood cannot always be clearly determined. Regarding the question of whose idea ZKM originally was, two men were strongly involved for years: Michael Heck, the head of the cultural department of the city government, and Manfred Reichert, a conductor known for his activities in the field of 'new music'. Mr Heck was a great political and administrative enabler of the arts; he personally loved all fine and performing arts, including poetry and specifically also music; Mr Reichert was an active artist who realised his projects in the context of the publicly funded cultural landscape in Germany, supported by people like Michael Heck. In any case, music was, from the very beginning, a central part of ZKM, which was exceptional for any media art centre.

Between 1985 and 1989 quite a collection of groups and committees were established to develop the idea, involving more than 70 politicians, experts and administrators.

A special group was given the task of writing the final concept for ZKM: Harald Ringler and Helmut Bohner as delegates from the city; Thomas A. Troge, a musician and engineer;[1] and Peter Zec, a holography expert. They were supported by three political committees and three expert committees. The expert committee on music included Hans Peter Haller, director of the Experimental Studio Freiburg, Bruno Spoerri from the Swiss Centre for Computer Music, Dirk Reith, director of the electronic studio of the Folkwang Conservatory in Essen, and Rudolf Frisius, a musicologist with a great deal of expertise in the field of avant-garde music and specifically electronic music.

The group travelled to the USA in 1987 to look at other similar institutions. At the time, I was 'commuting' between Germany and the Center for Computer Research in Music and Acoustics (CCRMA), Stanford University, supported by a grant from the state of Lower Saxony. I made sure I was at CCRMA when the delegation came there, so I could give them 'the tour'. I had been trying to found a centre for computer music in my home state of Lower Saxony since 1979, but this was a poor state and ruled by Social Democrats.[2] Baden-Württemberg was rich and

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[1] Thomas A. Troge was the one person in Karlsruhe who was knowledgeable about computer technology, programming, computer music and graphics. I am convinced that without him many aspects of ZKM that kept the integrated arts and technology focus would have been lost during the tumultuous political beginnings.

[2] In the mid-seventies Györgi Ligeti had tried to set up a centre for computer music in the state of Hamburg after his visit to CCRMA. It is worth mentioning that at that time IRCAM in Paris was in its first phase, duplicating the computer music infrastructure of CCRMA after a group under Pierre Boulez visited CCRMA in around 1975. Ligeti's proposal was not able to move forward because, if I remember correctly, the political decision was to fund social projects that were more needed, such as kindergartens, rather than such an

ruled by the conservative Christian Democrats; the cultural politics of this conservative party were much more open towards 'avant-garde' art than those of the Social Democrats, which were often more traditional.

This project group wrote the best draft plan for a new media arts centre that could have been conceived at the time, very concise and without political obfuscation.[3] It was published on 24 March 1988 as *Konzept '88*. This concept laid out three different departments and areas of activities for ZKM: 'Image', 'Music' and 'Media for the Citizen', which included a Media Museum.

ZKM was to have research and production departments for music, computer graphics, video and holography. It was to be publicly active through events, performances and exhibitions, but also by bringing the then new world of the PC within the reach of the 'citizen'; computers would be accessible and allow the 'citizen' to design the interior of their home or to get introductions in how to make music and pictures with computers. This would increase the acceptance of computer technology (a hot issue in Germany in the 1970s and 1980s[4]), and would enable artists, researchers and engineers to get in touch with each other and establish links between the academic institutions, the Forschungszentrum Karlsruhe and ZKM.

While ZKM was still in the conceptual phase, international symposiums and exhibitions were organised, bringing experts in 'art, science and technology' to Karlsruhe. The cultural activities and collaborations between institutions were moving forward. In spring of 1988, a seminar under the title of 'Musik und Informatik' was offered at the University of Karlsruhe as part of the computer science curriculum, and as my first experience in Karlsruhe I was invited to give a lecture in May of 1988.

Without being able to determine the manyfold struggles that are usually part of the beginning of great projects (and a reason for many to fail), the necessary administrative activities to move ZKM forward started with an administrative unit the city administration put in place in June 1986 under the

leadership of Manfred Reichert. Manfred Reichert's employment was terminated in April 1987 and the former legal counsel of the city, Kuno Schmitt, steered the ship until a new head was found.

Once this unit was without a content-driven spearheading leader, the entire project was in great difficulties. The state and the city had bought heavily into ZKM as a major political, cultural and economical collaboration. The Mayor of Karlsruhe, Gerhard Seiler, and the Prime Minister of the state of Baden-Württemberg, Lothar Späth, could not allow it to fail: they simply had to find a strong director who would guarantee its success.

Heinrich Klotz was a member in one of the many committees of ZKM's preliminary phase; he was the founding director of the German Architecture Museum in Frankfurt, the first architecture museum in Europe. The Prime Minister asked Klotz towards the end of 1988 to become Director of ZKM.

Heinrich Klotz was an art historian and architecture theorist. He was very much engaged in all visual arts and loved music. He had absolutely no background in media art, technology or related fields. He was a politician par excellence.

Heinrich Klotz agreed to become director of ZKM under two conditions: 1) He would be empowered to establish a brand new Hochschule für Gestaltung (HfG, Academy for Design) and 2) the concept of ZKM would be changed to include a Museum für Neue Kunst (Museum for Contemporary Art). He was granted both on top of what was already planned for ZKM.

Klotz claimed for himself that he was the inventor of the term 'Postmoderne' (postmodernism). The name Hochschule für Gestaltung came from the Bauhaus and was used for the Academy for Design in Ulm, the HfG Ulm. Klotz wanted to continue in the direction of 'die Moderne'. He wanted to continue the ideals of the HfG Ulm, which was shut down in 1969 after political struggles between the HfG Ulm and the State of Baden-Württemberg. Klotz coined during his time at ZKM the phrase 'second modern', defining it as the epoch following the 'postmodern'. He saw ZKM as a New Bauhaus, as a continuation of the Bauhaus, but now with computer technology.

In the summer of 1989 ZKM was established as a foundation by the State of Baden-Württemberg and the City of Karlsruhe. Both agreed to split the operating cost equally.

Several architectural competitions for a ZKM building had been conducted before Klotz was brought on board. In a final round, Rem Koolhas was selected to design the new ZKM; three years later, just after the completion of the design, Koolhas was dropped, along with the idea of a new building, and it was decided instead to convert an ammunition factory dating from the First World War.

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esoteric undertaking. In the mid-eighties, the Electronic Music Studio of the Technical University had received a VAX computer. Other initiatives in Germany were GIMMIK with Clarentz Barlow in Cologne and Dirk Reith at the Folkwang Conservatory in Essen.
[3]*Konzept '88* was also available in English and possibly in French. These versions should be recovered for their historical value.
[4]IBM Stuttgart sent a film crew to the USA in around 1977 to create a film for German schools, in which arts utilising computers were to show the human side of computing technology. The explicit reason was that the acceptance of computer technology in Germany had to be raised, and it was considered to be an appropriate approach to finance such a film and to make it available through the Landesbildstelle, a government agency where schools could get films to show in class. IBM has, so far, not been able to provide information on the project. The author was at CCRMA when the film team shot material at Stanford.

2.   ZKM AS POLITICAL INSTITUTION

Without Heinrich Klotz as political 'magician', ZKM would have never been able to survive the political struggles between 1989 and 1997. He manoeuvred between the industrious, frugal, pious attitude of the state government on the one hand, and the industrious, laid back and Francophile culture of the city government on the other. Heinrich Klotz's intellectual sharpness and passion added yet another component to the fire that made ZKM happen. For all of Klotz's energy and political prowess, he and ZKM would not have succeeded without the continual string-pulling by Kuno Schmitt, the retired legal counsel of the city. As mentioned above, Schmitt had also bridged the time between Manfred Reichert and Heinrich Klotz as leader of the pre-ZKM project group, and for decades he had been deeply rooted in Karlsruhe politics. Kuno Schmitt has been an active and vital member of the ZKM team over the past 25 years; it is fair to say that ZKM in all its different struggles would have been defeated if it were not for Schmitt's intimate knowledge of local politics.

The Institute for Music and Acoustics was the first entity of ZKM that became active, while Klotz was buying art works for the museum. In January 1990, I started officially as director of the Institute for Music and Acoustics, right after having established the *MultiMediale* as ZKM's biennale in the autumn of 1989 (as freelance curator). The other departments – the Institute for Visual Media, the Media Museum, and the Mediatheque/Media Library – went through different leadership phases until Jeffrey Shaw headed the Institute for Visual Media from 1991 until 2002, Dieter Daniels the Mediatheque between 1991 and 1994, and Hans-Peter Schwarz the Media Museum between 1992 and 2000.

Klotz's political arguments for getting support for ZKM were the usual ones, namely the addition of creativity to research and development in academia and industry; the flow of patents coming out of the work of artists with computer technology; and the general overall economic and cultural stimulus effect. Karlsruhe had always had a very strong inclination towards the arts and culture, and the arguments about arts and technology resulting in economical and technological advancements were happily never questioned.

The Museum für Neue Kunst that Klotz added to ZKM was a shift in the balance within ZKM's programme. Klotz's dream was to establish the largest and most important museum for contemporary 'art of all genres' in Germany.[5]

The operating budget at ZKM was tight, since it had not been adjusted for the addition of the Museum (and Klotz became known among arts dealers for paying high prices). Over the years Klotz twice attempted to remove the funding for the Institute for Music and Acoustics in order to free up funds for the addition of the Museum to ZKM, but was not successful. Aside from these attempts, Klotz supported and saw the value of the Institute.

ZKM and the Academy for Design were planned as sister institutions, with Klotz being the Rector of the Academy as well, where ZKM was to provide opportunities for research and production to the school and where the library and cafeteria were to be shared. The latter happened as an administrative obligation to receive federal government funding, but a true collaboration between the institutions did not come about in the years I was at ZKM (1990–2002).

Heinrich Klotz had to step down for health reasons in 1998, the year after the grand opening of the new ZKM building. He continued to work on completing the spaces for the Museum for Contemporary Art.

At this point, a most difficult phase threatened to destroy ZKM: The Museum for Contemporary Art was split from ZKM, and when Klotz's health declined in 1999 the state government wanted their choice, Götz Adriani, to be installed as Museum Director. A very destructive power struggle between the state and the city government – between Klotz, Adriani and then Klotz's successor Peter Weibel and the state government – burdened the development of ZKM. This struggle, driven by immense intrigues, continued until 2004, when the museum was re-integrated into ZKM.

After Klotz stepped down, the administrative director of ZKM, Gerd Schwandner, was seen as a possible successor. Schwandner had already followed his own political agenda to change the direction of ZKM during Klotz's reign, even though he was only the administrative director. His idea for ZKM was to turn it into a 'flashier' place with a more populist and tourism-orientated programme, and as a place serving the media and entertainment industries.

After many months of high-running tensions, in 1999 the board of the ZKM appointed Peter Weibel as the new director. Weibel's background as an artist and theoretician was rooted in art and 'new media'. Thus, after the founding era under Klotz had come to an end, the new era under a new director could still be a continuation and development along the basic

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[5]Interestingly enough, in the second half of the eighties Klotz, when he was visiting professor at Williams College in Massachusetts, had been in discussion with Thomas Krens, who was at the time director of the Williams College Museum of Art, to see if he, Klotz, would become the founding director of MassMOCA in North

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Adams, Massachusetts. MassMOCA became the largest centre for contemporary art in the USA, very much along the lines of a museum of all genres; and Thomas Krens became the director of the Guggenheim Museum in New York, with whom ZKM collaborated on several occasions.

programmatic lines of ZKM. Since Schwandner was still administrative director until 2000, Weibel had a rough start to his tenure. As a team, Shaw, Schwartz and I were able to support Weibel during his interviewing process and his first months on the new job with our detailed knowledge about the internal workings and political drifts within ZKM. Weibel gave ZKM a new direction in the years to come focused on his artistic, intellectual and political perspectives.

My contract and Shaw's ended in 2002, and we were concerned that Weibel would change both institutes into service departments for his own ideas, projects, and 'all-consuming' exhibitions. Indeed, positions and funds were shifted away from the institutes, new leadership was hired and new approaches found. And Ludger Brümmer – who started with residencies in the Institute in 1994 – moved music at ZKM forward to new arenas.

3. BEGINNINGS OF THE INSTITUTE FOR MUSIC AND ACOUSTICS, THE TEAM AND 'PHILOSOPHY'

At the end of 1988, I was approached by the city of Karlsruhe to write an expert opinion on *Konzept '88*. I included extensive comments on architecture, administrative structures and technological perspectives as well as the interdependencies of programme, architecture, administration and technology.[6]

In the spring of 1989, I was, like the year before, invited to give a lecture at the University of Karlsruhe. After the lecture, Heinrich Klotz asked me if I wanted to set up the music department of ZKM. I asked him if he, given his primary interest in the visual arts, would support music as described in *Konzept '88* or if 'image' was going to take over everything. He said he was going to support music as a full department. (Later on, as I wrote earlier, he was nevertheless tempted twice to close it down for budgetary reasons.) He then asked me if I would programme and organise a media festival that would place ZKM on the map alongside the *Ars Electronica*. I had three months, 200,000 German Marks, and the mayor's old Mercedes.

In the autumn of 1989, the *MultiMediale 1* brought together an international programme with sound and video installations, concerts of electronic and instrumental avantgarde and rock music, sculpture, interactive works and a series of lectures.

Thus the Institute for Music and Acoustics began with my joining ZKM in January 1990.[7] This was the first department of ZKM after the Museum für Neue Kunst, which had Heinrich Klotz as Director.

I wanted to start with research, residencies and production right away while working on the design of the new building. The team had to comprise a software expert, a signal processing expert, a music curator and a *Tonmeister*. I wanted to start with an international team, integrating different cultural and aesthetic perspectives on music with computers.

Within the first 18 months the basic team was in place: Heinrich (Rick) K. Taube, Pierre Dutilleux and Heike Staff. Thomas Gerwin was hired to take care of the IDEAMA archival project, and Caro Moessner, as the Institute's administrative hub, had been with ZKM since its pre-phase. In 1994, Christian Venghaus joined us as *Tonmeister*. Torsten Belschner joined in 1995 as system programmer and sound designer. Many freelancers and students helped to move the Institute forward in these early years.

The team for the Institute brought very strong personalities together; they were deeply engaged in their areas of expertise beyond 'doing the job' and they were willing to take a high risk and start something new and unknown. And every one of us had his view on 'how things should be'.

The initial team combined three cultures.

For Rick Taube, the American, it meant that he took the step to leave the corporate world where he programmed for Price Waterhouse and worked on his artistic programming in the early hours of the morning. He moved with his family to Germany, into an unknown culture, without a fluent knowledge of German.

For Pierre Dutilleux it meant coming from the French research and development environment, with a high level of expertise in digital signal processing, not knowing German, and moving to a culture that was so different from his native culture (a difference that had been established through many centuries of wars with each other).

For Heike Staff it meant coming from a deep involvement with contemporary music in the twentieth century, from listening to that often challenging music, enjoying the challenge, reading, thinking and writing about it, and without prior knowledge of how technology influenced its aesthetic production and reception.

Later, when Christian Venghaus joined as *Tonmeister*, another important expertise came to the team. Christian had studied classical music and sound engineering in an integrated degree, he had worked as a sound engineer and sound designer, and had been part of creating new theatrical and musical productions.

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[6]Many concepts and issues were discussed in this document that turned out to be relevant and 'predictors' for ZKM. The final paper is published in Goebel 2006: 252–85.
[7]The name Institut für Musik und Akustik was derived from my conviction that 'music with computers' was only meaningful with an understanding of and research in acoustics. I derived the name

(F'note continued)
from Stanford's Center for Research in Music and Acoustics, my 'home' for 'computer music'. Furthermore, I thought 'institute' would convey the right message, as opposed to 'department'.

Together we started the artist in residence programme and workshops, and produced ongoing events under the title 'ZKM in der Fabrik'. We were moving at incredible speed and creating one of the most fertile production environments for contemporary music production, which integrated state-of-the-art technology, by commissioning new works; supporting the development of computer programs in the field of music; crossing boundaries between performing arts, installation art, radio art, image and sound; programming events of time-based arts that crossed over many boundaries; and developing new hardware for research and production; and creating and supporting one of the most productive environments for live electronics outside of IRCAM, using the IRCAM Signal Processing Workstation (ISPW): all while designing and building a top-level production environment for the new building.

We worked with a division of labour that placed my role as the buffer between all that our team was doing and the overall ZKM administration, dealing with budgets, staffing, development for the new building, and also politics inside and outside of ZKM. I had to keep my team's 'back' free.

I always liked to integrate many different directions and approaches into the Institute, finding our focus through criteria of 'substance' and 'integrity', and not so much by creating or following directly identifiable aesthetic or research paradigms.

I was convinced that hardware and software always contain an inherent aesthetic direction, independent of how 'open' the design was. I did not want to implement an assistant structure – like that at IRCAM, where resident composers are 'assisted' by in-house technicians – and I insisted on seeing 'computer music' not as a new musical genre or superior paradigm, but as one possibility among many others, with its specific tools, instruments and compositional methods, but not as a qualitatively different music, per se.

I was also against establishing a 'school', while certainly developing a describable aesthetic context and working within a defined infrastructure. I was interested in each individual work and approach, and in the liveliness, reflection and experience of what was done.

Over time this discussion grew into a contentious issue within our team: 'how could we define our identity?' Pierre was desirous that we might be identifiable by a *son* (i.e. French for 'sound'): that someone should be able to identify a piece on hearing it as coming from ZKM. Heike and Christian wanted to see a clearer 'profile' of our work, something that could be identified from the outside and which we could present to position ourselves – something that could set us clearly aside. Both directions tried to find an antidote to the fact that our work as Institute was experienced as not identifiable enough due to my approach, one based on the idea of a mosaic of many perspectives that would reveal its clear shape only if viewed after some time and from some distance, and where the individual work stood on its own while being supported by the team.

The different views within our team on how such an institute could or should work and be run developed slowly over the first years, before we moved into the building. For the opening of ZKM we put together a very wide-reaching programme, from Kraftwerk (as requested by Heinrich Klotz) to commissioned works, including three operas with very complicated technical and performance settings, by K. Furukawa, A. Viñao, M. Maiguashca, P. Eötvös, W. Rihm and other artists.

After the opening, these differing perspectives about how to make institutional identity visible moved to the forefront. With the move to the new building; being under one roof with all the other departments; being spread all over the very big building; having to maintain a huge technical infrastructure, supporting more residencies and programming more events – the collaboration within the team changed as individual perspectives outgrew the group perspective.

It should be kept in mind that the Institute for Music and Acoustics had a staff of up to six between 1990 and 1996 and once in the new building the staff expanded to eight, including two non-permanent positions for 'Volontäre'.[8] Many interns, student workers, and freelancers worked with us, while ZKM's central administration covered all aspects not specific to the Institute.

4. TECHNICAL DIRECTION OF THE INSTITUTE AND ITS PROGRAMMATIC IMPLICATIONS

As the Institute started in 1990 and the building was designed, I had to develop the definition of the technical infrastructure even before the team was in place. Three central ideas guided me:

- I had observed that in the world of 'computer music' not only was the wheel invented again and again, but collaboration between different centres was extremely difficult. IRCAM had started with the CCRMA hardware and software setup and then moved in its own directions; at the University of San Diego, a package was developed that was used in several other locations around the world; EMS in Stockholm had its own system, CCRMA went its own way, STEIM had yet another approach, and so on. Communication was between individuals. On the trans-institutional level, there were hardly ever any true collaborations on a

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[8]A sort of paid internship, not with full professional pay, but still more pay than 'just an intern'. In the museum world this is a known first step on the ladder; it can be someone even with a Masters or PhD degree who begins as a 'trainee'.

concrete project.[9] Everyone was understandably busy in their own world.

- In the arts, I believe in doing with computers what cannot be done without computers. I was (and am) very much interested in sound synthesis that would create timbres, structures and works going beyond the digital imitation, simulation or emulation of the non-digital.
- The overall technical environment was to be state of the art in the area of open systems as used in 'computer music'[10] production and research, while also providing high-end equipment and facilities such as professional recording and mastering studios. Studios had to be as quiet as classical recording studios. The number of audio channels for any production or performance should be 'arbitrary'.

In the autumn of 1989 I visited 'Silicon Valley' to see where the digital audio and music world stood. Heinrich Klotz had given me the authorisation to have a second 'Samson Box' designed and built. The first Samson Box was built by Peter Samson and delivered to CCRMA in 1977 as the 'world's most powerful real-time digital synthesizer'. It had a special architecture designed for audio processing and synthesis and was hosted by a PDP computer. The commands for the real-time sound generation and processing were compiled on the PDP computer. These specific commands were then fed to the Samson box, which in turn churned out the actual sounds in real-time. Up to the late 1980s there was no more powerful machine for this purpose around, and at the time it was not possible to know when general-purpose CPUs would be fast enough for specially designed architecture not to be necessary any more.

I met with Pete Samson, who over the next months defined a second-generation Samson Box including a set of micro-instructions. I knew that a piece of hardware was nothing without the software, and I needed someone who would be capable and willing to take on the task of creating it. There was only one person I personally knew who I trusted to do so: William Schottstaedt, resident guru at CCRMA. Over the course of time it became clear that Bill and CCRMA would take the route of the NeXT computer and that Bill was not going to get involved with

a new Samson Box. Steve Jobs had hired the best team from CCRMA to implement the dedicated music part for the NeXT machine. Being without a software developer, I had to stop the new box, much to the disappointment of Pete Samson.

I had beta-tested the Dyaxis audio-station at CCRMA before my ZKM time, and we purchased a large Dyaxis system in 1990. This set the tone for many artists who came to work on editing and mastering anything from recorded instrumental music to soundscapes or radio plays.

Another important step in making the – at the time – most advanced technology available to artists came with the International Digital Electro Acoustic Music Archive (IDEAMA) project. We were able to buy a Sonic Solution System with CD-Maker in 1991. Now we were able to burn our own 'Red-Book compatible' audio CDs; this enabled sound installations and performances to be set up in a very robust way by just using a CD player. I believe this was one of the first opportunities for artists to burn and master their own audio CDs.

When Rick Taube came from the USA to Karlsruhe to join the Institute in 1991, his main research project was to program Common Music. For this he needed to have an Internet connection with CCRMA at Stanford. Since I was able to hire staff, we had moved away from the main administration of ZKM and started our small studios in an apartment building. Continuous 'high bandwidth' Internet connectivity at that point in time was fairly rare outside of universities and research centres. Rick's and Pierre Dutilleux's first major feat was to get us connected to the university backbone.[11]

My mind was set on getting a fully digital audio matrix for the new building that would connect any point to any other point, so that any sound could be sent and tapped anywhere in the building. CCRMA had at the time a digitally controlled analogue audio matrix. The next step to an all-digital matrix was obvious, but there was no suitable product around in 1990.[12]

I knew conceptually where I wanted the infrastructure to be. With Pierre Dutilleux we had an extremely highly qualified digital signal processing expert and very thorough engineer on board. With Rick Taube we had the computer-music expert. And we were looking for a *Tonmeister* who could bring the professional audio production experience to the table. Finally, in 1994 we found Christian Venghaus,

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[9]One of the few times some collaboration was aimed for in concrete terms was when Max Mathews was able to channel millions of dollars in the early eighties from the System Development Foundation (SDF) to CCRMA Stanford, MIT Media Lab, and the computer music centres at UC San Diego and North-Western University to develop a joint computer-music work station. These grants were of great help to the centres, but did not result in any real collaborative outcome as envisioned.

[10]Nothing specific is meant by the use of this term in this context, but just that computer technology is used within the context of music. The quotes indicate the battles once fought over terminology and the non-clarity of the term itself.

[11]The infrastructure of the Music Institute became the hub for all future network connections of ZKM. As a matter of fact, the Institute for Image Media and the Media Museum started on those two floors with us.

[12]I met with Andy Moorer – who was Vice-President of SonicSolution and whom I had known since my early days at CCRMA – in 1989 and 1990. We discussed the Sonic Net they had under development. I was enthusiastic that someone actually worked on such a matrix. As it turned out, Sonic Net did not come to fruition for us.

who simply took off on the digital plane while providing the audio engineering expertise in the areas of our programmes, events and productions, which were happening alongside the planning of the building. Christian Venghaus and Pierre Dutilleux basically put a digital audio infrastructure together that created a bridge between the top-end professional digital audio studio technology and the open music systems that were used in avant-garde production and development. There was no studio in Germany or any other place we knew of that combined these approaches on such a level.

When the new ZKM building opened in 1997, we had in place an audio matrix running on a dedicated fibre-optics network, connecting thousands of inputs and outputs throughout the building. Three German products were on the market at that point in time, and there were no alternatives from other countries. After a lot of testing, we chose Nexus from Stagetec.[13]

The audio matrix was complemented with a high-end digital mixing board from LAWO, for the large Blue Cube Studio. At the time, LAWO was the only company meeting our specification of splitting a board into a mother and daughter board between the control room and the actual studio, while using the same signal processing core. This allowed us to also to mix in the large studio and to use the board for performances.

One of the major issues in planning the audio infrastructure was to find an engineering consultant who would help us to design the highest quality in professional digital audio in combination with an open 'computer music' environment. We finally decided to work with Ernst Jo. Völker and his Institut für Akustik und Bauphysik. He and his company had absolutely no experience with digital audio at that time, but he had the experience of working in a complex architectural design and construction team. And he had the reputation of being practical and going against rules and regulations of the tight standards of the German radio stations if it made sense.

The computer infrastructure during the first years was centred on Macintosh computers and NeXT machines.[14] Since we had a hard time obtaining NeXT machines in Germany, an arrangement with CCRMA allowed us to have them buy us the machines, have them labelled as their property and thus bring them to ZKM. Rick Taube used NeXT for his development of Common Music. Pierre Dutilleux

established one of the most active environments in the world using the ISPW for real-time audio processing and music for live electronics running MAX/ISPW. As MAX/ISPW moved to MAX/FTS on Silicon Graphics computers, we also changed to a number of SGI machines. As the NeXT machines faded away, specific programs and projects were ported from NeXT to Mac. Finally the Linux branch had a late start, taken on by Götz Dipper when he joined ZKM in 2001, which led on to some of the Linux Audio conferences being hosted at ZKM after my departure.

There had been long discussions on the loudspeaker systems to be used. I was not in favour of an active system. Their fans always produce some noise, and when loud sections in music were immediately followed by very soft parts the fans might still be running at full speed. Obviously, this does not matter at rock concerts or outdoor performances, but in acoustically critical spaces the noise of these fans is always audible. We decided for passive d&b systems as the main PA, with the amplifiers removed to the machine rooms.

Another observation I had made was that indeed loudspeakers are 'filters' – they have their very own quality and properties. Especially when working with synthetic, 'unheard of' sound it is difficult to determine if the timbral quality stems from the algorithms used or from the speaker itself. We designed a loudspeaker studio with eight pairs of speakers, from top-end monitors to small 'living room speakers', and one could switch between speakers while playing music. This enabled us to have a greater understanding of the properties of a sound and of the speakers.[15]

A further direction was taken by getting quite a few Manger speakers. These speakers have an innovative and complex sound transducer that has a very fast rise time and very little overshoot after impulses. Since I am interested in timbral transparency (i.e. clear-cut transients) and localisation (which requires very fast response time), I found these speakers lend themselves extremely well to sound design in its literal meaning.

5. DESIGNING AND BUILDING ZKM AND THE STUDIOS

When Rem Koolhaas and his OMA was commissioned in 1989 to develop the plans for the new ZKM building, a close collaboration started on the specification of the studios and spaces needed for the Institute for Music and Acoustics based on the expert opinion I had written for ZKM in 1988.[16]

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[13]The system was not hierarchically structured – anyone could 'kill' any configuration, which not good for the open environment with many parallel users that we were planning. We had extensions programmed, which allowed configurations of sub-matrices for individual users.

[14]An Atari setup was used for 'compatibility reasons', as this was the main workhorse for individual composers who were not associated with an institutional studio in Germany at the time. A PC with MS-DOS was maintained for music printing under SCORE.

[15]The loudspeaker studio at the time can be viewed at http://container.zkm.de/ima/ls-raum.html.

[16]The design is documented in (Koolhaas and Mau 1995: 686–763); part of the design can be viewed online at http://www.oma.nl under the *museum* menu.

The city of Karlsruhe terminated the project development with Koolhaas in June of 1992. Koolhaas was very upset and frustrated by what he saw as stemming from a provincial mind-set.

The project development with Koolhaas was intellectually and architecturally very exciting and challenging. OMA had not built any performing arts centre at the time. And ZKM's programme was absolutely innovative and unique in its combination of exhibition spaces, performance and production spaces, all connected with state-of-the-art technology. One of the most intriguing experiences during the design development with OMA was how the acoustical requirements influenced the overall building and its cost in major ways. Based on the acoustical specifications for the music spaces, the cross-sections of the ducts for the air handling system had to be increased and space for attenuators were needed – something OMA had not been aware of. The building could not get higher and so the basement had to be built lower into the ground. There was a substantial cost increase associated with this.

It was the first time that I was enabled not only to think about how to arrange and specify production spaces for audio and video that would support a programme like ZKM's, but to work with an architectural team on such issues. Heinrich Klotz took care of all the architecturally exposed parts and the museum infrastructure, and I worked with OMA on the other aspects.

I saw the acoustical properties of buildings, studios and performance spaces as always extremely important counterparts to what could be done in the digital domain. The potential refinement of what we could create with technology needed the acoustical environment that had little to no noise, where sounds could be placed anywhere in the space and where instrumental and electronic sounds were equally supported. I had worked in too many places where the noise of machines did not allow one to closely listen to the unheard sounds; and where spaces for instrumental music did not provide the infrastructure for technology. I wanted all senses to be served with the same level of quality – not one space for music and one for theatre and one for multimedia performance. To achieve all this, a detailed involvement in planning and construction seemed necessary to me.

The studio and room layout for the Institute in the Koolhaas building was almost without modification carried over to the next building as it exists now – so the current ZKM still holds a little memory of the Koolhaas building.

The incredibly large building ZKM is in now used to be an ammunition and weapons factory; it was built during the First World War, and during the Second World War forced labourers from concentration camps were working in the building.

The building is protected as architectural landmark and had been decaying for many years. Artists had been squatting in parts of the building. The city had to find some use for it, so it was decided to cancel the Koolhaas plans and move ZKM into this building. Since it was so enormous, both Heinrich Klotz's Academy for Design and the city's gallery would fit under its roof.

The new selected architect Schweger und Partner had – like Koolhaas – no experience with the unique programme ZKM was to incorporate.

One of the consequences of this being an architectural landmark was that we were required to keep the ten internal atriums as open spaces. So, the Media Theatre was built into one of the atriums with slanted walls as a freestanding unit – an enforced design that actually made no sense at all from a programmatic point of view.

The factory is one of the earliest buildings to apply pre-stressed concrete in its floors, which allowed the construction of rather thin floors. For us this was really bad for the needed acoustical separation between studio spaces: sound would travel very easily through the building structure.

Furthermore, we were in need of two large studios, one for audio and one for video and image. Since the atriums of the ammunition factory had be kept open and the internal structure did not allow high acoustic isolation, it was planned to build two cubes outside of the old building, one for image and one for sound. The Blue Cube was finally built; the external studio for video was cancelled.

So one of the main issues for the Music Institute was resolved by being able to build a structurally independent studio outside of the old structure. Inside the old building a cluster of two studios was designed with a control room and a machine room serving both; plus there were seven additional studios for artists in residence.

The acoustician for the project was Müller BBM, and the collaboration with their project manager Ms Marosvölgyi over the years was excellent. She was absolutely open to the non-standard requirements for the studio spaces and helped to develop innovative ideas.

All these studios in the old part of the building had to be as acoustically separate as possible from each other. Planning and specifying these criteria was simple compared to getting the building adapted to these specifications. The city had not retained Müller BBM to oversee the ongoing construction, and at the same time they had in some instances chosen construction companies who had little experience in the specified acoustical construction but who had submitted the lowest bid. This resulted in inexperienced building companies having to do highly qualified construction. The architect had no experience with many aspects of

the acoustical construction, so I had to learn 'on the job' and monitor the construction myself.

Music was the most vulnerable part of ZKM's programme, because the museums, visuals arts and the Institute for Visual Media formed the strongest faction. As mentioned, twice the Institute was threatened with closure. The high quality for acoustical construction was very expensive. There was only one way to ensure that the Music Institute would get the appropriate quality in the building and in its technical infrastructure: I had to have insight into all details of the construction itself and equally importantly into the construction budget, and I had to follow up on all relevant steps as the building was built.

In 1994, Harald Ringler left ZKM; as architect on the ZKM staff he had made sure that ZKM interests in general would be represented during design and construction. At that point in time I had to step into the vacuum and take over guiding many aspects of ZKM's building during construction, including representing the user in the political struggles in owner–architects meetings, where money and quality were always moved like in a shell game.

For the room acoustics of the studios and the control rooms in the old building we decided to go with a system of perforated absorptive panels that could be placed as desired on rails along the walls.[17]

The aim for the room acoustics in the Blue Cube and its control room was basically that all four walls should have very similar acoustical behaviour.[18] This was based on the premise that loudspeakers could be placed anywhere in the space without a predetermined front–rear orientation. Furthermore, I did not and do not believe that synthetic acoustical environments for musical purposes are best achieved by making a room really dead, like in movie theatres that are built for surround sound. Distinct localisation of sound should be combined with a certain level of fusion provided by the room acoustics itself – basically resulting in an overlay of the synthetic space with the architectural space. This resulted in designing the large studio and the control room as mostly diffusive environments.

The walls of the control room are covered with diffusive, absorptive and reflective surfaces.[19] I believe this control room is one of the very few such spaces that have a very short reverberation time (0.3 seconds) without any pressure on the ear when entering it, which makes it feel very much 'alive'.[20]

The large studio[21] has an area of about 220 square metres and has around 6 metres clear height (additional volume is above the cooling ceiling). It has two walls with a band of RPG diffusers (the money ran out to do a more complete job), one wall that is reflective (mainly for instrumental music) and one wall that is broken up in the most intricate tilted landscape of panels to provide the acoustical effect of the wall being non-parallel with the opposing wall. A curtain rail around the whole studio allows the placement of absorptive curtains in panels of around 2 metres' width anywhere along the walls. This allows one to tune the space in a highly differentiated way. The curtains can be stored behind the reflective wall so it is possible to have no absorptive surfaces in the studio at all.

The Media Theatre[22] was also designed to strict acoustic criteria. The theatre was laid out to be equally quiet but less reverberant than the Blue Cube. The concrete walls were covered with a layer of expanded metal backed by acoustically transparent material. In between the concrete walls and the expanded metal, a system of banners with absorptive fabric was installed. These banners can be individually raised or lowered and stopped at any height via a remote control. This means the Media Theatre can be tuned quite effectively. (Since the banners are hidden, they may get forgotten over time…)

The Blue Cube, the Media Theatre and the cluster of two studios with control room each has a separate machine room, where all noisy equipment is housed; computers, amplifiers, routers, audio network components, hard disks. Originally such machine closets were planned for all studios, but were not implemented for cost reasons.

6. RESEARCH

ZKM is a freestanding institution and not part of a university. This has the advantage that 'anything goes'; whatever a project might need is not restricted by traditional academic or institutional barriers. The disadvantage is that researchers, undergraduates and postgraduates are not part of a potentially creative environment; they have to be specifically attracted. Research in the area of 'arts and technology' can usually fall into three groups: applied research that is initialised as part of a specific artistic production or project, more fundamental research that follows the paradigm of scientific research, or the development of tools that are made to be used by a others independently, such as software packages.

When Rick Taube was hired, the development of Common Music was a major focus of his work. In order to create as wide a horizon within the Institute,

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[17]http://container.zkm.de/ima/ls-raum.html.
[18]All spaces can be viewed in panoramic fashion at http://container.zkm.de/ima. One can select the different levels of the building and then click in the spaces one wants to visit.
[19]http://container.zkm.de/ima/gr-regie.html.
[20]The correlation of diffusiveness with perceived reverberation is not yet understood. Practical experience seems to contradict traditional perspectives. I think that a certain level of diffusion yields the perception of 'more' reverberation than the quantitative measurement of the reverberation time would suggest.

[21]http://container.zkm.de/ima/kubus.html.
[22]http://container.zkm.de/ima/mt-audit.html.

this algorithmic music composition environment was certainly one end of the spectrum. Between 1991 and 1995 Rick developed the major body of Common Music at ZKM. Rick taught Common Music in several workshops and supported the worldwide community.

Pierre Dutilleux was the scientific and engineering force driving research projects, collaborating in artistic productions, and engaging students from universities. He established relationships with local universities, had interns from international universities, and was advisor to five final theses written at ZKM in conjunction with external universities, and nine students over the course of time who each worked for a semester on very specific projects.

The research projects conducted at the Institute require a detailed assessment to understand how wide ranging the research at the Institute for Music and Acoustics was.[23] Pierre brought the research at ZKM to a level on a par with the local universities and with international developments, which has not yet been appreciated as part of the development of ZKM. I hope very much that special attention will be paid to the numerous projects Pierre, Rick and the visiting researchers moved forward between 1991 and 2001.

The major research projects realised in the Institute were: Common Music (H. Taube, algorithmic composition environment); IDEAMA – the International Digital Electro Acoustic Music Archive (J. Goebel with Th. Gerwin (ZKM) and M. Bauman and Max Mathews (Stanford)); AML – Architecture Music Laboratory (P. Dutilleux with a large team of 12 experts, an interactive exhibit matching spaces, music and acoustic properties); 'The Bali Project' (J. Goebel, P. Dutilleux, A. Herdy, S. Kartadinata and others – capture and transcription of Gender Wayang music, hardware and software); foo (G. Eckel, R. González-Arroyo, non-real-time sound synthesis and processing); ISPW – live electronic integration in operas and individual compositions (P. Dutilleux); contribution to the DAFX EU-Cost Project and publication (P. Dutilleux); and around ten student theses and papers developed and written under the guidance of P. Dutilleux.

7. MUSIC PRODUCTION, RESIDENCIES, WORKSHOPS AND PERFORMANCES

The programme, production and residencies were strongly shaped and developed by a collaboration of the whole team. But the main driving force between 1991 and 1998 was the curator of the Institute, Heike Staff. As expert in 'contemporary music' and 'new

music' of the twentieth century, she contributed a sharp analytical intellect and a critical ear while programming challenging music and interdisciplinary events. She learned quickly to integrate the aesthetic implications of technology into the musical discourse; through lively exchange, the Institute developed an outstanding presence through its programmes, residencies and commissions.[24] Heike Staff was the only member on staff who could focus on content and programme (the organisational execution of concerts, events and productions were also mostly in her court and took their major toll). It can be certainly stated that her influence on the programme of the Institute balanced the more technology heavy developments. Looking back, the aesthetic impact of the Institute was indeed making clear that the Institute was focused on content of highest and challenging content while pursuing the best technology, tools and working conditions for artists. The audience basis developed through the events by the Institute over the years leading up to the opening created a unique community that was then integrated into the new building.

After Heike Staff left in 1998, Mathias Osterwold held the position for two years between 1999 and 2001.

The first *MultiMediale* in 1989 saw a wide array of music, media art, installations, lectures and performances invited to the festival. The second *MultiMediale* in 1991 had an even a broader basis since Jeffrey Shaw had joined ZKM as head of the Institute for Visual Media, and the Media Museum was on its way; still most of the events were invitations. The third *MultiMediale* in 1993 established ZKM as multifaceted institution with its own production activities; premieres of works commissioned by and realised in the Institute for Music and Acoustics were performed, and the Institute for Visual Media presented its first productions as well.[25] The fifth and last *MultiMediale* in 1997 was the opening festival of ZKM's new building. The music programme with its many premieres was a manifestation of what the Institute built over the years leading up to this festival. Once the new building was opened, a new direction of residencies, productions, research and commissions started since now finally 'real' studios were available.

The Institute was laid out from the very first day for residencies of artists and researchers. The main goal was to get started as quickly as possible by

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[23]The Wissenschaftsrat (German Council of Science and Humanities) was asked by the state of Baden-Wüttemberg to evaluate ZKM. The report, all in English but for the first few pages, is accessible at http://www.wissenschaftsrat.de/texte/5738-03.pdf.

[24]The questions might arise: how all this was financed? Where did the money came from? The Institute had small contributions from the outside; almost all the money came through the budget of ZKM, which was given by the state and the city. And then the budget struggles had to be fought within ZKM.
[25]It has to be mentioned here that the coverage of the *MultiMediale* festival on the website of ZKM does not list the contributions of the Institute for Music and Acoustics in adequate balance to the visual arts exhibitions.

supporting development of new ideas and new productions. The residencies and projects were selected by the staff of the Institute and not by a 'committee'. This was important to give a certain guarantee to not get stuck in political dealings in the arts world. Accusations of subjectivity and bias were taken into account as the preferable mode of enabling high-quality and risky productions. One of the major principles was that residencies did not have to turn out results and that commissions could fail and should be discontinued if everyone involved felt that the work indeed had failed. There were not financial retributions in such cases.

Another major goal of the Institute was to integrate open computer systems with top-end 'closed systems' for digital audio production – that is, digital mixing boards, audio matrices, and processing gear. And, most importantly, to have a professional staff that would be able to utilise, support and manage such top-end technology in conjunction with the open systems, with the challenging and changing environments of new works that integrated interactive video or the internet or large music ensembles.

Christian Venghaus, the *Tonmeister* of the Institute, enabled the Institute to operate as a top-end recording and production studio (with video integration) on a par with the public radio stations in Germany, while being able to apply this high-end audio environment in new and boundary-pushing productions with more than 30 loudspeakers, live electronics, musicians, video, theatre, dancers, and so on.

In 2001 and 2002 the Institute created a volume that listed and described all projects that were realised in the Institute since its inception. This volume was to be published in conjunction with a similar overview by the Institute for Visual Media and hopefully the other departments of ZKM, under the title *produced@ZKM* to document the first ten years of ZKM's activities. This publication was not pursued after Jeffrey Shaw and I left ZKM. It may happen now that the second ten years of ZKM's productive and influential life has created a different balance between the two decades.[26]

A thorough description of the residents, projects, programmes, events and productions is necessary to show the real core of the Institute and what its influence was in the music world of the 1990s. I decided to not do so in the context of this article even though this is the absolutely more important perspective. Instead I wrote about the background, the thoughts and politics – how it came about. The truly great and manifold projects realised in the Institute will potentially speak for themselves once they are looked at closely. They are

more accessible to a musicological study; the mosaic they create does display a very clearly describable and discernible history.

A few projects have been touched on in this text. They are not representative for the overall oeuvre created at the Institute. Even though there had been many attempts to document the productions at the Institute in a coherent way, no real overview exists so far. The pressure on the staff of five to seven people was so enormous that this documentation lagged behind. To give an indication just from a quantitative perspective here are a few numbers.

It may be safely assumed that between 1991 and 2002 more than 200 new works were created in the Institute by over 110 artists in residence, ranging from electroacoustic works to complex 'interactive multimedia operas' with multi-year production spans, from solo instruments with live electronics to the integrated production of music composition and film-making, from interactive graphics–music CD-ROM publication to radio plays.

The following numbers are verified for the time between 1991 and 1998 (which includes the first year in the new building):

- 80+ artist-in-residencies (mainly before the move to the new building);
- 110+ new works, of which 45 were premiered at ZKM;
- 90+ concerts, events and installations with 180+ works performed;
- 30+ complex research projects from new software environments to hardware development and research in musicology;
- 20+ workshops, from a few days to many weeks, ranging from algorithmic compositions, digital signal-processing to physical modelling with ACROE/Grenoble and the first MAX workshop in Germany with Miller Puckette;
- 110+ lectures by staff;
- 6 CD publications with the Wergo label (more CD and DVD publications in the following years); and
- the translation and publication of Donald E. Hall, *Musical Acoustics* into German.

To give an idea how the work exploded in the new building: In 2000, 30 residential stays were supported; 9 large co-productions were produced; 50 concerts, events and installations were presented (supported with a staff of six or seven).

8. MULTIMEDIA – INTERMEDIA – 'WHAT CAN WE CALL IT?'

A major emphasis of the Institute was put on work that spanned visual and music domains. ZKM was founded explicitly for such collaborations, but they were realised only on very few occasions within ZKM.

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[26]Should anyone be interested in this overview over the productions of the Institute between 1990 and 2001, you may contact the author of this article.

The Institute for Music and Acoustics instigated many such projects, on which they mostly collaborated with partners from the outside. Even though the ties with the Institute for Visual Media were very close on institutional, political and intellectual fronts, very few collaborative productions came about. Whenever the boundaries were crossed, the initiative came from the Music Institute. Most probably this was founded in a difference of how artists in one domain are familiar and involved with contemporary artistic practices in the 'other' field. It seemed or seems to be the case that 'avant-garde' artists in the musical arena are more likely to be interested in the counterparts in the visual domain than vice versa.

In planning the new building, I took over planning of all performance spaces, including the Media Theatre. The Media Theatre has very strange proportions because the side walls had to be slanted to accommodate the code restrictions for architectural monuments (which the ammunition factory falls under). Nevertheless, the infrastructure allows many theatrical productions, and was used during and after the opening. But the idea of creating a very lively programme with performing-arts residencies that would include 'new technology' never took off, mainly for three reasons: budget (once in the new building, the exhibition activities became dominant), staff (all production institutes were understaffed for the programme they delivered) and availability (the media space is the only larger and acoustically separate space that allows events, screenings, performances and installations).

The Music Institute supported, co-produced and commissioned many works that integrated visual, performance and music practices. To just give a few examples: the very first video production in 1992 was a collaboration between the painters K. H. Sonderborg and W. Hannen and the musicians G. Christmann and P. Lovens playing and painting together ('in actu'); the composer E. Kats-Cherning and the film-maker K. Winter produced two outstanding productions, performed with the ensemble modern; a number of 'high-tech' operas were commissioned for the opening; an elaborate production with the Munich Opera Biennale realised the integration of real-time sensor technology and algorithmic compositions in a work by G. Winkler; an extremely complicated production of the *Gibrgskriegsprojekt* by J. Lopez involved film, helicopters, artificial blood, orchestra

and complex sound mixing; *Small Fish*, a production by K. Furukawa and M. Fujihata, and *Sonomorphis*, by B. Lintermann and T. Belschner, which was probably the only co-production between two employees of the Institute for Visual Media and the Institute of Music and Acoustics.

In addition there were quite a few more such productions that were realised – further information on these is available in the not yet published *produced@* publication.[27]

9. ENDING NOTE

Many important topics have not been touched on in this text, like how the Institute and the Experimental Studio Freiburg were intertwined through politics and concrete collaborations; how we collaborated with the SONY Music Box at the Sony Center in Berlin; how the first co-production with Opera Biennale in Munich in 2001/2002 could serve as a paradigm for such collaboration; why the Institute did not establish competitions and awards in this first phase; and how the overall collaboration with other institutions played out.

The perspective given in this article is very limited and is too focused on the author himself. Indeed, I did not find another way of starting to write the history of the Institute. But obviously only the staff members were the ones who made it happen as a team. It was indeed a stormy voyage, but I am happy about ship, course, and us as crew:

C. Mössner – H. Taube – H. Staff – P. Dutilleux – Chr. Venghaus – T. Belschner – B. Sturm – C. Pöpel – M. Osterwold – M. Kritzokat – A. Noelle – G. Dipper – V. Schmitt – N. Ganschow – F. Schweizer – G. Wolfstieg – R. Lorenz – S. Kartadinata – Joringel – Myra – D. Martinez – Chr. Müller-Tomfelde – Th. Ruoff – Chr. Dohrmann – H. Bruckner – A. Fleig – M. Müller – Th. Krol – M. Hechtle – K. Jaunich – A. Gloggengießer – M. Adelhardt – plus all interns, students, consultants, researchers and artists who worked on specific projects that had a home at the Institute.

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[27]See note 26.