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Revue française d'organologie et d'iconographie musicale

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Instruments électriques,  
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Unité mixte de recherche CNRS (UMR 8223) – Ministère de la Culture – BnF – Université Paris-Sorbonne

# Musique • Images • Instruments

Revue française d'organologie et d'iconographie musicale

17

## Instruments électriques, électroniques et virtuels

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La coordination éditoriale de ce volume a été assurée par Marc Battier, Alban Framboisier et Florence Gétreau.

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Musique-Images-Instruments : Revue française d'organologie et d'iconographie musicale / CNRS, Institut de Recherche en Musicologie (IReMus), n° 17, Paris, CNRS ÉDITIONS, 2018, 350 p., ill., tabl., 27 cm.

ISBN 978-2-271-11763-2

ISSN 1264-7020

Couverture : *Le premier orchestre d'Ondes musicales, Maurice Martenot, présenté pendant l'exposition internationale de 1937, photographie, Paris, Roger Viollet, RV-379163.*



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1. Harald Bode during a recording session at Radio Munich, ca. 1950. Harald Bode Archive, with kind permission of Peer Bode.



# *Between Mass Media, Entertainment Electronics and Experimental Music: Harald Bode's Melochords in the Intersection of Many Interests<sup>1</sup>*

Elena Ungeheuer and Oliver Wiener

The Melochord is a type of electronic musical instrument invented and developed in various formats by German engineer Harald Bode between 1947 and 1952 (fig. 1). In accordance with its initial designation to illustrate radio plays and film sequences, the Melochord was supposed to follow Bode's Melodium, built in 1938, which, as its name suggests, was a monophonic instrument. The Melochord, by contrast, usually had two separate voices or channels. Since the Melodium had been employed successfully in the scores of several famous film productions during the 1940s, Bode first of all tried to launch the Melochord in the broadcast and film sector. In 1949, he was already able to quote at least three new films using the instrument. In accordance with the semantic range frequently attributed to electronic instruments, the Melochord here evokes clichés of mystic or exotic subjects.

The music market can not only register electrical musical instruments as first exponents of consumer electronics in the first part of the 20th century. Before that, the way they were advertised as the ideal solution of domestic music for young ladies, and big outdoor events—these in fact were the main musical entertainment areas of that time—is a milestone signature for the development of

music-related sale transactions. Serious authorities of science and engineering made personal efforts in this direction on promotional literature and during live-performances at radio fair trades. In the background of those activities, there has been the need to legitimize a new organological approach in a field where the first-rate musical instruments represent the standard, based on the expertise of heavy-weight dynasties of instrument builders.<sup>2</sup>

Beyond and against that, the Melochord made a remarkable additional career—if not as a best-seller—as an experimental device that played a role in acoustic research as well as in the formative years of the Electronic Music Studio of the Nordwestdeutsche Rundfunk (NWDR) at Cologne. Unlike the Polychord, developed a short time after and produced and sold with some success by the Apparatewerk Bayern in the 1950s,<sup>3</sup> the melochord never went into major production. Bode resisted selling the Melochord to a company, which would have risked giving up the possibility to alter or improve it.<sup>4</sup> On the one hand, he tried to gain the

1. Our special appreciation goes to Akademie der Künste Berlin-Archiv, Tomas Meyer-Eppler (son of Werner Meyer-Eppler), Peer Bode (son of Harald Bode), Peter Donhauser (expert on electronic musical instruments) and Charles Atkinson (American musicologist who did the linguistic revision).

2. Elena UNGEHEUER, *Wie die elektronische Musik "erfunden" wurde ... Quellenstudie zu Werner Meyer-Epplers Entwurf zwischen 1949 und 1953*, Mainz, Schott music, 1992, p. 29-64.

3. Prices and types of the AWB organ are given by Fred K. PRIEBERG, *Musik des technischen Zeitalters*, Zurich, Atlantisverlag, 1956, p. 93: model 35, with two 5-octave manuals, 30-keys pedal, 3 swellers und 36 stops costed 9.950 DM; the smaller model 22, costing 8.460 DM, had only one manual and 18 stops.

4. [Anonymous,] "Sphärenklänge aus der Scheune," *Der Spiegel* 10/1948, p. 35 (see also: <http://www.spiegel.de/spiegel/print/d-44415869.html>). "Harald Bode führte sein Melochord einem



interest of the broadcasting companies, especially Radio Munich, where the instrument was used for the musical illustration of radio plays; On the other hand, Bode obviously took the Melochord as a locus of experimentation in the development of instruments for electrical sound generation. It is thus no coincidence that the instrument attracted the attention of the experimental acoustician and phonetician Werner Meyer-Eppler from the University of Bonn, whom Bode—even in later days—regarded “really as one of the movers”<sup>5</sup> in the instigation of the Cologne Electronic Studio and in the field of electronic sound generation in general. In September 1949, Bode had sent him a demonstration tape with recordings that had in part been made at the Munich Broadcast Studio shortly before. As the subsequent correspondence shows, Meyer-Eppler was impressed by the possibilities of timbral change the instrument allowed and commissioned Bode to build a Melochord for his studio at Bonn University in 1949. Two years later, Bode designed another Melochord for the early electronic music studio in Cologne. The heyday of the Melochord, however, was short-lived. A market overview for electronic

instruments, commissioned by Telefunken in 1952, mentioned the Melochord among others—such as the Baldwin Organ, the Sphärophon of Jörg Mager, the Hellertion of Bruno Hellberger and Peter Lertes, and Léon Theremin’s Aetherophon—also having disappeared from the market.<sup>6</sup>

### *Portraying the Engineer Harald Bode*

Whereas Harald Bode was still considered to be an “unsung innovator”<sup>7</sup> shortly after his death in 1987, the increasing research interest in the early history of electronic sound generation has recognized the pioneering role he played in the design of electronic instruments, especially in the conception of modular systems.<sup>8</sup> His life journey differs significantly from that of the elder protagonists of the early electronic instruments:<sup>9</sup> Instead of perfecting just one type of instrument, Bode developed a lot of different instruments, and he was able to combine his imagination as an engineer with some business skills. His work represents the transition from the pioneer phase of electric instrument construction to the integration of electronically

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*kleinen Kreis von Sachverständigen vor. Radio München sicherte es sich sofort als Leibgabe und will das Melochord schon in Kürze als Soloinstrument mit großem Orchester einsetzen. Vor allem aber scheint ihm das Melochord geeignet zur musikalischen Untermalung phantastischer Hörspiele, für die Mark Lothar im Auftrag von Radio München die Musik schreibt. | Seit jener Vorführung kann sich Harald Bode über mangelnden Besuch nicht beklagen. Fabrikanten und Exporteure bestürmen ihn in seinem kleinen Zimmer und schlagen ihm vor, sein Instrument in Serien herzustellen. Herr Bode muß freundlich, doch bestimmt ablehnen. Ein Blick in das mechanische Herz des Melochords zeigt, daß die ungezählten Einzelteile für einen Serienbau zur Zeit nicht aufzutreiben sind.*—“Harald Bode presented his Melochord to a small circle of experts. Radio Munich kept it immediately on loan and plans to use it as solo instrument with large orchestra. Above all the Melochord seems to be suitable for the illustration of phantasy radio plays with the music written by Mark Lothar for Radio Munich. | Since that presentation Harald Bode cannot complain about a lack of visitors. In his small chamber Harald Bode is assailed by manufacturers and exporters proposing to go into production with his instrument. Mr. Bode has to reject the offers in a friendly but nonetheless firm manner. A look into the mechanical heart of the Melochord shows that the uncounted components necessary for series production are not to be found at the moment.” [Translation Oliver Wiener].

5. Cited from memory by Thomas L. RHEA, “Bode’s Melodium and Melochord”, *Contemporary Keyboard magazine*, January 1980, p. 68; reprinted in *eContact!* 13.4 (2011), ([econtact.ca/13\\_4/rhea\\_bode\\_melodium.html](http://econtact.ca/13_4/rhea_bode_melodium.html)).

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6. Peter DONHAUSER, *Elektrische Klangmaschinen. Die Pionierzeit in Deutschland und Österreich*, Wien, Köln, Weimar, Böhlau, 2007, p. 242.

7. Herbert A. DEUTSCH, *Electroacoustic Music: the first Century*, Belwin Mills, Alfred Music, 1993, p. 17. Whereas the *New Grove Dictionary of Music and Musicians* contains a biographical entry (2<sup>nd</sup> ed. 2001, vol. 3, p. 770), Bode is not even mentioned in the register of persons in the 2<sup>nd</sup> edition of *Die Musik in Geschichte und Gegenwart*.

8. Two important places for the documentation of Bode’s life and work are the Estey Organ Museum, Brattleboro, VT (with the electronic organ collection) and the Harald Bode Archive, founded by Bode’s son Peer Bode (<https://haraldbodenews.wordpress.com/>), where Harald Bode’s notebooks are kept. The author Caspar Abocab wrote two one-hour radio features on H. BODE, “Ein Leben für den Klang: Der Erfinder Harald Bode und die elektronische Musik” (Bayerischer Rundfunk 2009) and “Music is my field: Harald Bode zwischen Ingenieurskunst und Hausmusik” (Westdeutscher Rundfunk 2011). A lot of documentary material is provided by the special issue on Harald Bode of *eContact!* 13.4 (2011), guest editor: Rebekkah Palov, [http://econtact.ca/13\\_4/index.html](http://econtact.ca/13_4/index.html). The issue was accompanied by the exhibition “Harald Bode: Tone color—known and unknown sounds” at Burchfield Penney Art Center at SUNY Buffalo State October 2011–April 2012.

9. P. DONHAUSER, *Elektrische Klangmaschinen...*, *op. cit.*, p. 240.



generated sound into studio production, and finally to the development of a modular concept of multi-device systems.<sup>10</sup>

Bode was born in Hamburg in 1909. His mother played harpsichord and his father played and taught pipe organ. Probably this soundscape influenced Bode's imagination of making and conceiving music as a great variety and extravagance of timbres that is manageable via keyboard interfaces and organ or harpsichord stops. Accordingly, his early electronic instruments, including the melochord, expose a sound classification with piped and plucked sounds. Bode studied mathematics, physics and philosophy at the University of Hamburg. It is notable that this broad educational path—out of technical colleges or polytechnics—was not common to the generation of engineers active during the Second World War.<sup>11</sup> To a large extent, Bode seems to have acquainted himself with electrical engineering methods by himself. After graduating in 1934, he began to experiment with electronic sound generation. The first outcome of his efforts was the Warbo-Formant Organ, an electronic cinema organ built in 1937, with funding support provided by the Hamburg band-leader Christian Warnke (War-Bo is an amalgam of their names). The organ, equipped with a set of combinable formant filters, had four tone generators, which allowed four-voice playing. With this instrument Bode first solved the problem of changing key assignment to a limited set of tone generators.<sup>12</sup> The instrument was at least built by Bode in two exemplars in Hamburg.<sup>13</sup>

10. Bode's retrospective "History of Electronic Sound Modification", *Journal of the Audio Engineering Society*, vol. 32, No. 10 (1984), p. 730-739.

11. Heinz BLENKE, *Technikwissenschaften im Wandel, Technik und Wissenschaft*, Armin HERRMANN, Charlotte SCHÖNBECK (ed.), Düsseldorf, VDI-Verlag, 1991, p. 429-469; Wolfgang KÖNIG, "Vom Staatsdiener zum Industrieangestellten: Die Ingenieure in Frankreich und Deutschland 1750-1945," *Geschichte des Ingenieurs*, Walter KAISER, Wolfgang KÖNIG (ed.), Munich/Vienna, Hanser, 2006, p. 179-231.

12. Thomas L. RHEA, "Harald Bode's Four-Voice Assignment Keyboard," *Contemporary Keyboard magazine*, December 1979, p. 89, reprinted in *eContact!* 13.4: [http://econtact.ca/13\\_4/rhea\\_bode\\_warbo.html](http://econtact.ca/13_4/rhea_bode_warbo.html).

13. A second specimen is announced in *Hamburger Anzeiger* from 21 September 1938, cf. the newspaper clipping on Simon Crab's web project *120 Years of Electronic Music* <http://120years.net/the-warbo-formant-orgel-harald-bode-germany-1926/>.

In 1938, Bode moved to Berlin and undertook postgraduate studies at the Institut für Schwingungsforschung in Charlottenburg (the famous name of Heinrich Hertz in the title of the institute was eradicated in 1936). One of the institute's departments was committed to acoustics. Collaborating with Oskar Vierling, he developed a new instrument, the Melodium. It might be surprising that Bode, after the experiences gained with the polyphonic formant organ, returned to the concept of a melody instrument again. In an article from 1940, Bode explained: "First of all, it was the insufficient pitch constancy which prevented it, in the case of monophonic keyboard instruments with pure electrically generated oscillation, from coming to useful results. Second, the possibilities of these instruments were not exhausted at all. To sum up, it can be said that with the Melodium, all the possibilities lying in a monophonic instrument with defined tone intervals can be achieved."<sup>14</sup> Since Bode was not convinced by alternative and continuous interfaces—like the resistor wire manual of the trautionium—the Melodium adhered to the traditional keyboard, a fundamental decision that still shaped Bode's later instrument designs, up to the question if the Moog Synthesizer should have a keyboard interface or not.<sup>15</sup> The Melodium should allow the player "to make music and to penetrate deeply into the comprehension of the nature of the sounds without a long study phase of a difficult playing technique".<sup>16</sup> In turn, the Melodium had the first touch-sensitive keyboard, based on a liquid

14. Harald BODE, "Bekannte und neue Klänge durch elektrische Musikinstrumente," *Funktechnische Monatshefte*, year 1940, issue 5, p. 72. "Einmal war es die mangelnde Tonhöhenkonstanz, die bei einstimmigen Tasteninstrumenten mit rein elektrischer Schwingungserzeugung nicht zu brauchbaren Resultaten führte, zum anderen aber hatte man die Möglichkeiten dieser Musikinstrumente noch nicht erschöpft. Zusammenfassend läßt sich sagen, daß am Melodium alle Möglichkeiten zu verwirklichen sind, die überhaupt einem einstimmigen Musikinstrument mit fest gewählten Tonintervallen offen stehen." [Translation Oliver Wiener].

15. Bode possibly was involved in the discussion of the Moog design. Caspar ABOCAB, "Ein Leben für den Klang" ([http://econtact.ca/13\\_4/abocab\\_lebenklang.html](http://econtact.ca/13_4/abocab_lebenklang.html)) cites Herbert A. Deutsch from the film *Moog* (2004) by Hans Fjellestad: "We discussed, in the early days, if the thing should have a keyboard or not. Is it necessary? And I know that Ussachevsky said a keyboard is perhaps no good idea, because it forces people to think in the established paths."

16. *Ibid.*



potentiometer and direct keying. The depression of the key lowered a long aluminium rail pressed down on a strip of felt soaked in glycerine. The pressure on that part altered the resistance between two electrodes, thus controlling loudness.<sup>17</sup>

In Berlin, Bode met some composers working for UFA film productions, especially Theo Mackeben, Mark Lothar, Fekko von Ompteda and Wolfgang Zeller, who used the sound of the melodium in their film scores.<sup>18</sup> Incidentally, Bode designed the circuitry for the Hohner Multimonica (1940), a combination of a fan-blown reed organ and a monophonic sawtooth wave analog synthesizer. Because the success of his instruments was not sufficient to earn his livelihood, Bode had several employments as a development physicist in the electronic industry, where he worked on an ultrasound system for submarine tracking and loudspeaker technology (1938-39), as a laboratory engineer and head of a development group for military radio, localization and targeting technology (1939-41), and finally on wireless communication at the Opta Radio AG, formerly Loewe (1941-45). These employments luckily justified Bode's being exempted from military service.<sup>19</sup> During the last year of the war Bode was able to convince the Opta AG to move his lab out of bomb-threatened Berlin to Bavaria.

Immediately after the end of the war, Bode left his unloved job at Opta to become independent. In his home in the alpine village of Neubeuern he did repair work on all sorts of radio devices. This enabled him to gather a collection of electronic

components necessary for the development of electronic musical instruments, a field he wanted to concentrate on for the rest of his life. In 1947, the first version of the Melochord was ready for presentation. Bode promoted it at the Munich radio fair and was hired for some music productions in radio and film (cf. fig. 1).<sup>20</sup> Since many church organs were destroyed during the war, there also seemed to be a chance for marketing electronic organs, in addition to the market sector of light music. In 1949, Bode conceived and built the Polychord, also known as the Bode organ—a full polyphonic instrument with a vacuum tube for each key—which was produced in several variants by Apparatewerk Bayern in Dachau.<sup>21</sup> Since there are no sales figures available neither for this instrument nor for Bode's later polyphonic modification of Constant Martin's Clavioline, the Tuttivox,<sup>22</sup> one should be cautious to speak about bestsellers. Bode saw the limited success of his ideas in Europe, so in 1954 he moved to the United States to join the Estey Organ Corporation as director of research and development, and later as vice-president.

At Estey, Bode's team tried to create an electronic organ targeted for the American mass market. On the basis of the polychord, they developed the Estey Model S and, after a productive period of technical improvements in 1957, the advanced model AS-1. From 1958 to 1960—after Bode had negotiated a part-time position with Estey—he devoted his energy to the concept of a musical instrument prefigured in the advanced melochord versions.<sup>23</sup>

17. T. L. RHEA, "Bode's Melodium and Melochord," *op. cit.*, p. 68.

18. "Sphärenklänge aus der Scheune," p. 35, and (with some audio examples) Caspar ABOCAB, "Wie ist der Klang? [How is the sound?]. An Historical Overview of Harald Bode's Instruments," *eContact!* 13/4 ([http://econtact.ca/13\\_4/abocab\\_bode\\_instruments.html](http://econtact.ca/13_4/abocab_bode_instruments.html)): Among these films are *Das Herz der Königin* (UFA 1940), directed by Carl Froelich, with Zarah Leander performing the role of Maria Stuart, the prominent Nazi propaganda film *Jud Süß* (UFA 1940) by Veit Harlan, *Friedemann Bach* (Terra Film 1941), directed by Traugott Müller and starring Gustav Gründgens in the leading role, and *Die goldene Stadt* (UFA 1942), directed by Veit Harlan (an expensive Agfacolor production imbued with blood and soil ideology).

19. More documentary material is provided by C. ABOCAB, "Ein Leben für den Klang," *op. cit.* Since this text is a radio collage, a lot of the quotations are unfortunately not verifiable.

20. P. DONHAUSER, *loc. cit.* The films are *Das verlorene Gesicht* (NDF München 1948), a mystery thriller directed by Kurt Hoffmann, the entertainment satire *Der Apfel ist ab* (Camera-Filmproduktion Hamburg 1948), directed by Helmut Käutner, the exotistic drama *Der große Mandarin* (Nova-Film Wiesbaden 1949), directed by Karl Heinz Stroux starring Paul Wegener in his last film role.

21. AWB was a company focused on television and radio receivers, sound-recording and reproducing devices, founded in 1951; it was taken over by Grundig in 1956.

22. The Tuttivox was manufactured by Jörgensen Electronics Düsseldorf and remained in production until the 1960s.

23. Bode himself addressed this association between the Melochord and the fully patchable synthesizer. Abocab, "Ein Leben für den Klang", cites from a sketchbook of Bode, "18. July 1961: [...] There will open up a new realm—as in the time, when I came to the fore with the Melochord" (translation OW).



The first patchable modular system built on the basis of a tape-loop device, known as Audio System Synthesizer and well documented by Bode,<sup>24</sup> clearly served as a conceptual point of reference for Robert Moog's early attempts in constructing synthesizers in the 1960s. As a consequence of the modular concept and his experience at the Estey Company, Bode abandoned the concept of stand-alone instruments and concentrated on the improvement of audio components, namely the ring modulator, the frequency shifter, the vocoder, and the phaser.

After the bankruptcy of Estey in 1960, Bode joined the Wurlitzer Company in North Tonawanda, New York. The following two decades brought some fruitful collaborations. The long relationship with the composer Vladimir Ussachevsky, active at the Columbia-Princeton Electronic Music Center, resulted in the development of the Bode Ring Modulators and the Klangumwandler (a frequency shifter, first developed in 1952 by engineer Ludwig Heck, Baden-Baden). In 1966, Bode made a business arrangement with Robert Moog to improve and standardize the ring modulator and the frequency shifter. They presented their High Accuracy Frequency Shifter at the 1972 Audio Engineering Society conference. The device featured a voltage-controlled oscillator and programmable shifts.<sup>25</sup> 1972 was also the year Bode started his own Sound Company on which he was able to focus on after his retirement from Bell Aerospace, where he had been hired in 1962 to develop micro circuitry. The following years saw the mature and marketable version of the Bode Vocoder and the prototype production of the Barberpole Phaser (based on the psychoacoustic principles of the Shepard tone and the Shepard-Risset infinite glissando).

24. Harald BODE, "Sound Synthesizer Creates New Musical Effects", *Electronics*, December 1, 1961; reprinted in *eContact!*, Bode-issue: [http://econtact.ca/13\\_4/bode\\_synthesizer.html](http://econtact.ca/13_4/bode_synthesizer.html).

25. Harald BODE and Robert A. MOOG, "A High-Accuracy Frequency Shifter for Professional Audio Application," Preprint No. 865, *42<sup>nd</sup> Convention of the Audio Engineering Society* (Los Angeles, 2-5 May 1972).

## *Organological Aspects of the Melochord*

In order to appreciate fully Bode's developments from the cinema organ to the synthesizer, it is necessary to understand the crucial role of the Melochord, the instrument that opened up a spectrum extending from a home organ up to a sound research instrument. The correspondence between Bode and Meyer-Eppler in fall 1949 (cf. appendix) shows that the freelance engineer regarded himself ready to offer diverse models, either with a four- or a five-octave keyboard and with or without internal amplifiers and loudspeakers. According to Caspar Abocab, Bode built six Melochords in total.<sup>26</sup> At the moment, we have photographs of only four specimens.

1. Bode's first Melochord of 1947 resembles a small harmonium with a five-octave keyboard and ten radio knobs on a narrow front of a height of approximately 7 cm<sup>27</sup>. The keyboard was divided into a two-octave bass-area and a three-octave treble-area. According to a *Spiegel* report, the instrument was foldable to suitcase size.<sup>28</sup> The suitcase option was most probably no longer possible with the larger models, but the handles on the side of the model as to be seen in photo 2 and those on the Melochord built for Meyer-Eppler clearly support the idea of a mobile instrument.
2. An advertising photo Bode sent to Meyer-Eppler shows a large model with a five-octave keyboard and a harmonium-like chassis (cf. fig 2).<sup>29</sup>

26. Caspar ABOCAB, "Music is my field," BR radio feature, minute 18:30. Further see C. ABOCAB, "Wie ist der Klang?" *op. cit.*: "Altogether Harald built only a handful of Melochords."

27. Two pictures of the first model are on Simon Crab's web project *120 Years of Electronic Music*: <http://120years.net/the-melochordharald-bodegermany1947/>. The upper picture showing the builder at the tuning process is also printed in Harald BODE, "History of Electronic Sound Modification," *Journal of the Audio Engineering Society*, vol. 32, no. 10 (October 1984), p. 732 (fig. 5). A detail cutout is to be seen on the front matter of *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*, 1954, vol. 6.

28. "Sphärenklänge", p. 35.

29. Elena UNGEHEUER, "Ingenieure der neuen Musik zwischen Technik und Ästhetik. Zur Geschichte der elektronischen Klangerzeugung," *Kultur & Technik. Zeitschrift des Deutschen Museums München*, issue 3, 1991, p. 34-41, photo on p. 40.





2. Large Melochord model with 5 octave keyboard in an advertising photo, Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 278.

3. The instrument built for Meyer-Eppler had the same divided keyboard and type of chassis, but it can clearly be recognized as an extension of the large model due to the phonetician's ideas, for there are input and output ports for external generators and filters.<sup>30</sup> The most interesting features are the paired input/output ports and control knobs on the front panel ensuring a quick access to both.
4. The last Melochord, built for the Studio for Electronic Music of the North-West German Radio, is documented by Bode in the issue on electronic music of the *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*.<sup>31</sup>

30. Photo with Werner Meyer-Eppler sitting in front of his Melochord. Elena UNGEHEUER, "Imitative Instrumente und innovative Maschinen? Musikästhetische Orientierungen der elektronischen Klangerzeugung," *Zauberhafte Klangmaschinen. Von der Sprechmaschine bis zur Soundkarte*, IMA Institut für Medienarchäologie (ed.), Mainz, Schott music, 2008, p. 45-59, photo on p. 51.

31. H. BODE, "Das Melochord des Studios für elektronische Musik im Funkhaus Köln," *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*, 1954, vol. 6, p. 27-29.

Together with the electronic Monochord of Friedrich Trautwein, it was removed from the studio under the early directorate of Karlheinz Stockhausen. The actual whereabouts of the instruments remain unclear.<sup>32</sup> The bright and sober design of Bode's Cologne Melochord stands out from the dark housings of the former models. Instead of the divided keyboard, it had two superimposed manuals of three octaves range in each case, and in contrast to the Meyer-Eppler instrument, the ports are placed on the rear of the instrument, demonstrating that it was obviously conceived as a freestanding part within the studio.

From these documents, it is possible to reconstruct the essential development stages of the instrument. Bode's Melochords are varied in line with a basic model of a two-voice instrument with a divided keyboard, working with two tube generators (bass range and treble range). The divided keyboard spans five octaves. A generator switch allows one to expand the total range up to seven octaves. In the correspondence with Meyer-Eppler Bode mentioned a small monophonic version with a three-octave keyboard, but at the moment there is no pictorial or material evidence that he actually realized that option. The Melochord has switches to determine the envelopes of the sounds in accordance with traditional instrumental sounds and further switches to alter the formant abstractly. The volume control is twofold: besides a basic volume controller there are foot pedals (swellers) for expressive alterations during play. Thus, from an organological perspective, the melochord is clearly related to organs, even though the register effect is not manipulable via selected combinations of organpipes/spectral distribution information, but by selection of envelopes or spectral time informations.

The first instrument, directly created as an enhancement of the melodium and allegedly built with some parts of the older instrument<sup>33</sup>, is still a stand-alone device, an instrument primarily made

32. According to the verbal information (20. 9. 2017) of the sound engineer Volker Müller the Melochord was no longer included in the inventory of the Cologne studio, when he was employed in 1971.

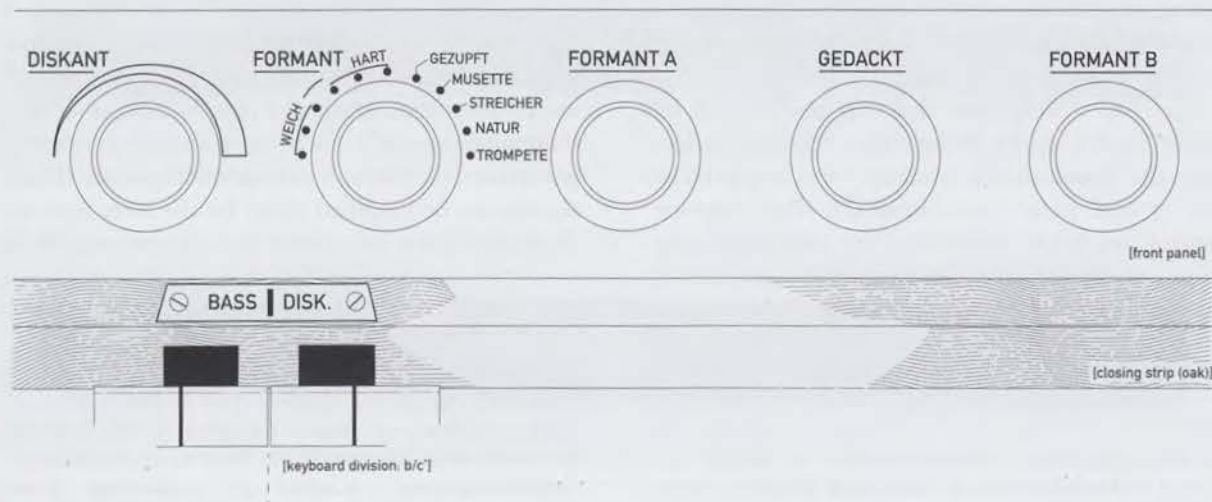
33. "Sphärenklänge aus der Scheune," p. 35.



3. Part of the front panel of Bode's first Melochord (1947). Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 278.

for playing and—to a limited degree—for sound experimenting purposes. The photo—which served as illustration on the front cover of the issue on electronic music of the *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*—allows one to reconstruct a part of the front panel (cf. fig. 3 and 4). In particular, the radio knobs for standard sound characteristics—with “musette”, “strings”, “trumpet”, “gedackt”—recall a harmonium-like design. In contrast to the monophonic Melodium, the Melochord with its divided keyboard was able to represent a bass and a treble register. The detail of the front panel shows the same twofold interest which shaped the design of the Melodium: The musician should be able to play immediately on the instrument without a long study phase, starting with familiar sounds—and what is important—to make new sound experiences by varying the formant parameters. The familiar registers should trigger an interest in electronic sound modification provided by the unspecified formant control switches. As it was the case with the melodium, the front panel of the melochord was an inscription of a didactical guidance to the individual player's sound research.

While the following large model of the Melochord supports this conception of the stand-alone instrument, the melochord built for Meyer-Eppler takes an important step towards studio implementation and modular design. Two parts have survived which are now kept in the musical instrument collection



4. Switches on the central part of Bode's first Melochord (drawing by Oliver Wiener).





5. Bode's Melochord built for Meyer-Eppler in 1949, front panel.

of the Institute of Music Research of the University of Würzburg (fig. 5-6).<sup>34</sup> The instrument was obviously disassembled after the dismantling of Meyer-Eppler's studio at Bonn University in the 1960s, and later it suffered water damage during an improper storing phase.

The two extant parts of the instrument are the main board with the front panel and the deformed substructure (the contact row) of the keyboard. Thomas L. Rhea wrote that the Meyer-Eppler instrument was equipped with a touch-sensitive keyboard.<sup>35</sup> The remaining contact row does not clearly support this assumption, but perhaps the variable distance of the springs to the contacts connected to the resistors on the bottom side influenced the volume by voltage regulation. In any case the instrument had a kind of complex envelope generator. The front panel (cf. fig. 7) has a control switch for the time constant and variably adjustable attack and release phases ("An- und Abklang"), applied to the chosen formant.

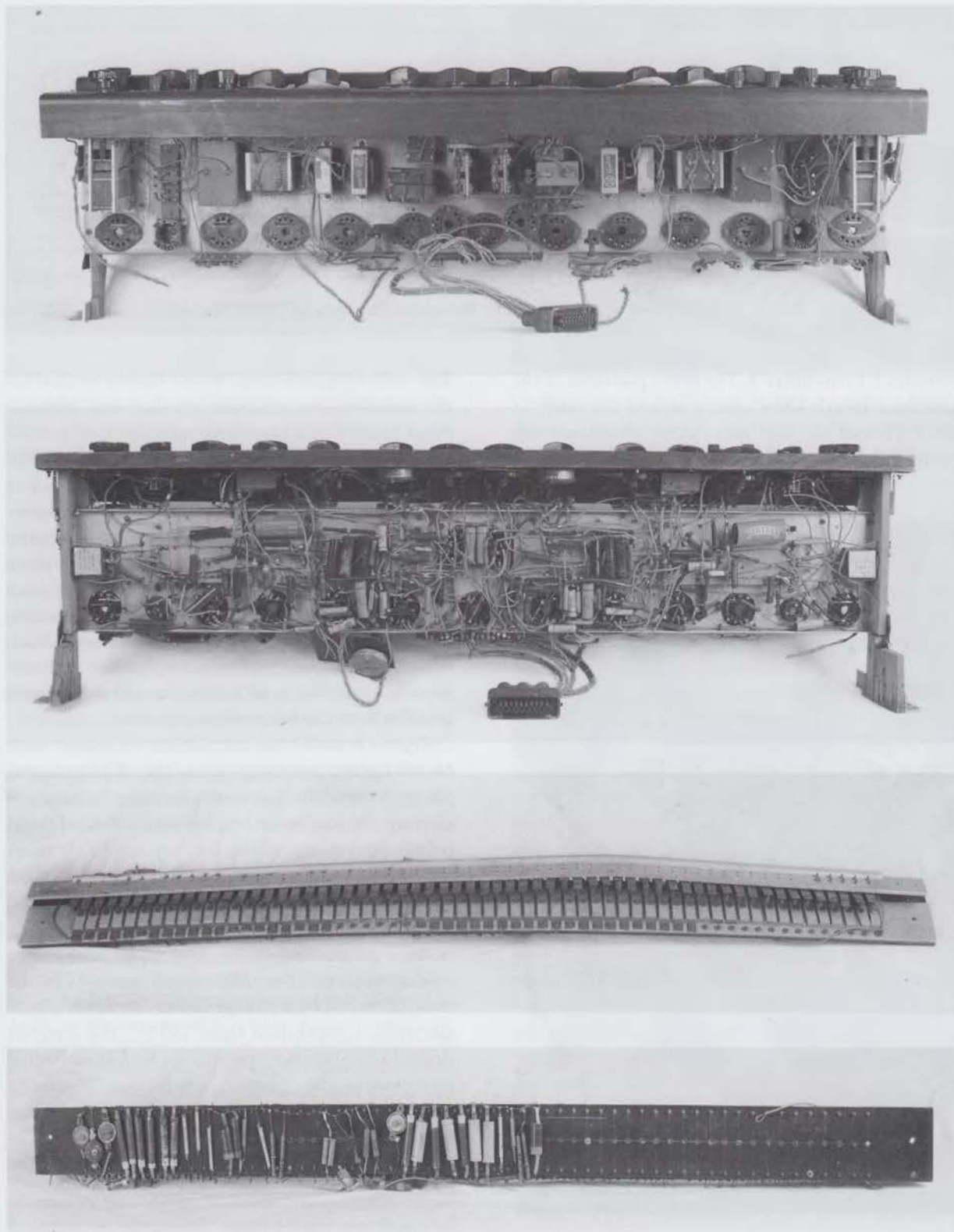
The Bonn Melochord that was co-designed by Meyer-Eppler shows characteristic changes reflecting the acoustician's research focus on perceptibility and sound transformation. The envelope control on both sides—the left and the right areas—is divided: (1) into a continuous controller for the time constant ("Zeitkonstante")—a subject

of intensive acoustical discussions until now<sup>36</sup>—in order to fine-tune the sound attack, which is quite important for the identification of sounds (perceptibility) and also for compositional purposes to obscure it, and (2) into one controller for attenuation. The controllers are backed with scales from 0 to 270 on cut out photo prints, glued on the panel surface. In contrast to the switches of the other melochord models, these scales allowed it to measure and reproduce varying settings of the sound manipulation with high precision. The time constant controller—which is lacking on the later Cologne instrument—is a unique feature of the Bonn Melochord, which in fact may be seen as the most delicate tool to satisfy experimental demands. According to its destination as a research instrument, all imitative timbre settings are eliminated with the exception of the piped and plucked characteristics ("Bl." = Bläserklänge/ "Z." = Zupfklänge) and the standard vibrato units (variable in five steps). It is possible to switch off the generators on each side independently and to induce other sources ("Fremdgenerator") such as different frequency generators, playback devices or microphones. These sounds can be modified either by the filter settings provided by the instrument or by an external filter

34. Studiensammlung Musikinstrumente & Medien am Institut für Musikforschung der Universität Würzburg; inventory number Ate 1.

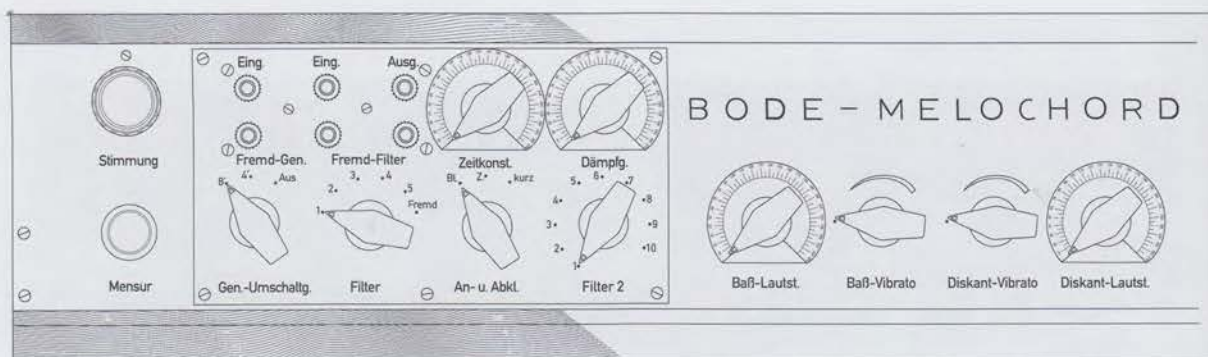
35. T. L. RHEA, "Bode's Melodium and Melochord," *op. cit.*

36. Fritz WINCKEL, *Music, Sound and Sensation. A Modern Exposition*, Toronto and London, Dover, 1967, p. 51-57 ("Time Constant of Sound Perception"); Hans-Joachim MAEMPEL, Stefan WEINZIERL and Peter KAMINSKI, [chapter] "Audiobearbeitung", *Handbuch der Audiotechnik*, Stefan WEINZIERL (ed.), Berlin, Springer-Verlag, 2008, p. 719-785, here: p. 733.



6. (a) The Melochord from above; (b) Bottom view of the main plate ; (c) Substructure (contact row) of the manual, seen from above; (d) Substructure of the manual, bottom view.





7. Left and middle field of the front panel of Meyer-Eppler's Melochord (drawing by Oliver Wiener).

complex ("Fremdfilter"). The other positions of the generator switch allow one to expand the range of the keyboard: the bass area can be transposed one octave lower (4'), the treble one octave higher (16').



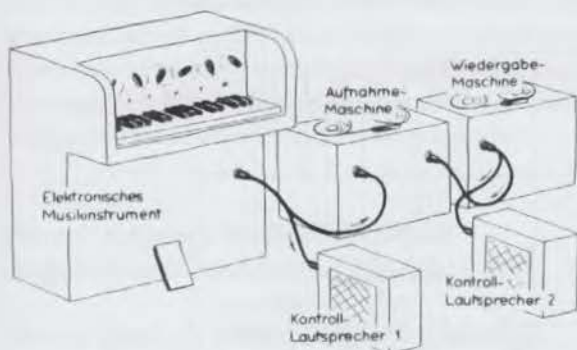
8. Meyer-Eppler in front of his Melochord operating the Elektrolarynx, Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 278.

The well-tempered scale, which Bode provided for the melochord, is alterable in a not very sophisticated manner by a knob with no scalar specification ("Stimmung"). In a similar way, "Mensur" can be controlled: The term metaphorically refers back to the measurement of organ pipes and at the interface of the melochord signifies an access to varying the spectral density. Narrow pipes produce more partial tones, wider pipes a darker spectrum with clear fundamentals. Since one knob was responsible for Melochord's built-in filters and one other knob allowed the input external filters besides a second set of internal filters, all kinds of sound shapes were possible with the instrument.

Figure 8 shows the instrument in action, with Meyer-Eppler speaking into the Elektrolarynx plugged into the external generator input, and altering the frequency by playing on the keyboard (while the volume of the left keyboard side is set on maximum and the vibrato unit on step 1, time constant and attenuation are both in the middle on degree 135).

As a productive device within Meyer-Eppler's studio context, the Melochord needed to be complemented by a storage device. In an article on electronic composition from 1953<sup>37</sup>, the scientist drafted a basal studio constellation with an electronic instrument—the graphic abstraction is clearly inspired by his Melochord—and two magnetic tape recorders with control speakers (fig. 9). The composition procedure was based on layering: The electronic signal from the instrument was recorded

37. Werner MEYER-EPPLER, "Elektronische Kompositionstechnik," *Melos* 1 (1953), p. 5-9.



9. Basic outline of a studio for electronic composing, inter alia published in Meyer-Eppler's article "Elektronische Kompositionstechnik" (Melos 1953); Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 55.



10. Front view of the Cologne Melochord given in Bode's Article "Das Melochord", in: *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*, No. 6, 1954, p. 28.

on tape 1, copied on tape 2 and then copied back to tape 1, where it could be mixed with additional sounds from the instrument. Meyer-Eppler called this immediate access to the oscillations—without an intermediate acoustic (or microphonic) stage—the "authentic composition"<sup>38</sup> which he regarded as a condition for an advanced autonomous use of electronic instruments. In a letter to Karlheinz Stockhausen from 1952, Herbert Eimert described this immediate composition scenario, when Bruno Maderna played and composed on Meyer-Eppler's Melochord during a short visit in Bonn.<sup>39</sup>

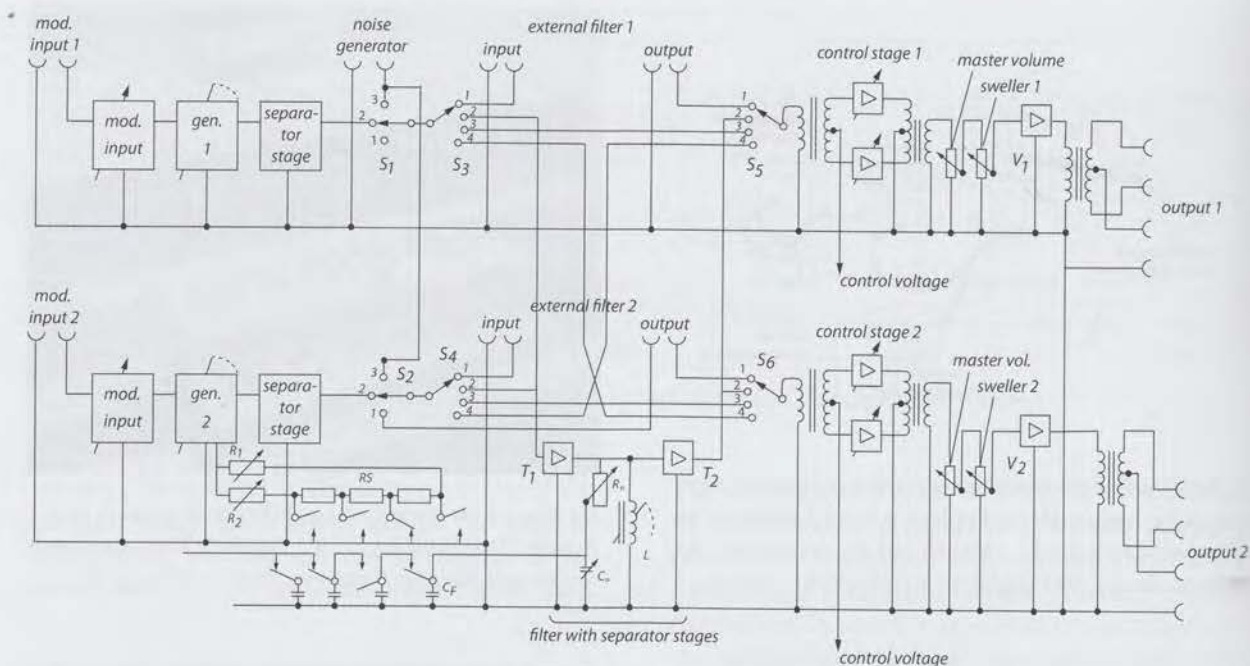
38. *Ibid.*, p. 7.

39. Helmut KIRCHMEYER, "Konfliktstoff Pausenzeichen: Ein Kapitel Hamburg-Kölner Rundfunkgeschichte aus der Sicht Herbert Eimerts, nebst einem Nachspann bislang unveröffentlichter Briefe Eimerts und Stockhausens aus dem Jahre 1952," *Archiv für Musikwissenschaft* 67 (2010), p. 52-76, esp. p. 69: "In Bonn habe ich ihnen (Luigi Nono und Bruno Maderna) / nicht nur das Beethovenhaus gezeigt, sondern auch in Meyer-Epplers Institut für Phonetik und Kommunikationsforschung unsere elektronischen Bänder / vorführen lassen, über die sie fast aus dem Häuschen gerieten. Maderna / fing an Ort und Stelle an elektronisch zu komponieren und montierte auf / Band drei auf dem Melochord produzierte Melodien übereinander."—"In Bonn I showed them (Luigi Nono and Bruno Maderna) the Beethovenhaus. Furthermore in Meyer-Eppler's institute for phonetics and communication research I have let them listen to our electronic tapes which made them beside themselves with joy. On the spot Maderna began to compose electronically and combined on tape three melodies produced at the Melochord." [Translation Oliver Wiener].

The last important step from an instrument for performance to an innovative studio device was taken with the Melochord Bode designed for the first draft of the studio for electronic music at the NWDR (fig. 10). Up to Meyer-Eppler's instrument, the Melochord in its quasi symmetrical design of two separate playing areas served the musical concept of bass and treble, differentiable by timbre. By contrast the Cologne instrument showed the recognition that the two channels of the instrument needed not necessarily be associated with voice registers. They could stay what they were: channels. The conclusion drawn from the concept of parallel channels with a lot of sound control abilities was to combine them in order to allow control of both via a single operation. This idea was realized in the crossing paths in the middle of the Melochord's block diagram given by Bode. As can be seen, the customary fixed filters (or timbres) and the vibrato generators of the standard version are missing, but there is a stage filter installed for the representation of formants following the fundamental frequency. In addition to the Meyer-Eppler melochord, there are four further switches up- and downstream to the external filter in- and outputs ( $S_3$  to  $S_6$ ) which allowed the connection and mutual control of the two channels when set on position 4 (fig. 11).

Bode illustrated the variation possibilities of the interconnected channels by the following examples:





11. Block diagram for Bode's Cologne Melochord, given in Bode's Article "Das Melochord", in: *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*, No. 6, 1954, p. 28.

The choice of the different switching paths when operating the switches  $S_1$  to  $S_6$  results in a series of variation options. It suffices to give just a few examples here: If generator 2 is blocked ( $S_2$  on position 1) and the stage filter is included in channel 1 ( $S_3$  and  $S_5$  on position 2), it is possible to determine the pitch and the non-stationary processes by playing on channel 1, while playing on the keys of channel 2 influences the timbre. If channel 1 is blocked ( $S_1$  on position 1) and a noise generator is connected while  $S_2$  is on position 3 and  $S_4$  and  $S_6$  are on position 2 (stage filter), it is possible to play coloured noise on discrete pitches, and with the respective setting of the standard setup stages as 'piped' or 'plucked' noise. If the same settings are used and for example orchestral music is sent to the noise generator input, the music appears to be 'modulated' with vocal colors.<sup>40</sup>

40. Harald BODE, "Das Melochord", p. 29: "Durch die Wahl der verschiedenen Schaltwege bei Betätigung der Schalter  $S_1$  bis  $S_6$  ergibt sich eine Reihe von Variationsmöglichkeiten, aus denen nur einige Beispiele herausgegriffen seien: Durch Sperrung von Generator 2 ( $S_2$  auf 1) und Einbeziehung des Stufenfilters in den Kanal 1 ( $S_3$  und  $S_5$  auf 2) ist es möglich, durch Spiel auf den Tasten des Kanals 1 die

Here the concept of a self-contained instrument completely gives way to that of a multiply patchable modular device, designed for finding new sound transformations. Like Meyer-Eppler in his article on electronic composition, Bode concluded his explanation of the Melochord with an outlook on storage devices (magnetic tape recording) which primarily served the purpose of the studio instrument as an experimental tool.<sup>41</sup> The young composer's passion

Tonhöhe und die nichtstationären Vorgänge zu bestimmen, während durch ein Spiel auf den Tasten des Kanals 2 die Klangfarbe beeinflusst wird.—Blockiert man den Kanal 1 (Schalter  $S_1$  auf 1) und schließt bei Schalterstellung  $S_2$  auf 3 einen Rauschgenerator an, so läßt sich bei Einstellung  $S_4$  und  $S_6$  auf 2 (Stufenfilter) ein Tonhöhenpiel mit farbigem Rauschen darstellen, und zwar je nach Einstellung der Regelstufe 2 als 'geblasenes' oder 'gezupftes' farbiges Rauschen. Wird bei gleichen Schalterstellungen beispielsweise Orchestermusik auf den Rauschgeneratoreingang gegeben, so erscheint die Musik mit Vokalfarben 'moduliert'." [Translation Oliver Wiener].

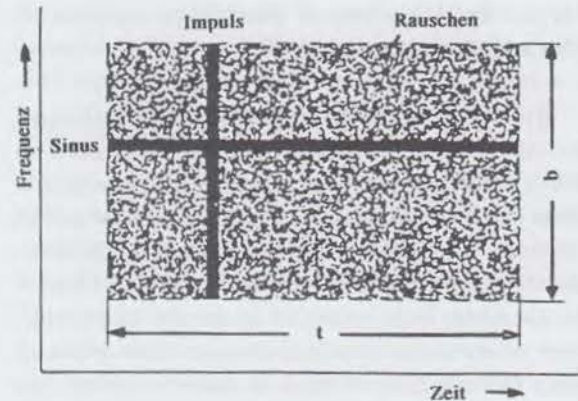
41. Rhea early pointed out that the Cologne Melochord was "designed specifically for studio use—not live performance." T. RHEA, *The Evolution of Electronic Musical Instruments in the United States*, Ph.D., George Peabody College for Teachers, Ann Arbor, Michigan, 1972, p. 203.

for achieving the new and dropping the old to some extent made them blind for the Melochord's potential, which in fact was quite close to what they developed as studio practices for themselves. Thus, they rejected it due to its resemblance to common organs and its conventional keyboard interface.

### Meyer-Eppler's Melochord-Based Experiments and Sound Models

#### Meyer-Eppler's Pragmatic Orientation in Acoustics

Werner Meyer-Eppler assumes the status of an eminent academic authority in science who established an impressive range of fundamental experimental practices in the field of acoustics. His collaborations with colleagues, with engineers and with artists in the 1940s and 1950s display all varieties of highly entangled lexical, practical and intuitive forms of knowledge in order to push technological, mental plus aesthetical limits towards new horizons. The experimentalist Meyer-Eppler always followed a practical orientation that has had left its traces already in his first publication on electrical sound generation from 1949.<sup>42</sup> His pragmatic principle of researching could be formulated as 'Given the initial situation x plus the target situation y, what has to be done?' Consequently, Meyer-Eppler defined categories of sound in terms of how they were to be practically generated. In his lectures, workshops and publications, he made accessible an acoustic world of analogue techniques where every kind of sound could be deduced from another via specific means of instrumental modifications. For example, by means of a graphic (fig. 12)<sup>43</sup> he showed



12. The correlation between noise, sine wave and pulse after a diagram of Meyer-Eppler. Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 61.

didactically how a pulse comes up when the time section is maximally narrowed, and a sinewave comes up when the spectral range is maximally narrowed.

Since Meyer-Eppler understood acoustics as an academic taxonomy of what can be heard, all his acoustical research included psychoacoustical aspects. His experimental approach was dedicated to spell out the experiments of listening based on a broad knowledge about the manifold manifestations of the non-linearity between physical facts and audible phenomena.<sup>44</sup> In terms of acoustical measuring, Meyer-Eppler positioned his research approach in the more general physical frame of quantum physics and transferred Heisenberg's relation of uncertainty into acoustical circumstances.<sup>45</sup> In sum, Meyer-Eppler provided a huge variety of experimental methods, upon which he commented in a highly reflexive manner.

42. Werner MEYER-EPPLER, *Elektrische Klangerzeugung. Elektronische Musik und synthetische Sprache*, Bonn, F. Dümmler, 1949. As a detailed study on Meyer-Eppler's theory of electronic music see E. UNGEHEUER, *Wie die elektronische Musik "erfunden" wurde*, op. cit.

43. Elena UNGEHEUER, "Parallelen und Antiparallelen: Meyer-Eppler und die elektronische Musik," *Neue Musik im Rheinland. Bericht von der Jahrestagung Köln 1992*, Heinz BRENNER (ed.), Berlin, Cassel, 1996, p. 73-85, diagram on p. 75.

44. Elena UNGEHEUER, "Der instabile Klang. Zur Aneignung akustischer Forschung in musikalischer Komposition," *Handbuch der musikalischen Akustik*, Stefan WEINZIERL (ed.), Laaber 2014, p. 155-174.

45. Werner MEYER-EPPLER, "Mathematisch-akustische Grundlagen der elektrischen Klang-Komposition," *Technische Hausmitteilungen des Nordwestdeutschen Rundfunks*, No. 6, 1954, p. 29-39.



## Meyer-Eppler's Sound Models to Inspire Electronic Composing

Meyer-Eppler always emphasized that he wished not to be seen as a composer. With regard to music, he saw his role as a consultant providing a deep expertise in acoustics. The electronic sound examples which Meyer-Eppler produced on his own mostly demonstrated perceptive transformations—for example, from sound to noise and backwards, from white noise to coloured noise, from pulse to tone. He was keen to explain how modifying just a few or only one technical parameter could cause an impressive shift of perception, possibly including technical faults like noise caused by multiple copying of magnetic tapes. During the second half of the 20th century, the western history of composition shows a new trend to increase the quantity of compositional parameters compared to the former modest number of acoustic properties like pitch and duration. The initiative to establish a useful notion of “parameter” for composition that relates directly to all technical and instrumental means of modifying sound has to be mainly attributed to Meyer-Eppler.

It seems important to underline that Meyer-Eppler did not push forward the sinewave as a primordial element that should be reflected in all electronic music. In opposition to the narrative of the music historian Herbert Eimert, Meyer-Eppler never valued raw material as such, but rather its potential to be modified. His pragmatic attitude was what distinguished him as a connoisseur of artistic interests who consequently was invited as a speaker to nearly every important conference about electronic music. In Basel (Tagung über Elektronische und Konkrete Musik, 1955), he put it like this: “*Fundamentally the electronic sounds allow to arbitrarily transform the elementary signals into each other. (...) Even pulses can be transformed. When filtered they are transformed into decaying sine-wave tones. If the filtered pulses follow each other periodically with sufficient speed, the result is a sound, while if aperiodic, noise.*”<sup>46</sup>

46. “*Grundsätzlich bieten die elektronischen Klangmittel die Möglichkeit Elementarsignale beliebig ineinander umzuwandeln. (...) Auch Impulse lassen sich umwandeln. Durch Filter werden sie in abklingende Sinustöne verwandelt. Folgen die gefilterten Impulse rasch genug periodisch aufeinander, so entsteht ein Klang, folgen*

## *The Melochord: Meyer-Eppler's Basic Tool for Sound Transformations and for Montage*

### Sound Montage within Static Layerings

A series of Meyer-Eppler's sound models had been designed with the goal of presenting new options to superimpose sound layers: Rhythmic patterns, melodies, noises, which formed, what could be described as ‘sonic cartoons’, filled with little effects, gadgets and didactical settings. Despite a few interesting noise aspects, none of them could be called innovative or experimental. They were rather simplified models of how an orchestration work. They could be labelled as static since the single sound layers did not interrelate and did not touch each other in terms of frequency range, hardly masking each other. Meyer-Eppler on the one hand wanted to show the basic preconditions of tape recording, on the other hand he demonstrated the timbre richness of an electronic musical instrument. The perhaps most innovative challenge of this kind of static sound montage laid in the role of a manifold sound producer (today we would speak of a synthesizer), which the Melochord had to play.

### Dynamic Arrangements of Sound Transformations

The second main type of sound models was dedicated to the contrary: dynamic, or moving. Meyer-Eppler decelerated and accelerated the playing speed of the tape recorder in order to show how fundamentally the sound qualities were affected by this simple operation. In one instance, he cut a continuous deceleration process in three parts and gained three totally different sound arrangements, starting with a repeated melody and ending with a slowly tremoring noise. Iterative processes completely transformed the initial sounds. The knobs of the Melochord were turned on and off and the instrument's different modification options (filtering, changing between electronic sounds and voice sounds, amplitude and frequency modulation,

*sie unregelmässig, so entsteht Rauschen.*” Lecture manuscript, Akademie der Künste, Berlin, Werner-Meyer-Eppler-Archiv, Nr. 61.



etc.) were interwoven in a sophisticated manner. In this category of sound models masking, fusing, morphing were categorised. The Melochord and the tape recorder worked together to exemplify the experimental ideas of the author, Meyer-Eppler. This profound change in musical thinking was symbolically demonstrated by him at his first lecture in an artistic context (Internationale Ferienkurse für Neue Musik in Darmstadt 1950). A 100 Hertz tone was continuously superimposed by a slowly rising tone. Due to the increasing copy noise of the iterative operations, a dense pulsing sound *gestalt* dominated more and more, filling out the whole range between tone and noise.

### *Artistic Manifestations of Melochord-Based Sound Models*

#### Continuous Transformations of Sound: A Pioneering Musical Objective

In terms of aesthetics, the ground-breaking aspect of continuity, be it on a sonic level or on a pragmatic level of manipulating technical parameters, lays in its innate alternative to common atomistic concepts of musical composing.<sup>47</sup> As a matter of fact, the question of compositional elements, material and *gestalts* (Where do the start and end? How reliable are they?) must be asked anew if sound shapes are originating morphologically from one another. Finally, it is our perception that again thwarts the continuity effect: Humans always activate threshold values in order to satisfy interpretative categories, schemes and expectations. One of the most fundamental sound experiments which Meyer-Eppler presented many times was based on this idea: An accelerating sequence of pulses causes

47. Elena UNGEHEUER, "Die Geburt der Idee aus dem Geist der Technik? Anmerkungen zum Klangkontinuum in der elektronischen Musik," *Musiktheorie*, 12/1 (1997), p. 27-36; *Id.*, "From the Elements to the the Continuum: Timbre Composition in Early Electroacoustic Music", *Contemporary Music Review*, 10/2 (1994), p. 25-33; *Id.*, "Le fini et l'infini: catégories de la composition et de la perception musicale," *Actas del Primer Congreso Internacional de Ontología. Categorías e inteligibilidad global*, Publicaciones de la Universitat Autònoma de Barcelona, Enrahonar. Monografies 6, Bellaterra 1994, p. 493-499.

first the perception of a rhythms, then of a continuously rising tone. Karlheinz Stockhausen took this experiment as a starting point for his famous musical theory of time (...*wie die Zeit vergeht...*<sup>48</sup>).

In general, electroacoustic music shows a tendency towards phenomena of transitions, shifts, and changes. Gottfried Michael Koenig made complex form principles out of the idea of continuous transformation (explicitly in his compositions *Essay* and *Terminus I*). György Ligeti established a huge variety of glissando *gestalts* in his (also non-electronical) pieces. In *Perspectives*, a piece Luciano Berio realized in the studio of Milan in 1957, sound sequences made of pulses were presented in different playing speeds. *Continuo* is the name of an electronic piece Bruno Maderna composed in 1958. Mauricio Kagel talked about the principle of translation as a basic model for his first electronic piece he made in Cologne, *Transición I* (1959/60). It was supposed to realize a perfect continuity beyond categories like beginning and ending. The composers' interest in artistic research, as it might be put in today's terms, affected their relation to sound and to their own listening to sound.

#### Literal Use of Meyer-Eppler's Melochord Sounds in Music

Heinz Schütz, *Morgenröte*

The role of technicians and engineers as co-creative agents in the field of electronic music cannot be underestimated. Heinz Schütz has been the first radio technician entrusted explicitly to help setting up the first electronic studio at the broadcasting station Cologne (NWDR). His position was at the front end of the machines; in the background sound engineer Dr. Fritz Enkel, head of Low Frequency Division supervised the new studio developments. In 1951, Heinz Schütz realized a piece of tape music programmatically named *Morgenröte*. It makes audible how Schütz treated tape recorders as musical instruments, e.g. by decoupling the right-hand plate that normally is assumed to wind the

48. Karlheinz STOCKHAUSEN, "... wie die Zeit vergeht ..." [1957], *Texte zur Musik 1. Aufsätze 1952-1962 zur Theorie des Komponierens*. Dieter SCHNEBEL (ed.), Cologne, DuMont Schauberg, 1963, p. 99-139.



tape. Then he was able to move rhythmically the tape passing along the recording head. Following this instrumental gesture in combination with the inertia moment of the mechanics, bell-like sounds coloured the *Morgenröte*. Schütz' sensitive handling of the sliders allowed him to provide the sounds with individual envelopes. A great amount of the tape material from *Morgenröte* was taken from Meyer-Eppler's Melochord sound examples (see Archiv der Akademie der Künste Berlin), which were put together simultaneously and successively in the manner of a collage, a style characteristic of the early compositions produced at the Cologne studio. Since many of these pieces share the same basic material, it is not an exaggeration to say that Bode's Melochord shaped their sound for large part.

Robert Beyer and Herbert Eimert, *Klang im unbegrenzten Raum*

Up to the presentation of the first musical results of the new electronic studio at the *neues musikfest* in Cologne (1953), Beyer, Eimert, and Meyer-Eppler already took responsibility for two experimental phases: *Spiel für Melochord*, which mainly combined Melochord sound produced by Meyer-Eppler. The following four tonal studies were assigned to Beyer and Eimert, one of them was *Klang im unbegrenzten Raum*: Melochord sounds were combined with sound effects generated with the help of a beat frequency oscillator and tape machines. Again, they partly showed the role of radio technician Heinz Schütz.

Bruno Maderna, *Musica su due dimensioni*

*Musica su due dimensioni* ranks as one of the first live-electronic pieces and its prerecorded tape contains Melochord sound<sup>49</sup>. Its history is related

49. As is known Maderna used this title for two different pieces. The first one was conceived for flute, tape and cymbals. Here Meyer-Eppler was involved. Its complete title is *Musica su due dimensioni* (1952). The piece has been published in a critical edition: Bruno Maderna, *Musica su due dimensioni* (1952), a cura di Nicola Scaldaferrì. Riedizione critica delle opere di Bruno Maderna diretta da Mario Baroni e Rossana Dalmonte, Milano, Edizioni Suvini Zerboni, 2001. The second piece is composed for flute and tape (1958), it is entitled simply *Musica su due dimensioni*.

to the that of musique concrète. Pierre Henry's and Pierre Schaeffer's sung and recorded sounds combining opera *Orphée* had been suffering a performance disaster at its creation in Donaueschingen in 1951 (among other things, due to bad loudspeakers). The technical deficiencies exposed the conceptual weakness of the piece. Consequently, after that, Meyer-Eppler was eager to avoid harsh confrontations between electronic and live performed sounds. There exists a letter exchange<sup>50</sup> witnessing Meyer-Eppler's awareness of the two worlds of perception due to the limits of technology at that time, thus inspiring the title of Maderna's piece. Both of them tried to manage the imbalance between recorded and performed sounds by reducing overlapping situations. In principle, every sound quality should have its own time period. This idea should probably be attributed to Meyer-Eppler since the compositional sketches show Maderna's interest to intermingle both areas. Meyer-Eppler finally helped to realize a tape part that contained Melochord as electronic imitations of the flute sounds performed on stage, with the result of a homogeneous synchronisation.

### *The Melochord's numerous facets of instrumental design*

Since its very beginnings in the early 20th century, the history of electric sound used in music has been escorted by strong ideological debates. Up to now, one of the topics of conflict has been the tension between the poles of imitation and innovation in terms of technology, design, handling, sound results and artistic use. Electronic musical instruments such as the Melochord have found themselves caught in the crossfire between these opposing positions.

Concerning imitation, the main stakeholder has been the builders of the instruments themselves: Considering the highly developed standard

50. Letter from Meyer-Eppler to Maderna, Gianmario BORIO and Hermann DANUSER (ed.), *Im Zenit der Moderne. Die Internationalen Ferienkurse für Neue Musik Darmstadt 1946-1966*, vol. 2, Freiburg, Rombach, 1997, p. 86-87. For the whole context within the electronic compositions at Darmstadt. Pascal DECROUPET, "[IV.] Elektronische Musik", *ibid.*, p. 63-118.



of acoustical instrument making in those cultures that fostered electric sound generation, it is easy to understand the need for convincing arguments in order to legitimise the new electrical approach to building musical instruments. What are the electrical instruments designed for? Do they compete with non-electrical ones? During the first period of electrical musical instruments, the 1910s and 1920s, the instruments themselves resulted mostly from evening activities of physicists or engineers. That underlines the importance they attached to realizing their musical mindset, which showed a great loyalty towards exponents of occidental music history (such as Bach and Mozart). Thus, an unquestionable non-competitive profile of the instrument's purpose was declared in leaflets and in radio exhibitions. Supporting domestic music, bringing a huge spectrum of instrumental colours into the living room, controlling volume within a wide range, organ-like playability had to be proclaimed. This strategic alignment, supported by rather plain demonstrations of old-fashioned tunes during trade fairs etc., made the electrical performance instruments—including the later Melochord in its first Bode-design—appear to be an imitative endeavour.

Concerning innovation, the main stakeholders have been those who appreciated the new technological approaches in themselves: Even if some of its realisations have had to wait some decades and although the number of protagonists formed a minority against a large history-oriented mainstream, during the first half of the twentieth century, music and art aesthetics of its own showed a considerable tendency in their own right to innovation (dodecaphony, micro-tonality, free tonality). This includes the incorporation of external impulses from construction sciences (such as László Moholy-Nagy), industrial techniques (futurists, montage techniques), and experimental physics (optical sound). On the part of the artists concerned, this openness caused high expectations with regard to new procedures of interest. This orientation made electric sound generation appear to be as an innovative endeavor as such.

With regard to the Melochord this controversy is highly condensed into one instrument. Since the first versions of the instrument had the unspectacular appearance of an electronic organ, and since the Bonn and Cologne Melochords already differed to a large extent in terms of the handling options

offered via the interface, we should talk about at least two steps of the Melochord's instrumental development. But still for the second-step-Melochord, the attribution of innovative and imitative aspects remains ambiguous, and depends upon the musical function the Melochord fulfills.

### The Melochord: A Traditional Instrument for Performance

Bode tried to please everyone with his engineering artistry. But, as indicated above, there were discrepant ideological orientations surrounding electrical sound generation, specifically between the imitative and the innovative approaches. To outline: As a strong advocate for innovation, Edgard Varèse demanded liberty for the laboratory-like realization of musical art beyond what performers were able to produce.<sup>51</sup> Robert Beyer, music director and sound expert at one of the first sound-film companies, came to the point from the perspective of an aesthetic innovation close to what Ferruccio Busoni unfolded in his *Entwurf einer neuen Ästhetik der Tonkunst* (1907/1916): namely, envisaging the threatening fall of musical vision due to the limits of musical instruments. Already in an article of 1928, he exposed the imprisonment of the magic of electric sound generation created by the keyboard as a closed interface that does not allow access to the core of sound generation. The imitative organ-like standard setting of Bode's first Melochords—a typical feature in the field of consumer electronics to ensure the performer's access to electronic sounds with as little resistance as possible—was a thorn in the side of the advocates of an autonomous electronic music. Discussions concerning reasonable degrees of pre-designed sounds have dominated the synthesizer-world until today. Beyer had to wait until 1949, then in his capacity as sound engineer at NWDR broadcasting Cologne, to attend the presentation of electronic sound generation in a manner that made the composer's direct access to all kinds of sound modification a concrete option. The occasion was that upon which Werner Meyer-Eppler presented the Vocoder at the first sound

51. E. UNGEHEUER, *Wie die elektronische Musik "erfunden" wurde*, op. cit., p. 42 sq. and 99.



engineering conference in Detmold (1949).<sup>52</sup> To avoid any misunderstanding: the telephony device Vocoder had never been played within, nor even acquired for the Cologne electronic studio. But the Vocoder's schematic that Meyer-Eppler displayed in Detmold while talking about 'spectral modulation' started things off: Consequently, it was Beyer who brought Meyer-Eppler's expertise to the Cologne Broadcasting, and who persuaded the intendant, Hanns Hartmann, to invest into a terra incognita named 'electronic music'.

Beyer brought together the whole know-how of electronic sound engineering in the early 1950s in a famous radio program on October, 18<sup>th</sup>, 1951, in order to celebrate the foundation of a new electronic studio. Participating were Friedrich Trautwein (builder of the trautionium), Herbert Eimert (editor of the "Musikalisches Nachtprogramm", an unparalleled rich and authentic series of nocturnal features on any important matter of avant-garde music at that time, and a main source of financing for artists as script writers, translators, announcers, etc.), Werner Meyer-Eppler, and Robert Beyer himself. This program witnessed a multi-layered and non-homogenous discussion on promises, goals and questions attached to the new perspectives of using electric sound engineering for musical purposes. Beyer basically criticized the Melochord sound examples as still being captured within pitch relations of traditional melodies. He took a different stance regarding the Vocoder sound examples, as he himself emphasized, referring to his idea from 1928 to realize a free-floating timbral music.

During the radio debate, Beyer's radical exclusion of imitative electronical musical instruments had been contradicted by Trautwein's plea for sophisticated electronical instruments: His monochord was supposed to be installed in the studio, together with a Bode Melochord. Meyer-Eppler was busy unfolding a series of detailed findings in the field of acoustics. He did not position the Melochord either as a performance instrument or as a piece of studio equipment in this situation, but talked about Melochord examples as experimental material. Later, in 1956, he took a critical stance while classifying a first generation of

electrical musical instruments—not including the Melochord, however—as unsuitable for serious musical purposes.<sup>53</sup>

Most avant-garde composers interested in working at the electronic studio in Cologne shared Beyer's position against imitative performance instruments. In August 1953, Henri Pousseur visited his friend Karlheinz Stockhausen in Cologne and listened to the first 90 seconds of the latter's *Studie I* as well as to tapes with the new pieces attributed to Robert Beyer and Herbert Eimert. These pieces had earlier been presented at the *neues Musikfest* in Cologne. Among them, was *Spiel für Melochord*, made nearly completely by Melochord sound sequences, as can be found in the scientific estate of Meyer-Eppler. Already in autumn 1952, Pierre Boulez reported to Pousseur in a letter about an interesting construction with a damnably traditional sound-aesthetic. After his visit, Pousseur wrote disparagingly in his article "Vers une musique intégrale": "In the 'electronic studios' of Bonn and Cologne, sound products are put together in the most trivial ABC manner or in the manner of a cheap impressionism. These sound elements are produced by instruments with fixed timbres and a traditional pitch scale, such as the Melochord and the Trautionium, both German brothers of the ondes Martenot."<sup>54</sup>

### The Melochord as an Instrument for Composing

In fact, the way Meyer-Eppler designed and used it, the (later) Melochord can be described as an instrument for composing in the avant-garde sense of the time: Designing sounds via playing, recording and assembling. It is worth noting that these different functional areas fall into the classificatory system set up to carve out the difference

53. Werner MEYER-EPPLER, "Leichte Musik' und Elektrotechnik in Vergangenheit und Gegenwart," *Gravesaner Blätter*, Heft 2-3, 1956, p. 78.

54. Henri POUSSEUR, "Vers une musique intégrale", *Jeunesses musicales*, November 1953, s.p., [translated by E. Ungeheuer] "In den 'elektronischen' Studios von Bonn und Köln baut man nach dem allerbanalsten Noten-ABC bzw. nach Art des billigsten Impressionismus die Klangprodukte von Instrumenten mit festgelegten Klangfarben und einer traditionellen Tonhöbenskala wie dem Melochord und dem Trautionium, deutsche Brüder der Onde Martenot (sic) zusammen."

52. *Ibid.*, p. 98-102.



between musically working with machines or with instruments<sup>55</sup>. The basic matrix of the system in question interconnects machines (equipped with a storage device for sounds, sound sequences and any data) and instruments (not equipped with similar devices) with two types of interfaces: closed interfaces and open interfaces. Closed interfaces allow activating pre-configured sound constellations, while open interfaces require complex activities on the part of the player, who mentally has to anticipate the targeted sound and make bodily gestures in order to shape sound in time. The history of electronic music shows that compositional and aesthetical innovation has been highly related to instruments with open interfaces. Explicitly, the electronic studio at Cologne radio station bears testimony to that finding. After 1953 it never used the Melochord and Trautonium anymore. Telecommunication devices such as beat frequency oscillators, filters, tape recorders, ring modulators, slider controls, etc., became important instruments, which strongly required appropriate instrumental gestures in order to support the musical concepts. The interest in mechanisation and automatisations increased only at a later stage. Semi-automatic processes, as Stockhausen named them around the time of his composition of *Hymnen*, allowed one to impose progression characteristics from one sound parameter to the other. Voltage control allowed kind of background formula to organize a series of instruments following one concept or gestalt, which could be incorporated in the compositional system, e.g. a serial system.<sup>56</sup>

Voltage control techniques enabled a complex circuitry without necessarily turning the ensemble of connected instruments into a machine with a closed interface. Robert Moog perfected this approach which led to the presentation in 1964 of his modular synthesizer. Non-standardized use,

experimental openness towards unexpected sound results, and the invitation to do 'electronic hand-crafts', just to name three important figures of innovation-oriented creativity, remain. The Melochord and Bode's collaboration with the experimental personality of Meyer-Eppler, which can hardly be assumed to be accidental, match the employment biography of Harald Bode, including his role in the inspiration of Robert Moog's conceptions of the synthesizer.

### The Melochord as a Portable Electronic Studio

The paragraphs above point out a significant proximity of the Melochord design to the Moog synthesizer in different respects. It remains to declare that this article has no interest in creating a new legend of the real pioneer of the concept of modular synthesizing. The history of electricity, including the history of electronic sound generation, is accompanied by a bloody history of pioneers—true and false ones—, and by battles around patent documents, hostility and intrigues. As a matter of fact, Meyer-Eppler took the Melochord as a portable electronic studio to be an important part of his acoustic laboratory, thus as a studio within a studio, and Bode co-created new technical implementations. And this leads us to the important message: It is not about technical media determining the dealing with and finally originating new orientations. Against this type of media determinism, developments around the Melochord reveal how the mindset, the awareness and the individual perspective were able to turn a traditional imitative play instrument towards a modularized approach and to inspire music history to large-scale reorientations even without ever been played by professional composers in these contexts.

English adaptation Marc Battier

55. E. UNGEHEUER, "Imitative Instrumente und innovative Maschinen?" *op. cit.*, esp. p. 51-53.

56. Gottfried Michael KOENIG, "Die zweite Phase der elektronischen Musik (1965)," *Ästhetische Praxis. Texte zur Musik*, Roger PFAU (et al.), vol. 2, p. 316-335 (esp. the commentary on his composition *Terminus I*, p. 324-327).



## APPENDIX

The Bode Meyer-Eppler Correspondence October/November 1949<sup>57</sup>

## (1) Meyer-Eppler to Bode

{ohne Adresse} 26.9.49.  
Herrn | Harald Bode | Neubeuern /Inn

*Sehr geehrter Herr Bode!*

*Haben Sie schönen Dank für die Zusendung des Melochord-Bandes. Die Aufnahme hat hier grossen Eindruck gemacht. Es ist schön, dass der erklärende Text gleich mit aufgesprochen ist.*

*Besonders interessant waren für mich die gezupften Bläserklänge mit verschiedenem Dämpfungsdekrement. Die scheinbare Änderung der Klangfarbe oder besser des Klangcharakters beim Übergang von stationären zum nichtstationären Klang ist frappant. Für den Musikwissenschaftler ergeben sich hier noch mancherlei Perspektiven.*

*Mit Herrn Dr. Thienhaus hatte ich übrigens während der gestern beendeten Physikertagung hier eine angeregte Diskussion über den Wert der elektronischen Musikinstrumente für die neue Musik und bedaure es sehr, dass ich Ihr Band nicht mehr vorführen konnte; es hätte ihm gewiss einen anderen Eindruck von der Sache vermittelt als es eine Hammond-Organ tun kann.*

*In der Hoffnung, bald wieder von Ihnen zu hören, und mit nochmaligem Dank | bin ich | Ihr | (ms.) W. Meyer-Eppler*

*P.S. Mein Buch über "Elektrische Klangerzeugung" wird in etwa 8 Tagen bei Dümmler, Bonn, erscheinen.*

[without adress] 26.9.49.  
Mr. | Harald Bode | Neubeuern /Inn

Dear Mr. Bode!

Thank you very much for sending me the Melochord tape. The recording made a great impression here. It is good that the explanatory texts are also on the recording.

Of particular interest for me were the plucked wind sounds with different damping decrement. The apparent change of the timbre or, more precisely, of the sound-character in the transition from stationary to non-stationary sound is striking. For the musicologist, a number of perspectives are opening up here.

During the conference of physicists that ended yesterday I had a lively debate with Dr. Thienhaus<sup>58</sup> on the value of the electronic music instruments for new music, and I really regret that I could not present him your tape; it certainly could have given him quite a different impression of this than a Hammond Organ can.

Hoping to hear from you soon, with further thanks | I am | your  
(ms.) W. Meyer-Eppler

P.S. My book on "Electronic Sound Generation" will appear in 8 days with Dümmler, Bonn.

57. Akademie der Künste, Berlin, Werner Meyer-Eppler-Archiv, Nr. 61. Translated by the authors.

58. Erich Thienhaus (1909-1968), organologist and acoustician, founder of the "Musikalisch-akustische Institut" for the education of sound engineers at the Nordwestdeutsche Musikakademie at Detmold.

## (2) Bode to Meyer-Eppler

*Harald Bode | Neubeuern a. Inn**(13b) Neubeuern, den 2.10.49**Herrn Dr. W. Meyer-Eppler | Phonetisches Institut | der Universität Bonn.**Sehr geehrter Herr Doktor!**Es freut mich, zu erfahren, dass das Melochordband gut bei Ihnen angekommen ist, und dass Sie mit der Form der Klangdemonstrationen einverstanden sind. Für die Bespielung des 2. Teiles ergab sich zufällig im Studio des Bayerischen Rundfunks auf der Münchener Elektromesse Gelegenheit, da auch das Melochord dort ausgestellt war.**Meine Instrumente sind bereits lieferbar, die Preise der verschiedenen Typen bewegen sich zwischen DM 1.800 – für ein einstimmiges Modell ohne Zupfklänge mit 3-oktaviger Tastatur und DM 4.800 – für ein 2-stimmiges Modell mit Zupfklängen, synchronisierten Koppeln und einer 5-oktavigen Tastatur kompl. mit Verstärker und Lautsprecher.**Selbstverständlich verbilligen sich die Instrumente bei einem Verzicht auf äusseren Komfort und bei Einsparung des Verstärkers und des Lautsprechers, sofern diese bereits in ausreichender Qualität verfügbar sind. Vielleicht teilen Sie mir einmal mit, welche Mittel Ihr Institut etwa für ein solches Instrument zur Verfügung stellen könnte und welchen Aufwand Sie andererseits gern wünschen, d.h. ob Einstimmigkeit, Zweistimmigkeit, Blas- und Zupfklänge, Koppeln, feste oder auch stufenweise mit der Tonhöhe des Grundtones abgestimmte Filter, Tonumfang u.s.w. Ich würde Ihnen dann ein detailliertes Angebot ausarbeiten, das Ihren Ansprüchen weitgehend gerecht wird.**Mit grossem Interesse habe ich erfahren, dass jetzt Ihr Buch im Dümmelverlag in Bonn erscheinen wird. Ich werde in den nächsten Tagen dorthin schreiben und bin schon sehr gespannt darauf.**Ich freue mich, bald mehr von Ihnen zu hören und verbleibe einstweilen mit den besten Grüissen | Ihr | (ms.) Harald Bode**Harald Bode | Neubeuern a. Inn**(13b) Neubeuern, the 2.10.49**To Dr. W. Meyer-Eppler | Phonetic Institute | University of Bonn.**Dear Doktor!**I am glad to hear that the Melochord tape arrived safely, and that you agree with the form of the sound demonstrations. For the second part of the tape I had a chance opportunity during the Munich Electronic Exhibition, since the Melochord was exhibited there, too. My instruments are already deliverable. The prices of the different types vary between DM 1.800—for a one-voice model without plucked sound with 3-octave keyboard, and DM 4.800—for a 2-voice model with plucked sounds, synchronized couplers and a 5-octave keyboard, including amplifier and loudspeaker.**Of course the prices of the instruments are reduced when one can forego external comfort and amplifier and speaker are waived, as long as they are already available in adequate quality.**Perhaps you can tell me next time what financial means your institute is able to provide for such an instrument, on the one hand, and what technical features you desire, on the other, i.e. if you would like to have one or two voices, wind/brass and plucked sounds, couplers, filters that are either fixed or gradually adjust to the pitch of the fundamental tone, range, etc. I could then prepare a detailed quotation that will largely fulfill your requests.**I've learned with great interest that your book will appear soon with Dümmel in Bonn. I shall write to the publisher in the next few days, and I am already very excited about it.**Looking forward to hearing from you soon, I remain | sincerely yours | (ms.) Harald Bode*



## (3) Meyer-Eppler to Bode

*{Ohne Adresse}*

10.10.49

Herrn | Harald Bode | Neubeuern a.Inn*Sehr geehrter Herr Bode!*

*Für Ihren freundlichen Brief vom 2.10. danke ich Ihnen bestens. An Ihrem Melochord sind wir sehr interessiert, nach Möglichkeit an einem Modell, mit dem auch zweiförmige Klänge (Vokale) gebildet werden können, und zwar sowohl als Dauervokale wie als gezupfte Kurzvokale. Die Mittel für alle grösseren Anschaffungen stehen uns allerdings nichts laufend zur Verfügung, sondern wir sind da auf den etwas dornenvollen Weg angewiesen, unsere Mäzene für das jeweilige Projekt zu erwärmen. Ich wäre Ihnen deshalb sehr dankbar, wenn Sie für das Institut einmal einen Kostenvoranschlag für ein Instrument der geschilderten Art mit Verstärker und Lautsprecher aufstellten, den wir dann, mit der Vorführung Ihres Bandes, als Erläuterung, den Herren vorlegen können.*

*Es würde wahrscheinlich genügen, wenn wir ein einstimmiges Instrument hätten (oder besitzt Ihr zweistimmiges Instrument getrennte Manuale?); die Formantbereiche sollten kontinuierlich zu verändern sein, damit man auch vokalische Zwischenfarben einstellen kann. Ferner sollte es möglich sein, den Tongenerator abzuschalten, um äussere Wechselstromquellen anderer Art (z.B. Rauschgeneratoren) anschliessen zu können und vokalisches zu färben.*

*Ein Tonumfang von 5 Oktaven wäre zweckmässig.*

*Mit besten Grüßen | Ihr | (ms.) W. Meyer-Eppler*

[without address] 10.10.49

Mr. | Harald Bode | Neubeuern a.Inn

Dear Mr. Bode!

Thank you very much for your friendly letter of 2. October. We are very interested in your Melochord, if possible in a model that is able to build two-formant sounds (vowels), namely as both continuous vowels and plucked short vowels. The means for all larger acquisitions are not available on an ongoing basis, hence we have to follow the rather thorny path of warming up our patrons to the actual project. So I would be very grateful if you could prepare for the institute a quotation for an instrument of the type described, with amplifier and loudspeaker. Then we could submit it to the gentlemen, together with the presentation of your tape as explanation.

It would probably be sufficient for us to have a one-voice instrument (or does your two-voice instrument have two separate manuals?); the frequencies for the formants should be continuously variable, so that one can adjust intermediate colors of the vowels. It should also be possible to switch off the tone generator in order to connect AC sources of other kinds (e.g. noise generators) and color them vocally.

A range of 5 octaves would be appropriate.

Best regards | your (ms.) W. Meyer-Eppler

## (4) Bode to Meyer-Eppler

Harald Bode | Neubeuern a.Inn(13b) Neubeuern, den 25.10.49Herrn Dr. W. Meyer-Eppler | Phonetisches Institut | der Universität Bonn.*Sehr geehrter Herr Doktor!*

*Entschuldigen Sie bitte, dass ich erst heute dazu komme, Ihren freundlichen Brief vom 10.ds.Mts. zu beantworten. Ich freue mich über Ihr Interesse an einem Melochord, und ich werde Ihnen in den nächsten Tagen ein Angebot über 2 verschiedene Instrumente ausarbeiten, und zwar über ein einstimmiges Instrument mit einer*

*3-oktavigen Klaviatur, dessen Stimmbereiche so umschaltbar sind, dass ein Tonumfang von 5 Oktaven beherrscht wird, und ausserdem über ein zweistimmiges Instrument mit einer 5-oktavigen Klaviatur, bei dem zwei je einstimmige Bereiche mit 2 bzw. 3 Oktaven Umfang nebeneinander liegen. Diese beiden Stimmen können dann bezüglich der Klangfarbe, der Lautstärke und der Modulation getrennt voneinander behandelt werden. Ich werde Ihnen mit dem Angebot noch eine genauere Beschreibung folgen lassen.*

*Heute darf ich vielleicht erwähnen, dass ein vollstimmiges Instrument, an dessen Fertigstellung ich gerade arbeite, auch – unter anderem – mit zweiformantigen Klängen ausgestattet sein wird, sodass es in dieser Richtung eine gewisse Verwandtschaft mit dem von Ihnen gewünschten Modell aufweisen wird. Ich würde Ihnen aber empfehlen, Ihr Melochord ausserdem auch mit überkritisch gekoppelten elektrischen Resonatoren auszustatten, damit man gewissen charakteristischen Eigenschaften der Vox humana noch näher kommt. Ich habe schon früher mit solchen Anordnungen sehr gute praktische Erfahrungen gesammelt im Gegensatz zu anderen Forschern, die sich nur auf die Verwendung separater Formaten beschränkten. Selbstverständlich würden sämtliche Bestimmungsgrößen der Formanten einstellbar sein.*

*In etwa einer Woche hoffe ich Ihnen das Angebot zugehen lassen zu können. Bis dahin verbleibe ich | mit den besten Grüßen | Ihr | (ms.) Harald Bode*

Harald Bode | Neubeuern a.Inn

(13b) Neubeuern, 25.10.49

Dr. W. Meyer-Eppler | Phonetisches Institut | der Universität Bonn.

Dear Doctor!

Please excuse me that I am only today getting around to answering your friendly letter of 10. October. I am pleased with your interest in my Melochord, and in the next few days I will prepare a quotation for two different instruments, namely a one-voice instrument with a 3-octave keyboard, whose range is switchable within 5 octaves, and further for a two-voice instrument with a 5-octave keyboard and two monophonic playing areas of 2 and 3 octaves' range side by side. These two voices are separately variable in timbre, loudness and modulation. Along with the quotation I shall also send you a more precise description.

Let me mention today that I am in the final stages of completing a full-voice instrument. As it is equipped with two-formant sounds, among other things, it will have some resemblance to the model you desire. I would also advise you to equip your Melochord with supercritically coupled electric resonators to get closer to certain characteristic features of the Vox humana. I have gathered very good practical experience with such arrangements in the past, in contrast with other researchers, who were limited to the use of separate formats. Of course all parameters of the formants would be adjustable.

I hope to send you the offer in about a week. Until then I remain | with best regards | your | (ms.) Harald Bode

## (5) Bode to Meyer-Eppler

Harald Bode | Neubeuern a.Inn

(13b) Neubeuern, den 3.11.49

Herrn Dr. W. Meyer-Eppler | Phonetisches Institut | der Universität Bonn.

Sehr geehrter Herr Doktor!

*In der Anlage übersende ich Ihnen heute die Angebotsunterlagen über die verschiedenen von mir vorgeschlagenen Melochordmodelle. Ich habe die Angaben getrennt und in Briefform gefasst, damit Sie selbst dasjenige aussuchen können, das Sie Ihren Mäzenen unterbreiten wollen. Die äussere Form des grösseren Modells kennen Sie ja bereits aus dem Ihnen übersandten Lichtbild.*

*Es würde mich freuen, wenn eines der beiden Modelle gebaut werden könnte und wünsche Ihnen bei Ihren Finanzierungsbemühungen viel Erfolg!*

*Ich hoffe, bald mehr von Ihnen zu hören und verbleibe | mit den besten Grüßen | Ihr | (ms.) Harald Bode*



Harald Bode | Neubeuern a.Inn  
To Dr. W. Meyer-Eppler | Phonetic Institute | Bonn University.

(13b) Neubeuern, 3.11.49

Dear Doctor!

Please find attached the quotation documents for the different Melochord models I am proposing to you. I have prepared the documentation separately and in the form of letters, so that you yourself can pick out the one you wish to submit to your patrons. You already know the external shape of the larger model from the attached photo.

I would be very happy if one of the models could be built, and wish you good success with your financing efforts!

Hoping to hear more from you, I remain | with best regards | your | (ms.) Harald Bode

### (6) Meyer-Eppler to Bode

Dr. W. Meyer-Eppler

9.11.49

Herrn | Harald Bode | Neubeuern a.Inn

*Sehr geehrter Herr Bode!*

*Haben Sie besten Dank für Ihren Brief vom 3.11. mit den Angebotsunterlagen. Wir werden versuchen, unsere Geldgeber zur Bestellung des grösseren Modells zu veranlassen, da dieses auch für die Musikwissenschaftler von Interesse sein dürfte. Hoffentlich haben wir in absehbarer Zeit Erfolg mit unseren Bemühungen bei den Mäzenen.*

*In Ihrem Brief vom 25.10. erwähnen Sie ein vollstimmiges Instrument, an dessen Fertigstellung Sie gerade arbeiten. Enthält dieses Generatoren für jeden Ton, oder arbeiten Sie mit Frequenzteilung? Sobald Sie den Preis eines solchen Instruments übersehen können, würde es mich interessieren, ihn zu erfahren.*

*Mit den besten Grüßen | Ihr | (ms.) W. Meyer-Eppler*

Dr. W. Meyer-Eppler

9.11.49

To | Harald Bode | Neubeuern a.Inn

Dear Mr. Bode!

Thank you for your letter from 3. November with the offer documents. We will try to convince our sponsors to order the larger model, for it could also be interesting for the musicologists. I hope we will be successful with the patrons in the foreseeable future.

In your letter from 25. October you mention a full voice instrument you were in the process of finalization. Is it equipped with generators for each tone or are you using frequency separation? As soon as you can estimate the price of such an instrument, I would like to know it.

With best regards | (ms.) W. Meyer-Eppler

### (7) Bode to Meyer Eppler

Harald Bode | Neubeuern a.Inn

(13b) Neubeuern, 23.11.49

Herrn Dr. W. Meyer-Eppler | Phonetisches Institut | der Universität Bonn.

*Sehr geehrter Herr Doktor!*

*Vielen herzlichen Dank für Ihr freundliches Schreiben vom 3. ds. Mts. Entschuldigen Sie bitte oftmals, dass ich erst heute dazu komme, es zu beantworten.*

*Das neue vollstimmige Instrument arbeitet ähnlich, wie das Hammond-Novachord – mit Kaskadensynchronisation, allerdings nach einer von mir neu entwickelten Schaltung, die gegenüber dem Novachord Vereinfachungen aufweist. Der Röhrenaufwand für die Tonerzeugung der 5 Oktaven vom C bis zum c4 beträgt 61 Röhren. Weitere*

- *12 Röhren sind für Verstärker und andere Zwecke vorgesehen. Das Instrument hat die Grösse meines jetzigen Melochords und kostet voraussichtlich DM 3.500.*

*Genauere Unterlagen werde ich Ihnen gerne noch in nächster Zeit zusenden.*

*Mit den besten Grüßen, | Ihr | (ms.) Harald Bode*

Harald Bode | Neubeuern a.Inn

(13b) Neubeuern, 23.11.49

To Dr. W. Meyer-Eppler | Phonetic Institute | Bonn University.

Dear Doctor!

Thanks very much for your friendly letter of 3. October. Please excuse me that I am only today getting around to answering it.

The new full-voice instrument operates in a way similar to the Hammond Novachord—with cascade synchronisation, but with circuitry I have newly developed that is simpler than that of the Novachord. The tone generation within the 5 octaves from C to c4 requires 61 tubes. An additional 12 tubes are provided for amplification and other purposes. The instrument has the size of my current Melochord and is estimated to cost DM 3.500.

I shall send you more precise documents soon.

With best regards | your | (ms.) Harald Bode



XIX<sup>e</sup> et XX<sup>e</sup> siècles. Il est professeur au Conservatoire national supérieur de musique et de danse de Paris ainsi que chargé de cours à l'École nationale supérieure des Mines de Paris.

**STROPPA Marco** (Italie)

Compositeur, chercheur et pédagogue, Marco Stroppa, né à Vérone en 1959, étudie la musique en Italie (piano, musique chorale et direction de chœur, composition et musique électronique). Entre 1984 et 1986, il poursuit des études scientifiques (informatique, sciences cognitives et intelligence artificielle) au Media Laboratory du Massachusetts Institute of Technology (MIT). Depuis 1982 il est associé à l'IRCAM en tant que compositeur et chercheur dans le contrôle de haut niveau du son synthétisé par ordinateur; il collabore avec Carlos Agon et Jean Bresson au développement des bibliothèques OMChroma et OMChant dans l'environnement OpenMusic. Ces contacts ont été déterminants dans sa formation musicale. Enseignant très actif, il est professeur de composition à la Musikhochschule de Stuttgart. En 2012 son premier opéra, *Re Orso* est créé à l'Opéra Comique de Paris. Il sera repris en 2018 à Bruxelles.

**TERUGGI Daniel**, Paris (France)

Compositeur, directeur du Groupe de Recherche Musicale (GRM) de 1997 à 2017, et du Département Recherche de 2011 à 2016 à l'Institut national de l'audiovisuel (INA), Daniel Teruggi développe son activité musicale en France depuis 1977, année où il quitte l'Argentine puis intègre le GRM en 1981. Son travail de composition se situe toujours dans le domaine électroacoustique avec instruments et acousmatique; se concentrant depuis 2004 dans des œuvres multiphoniques sculptant l'espace par ses mouvements et localisations.

Au-delà de son travail musical, il a développé une importante activité internationale autour des archives audiovisuelles, en particulier les archives musicales et la préservation du fait musical.

**UNGEHEUER Elena**, Wuerzburg (Germany)

Elena Ungeheuer is holding a professorship for contemporary music at the University of Wuerzburg, Germany. She founded the Atelier Klangforschung as a campus building and a space of opportunities to stimulate the mutual enrichment of academia and art work. In her doctoral thesis about the influence of the Bonn acoustician Werner Meyer-Eppler on the studio of electronic music in Cologne in the early 1950s, she included a far-reaching reflection on the history of electronical musical instruments. E. Ungeheuer developed an approach of pragmatic music research that stresses to recognize multiple agencies and interdisciplinary networks of knowledge, technology and strategic orientations that music is loaded with. Her further areas of focus are music and media, music and language, an aesthetic theory of action, musical perception and dance.

**WAKSMAN Steve**, Northampton (USA)

Steve Waksman is Sylvia Dlugasch Bauman Professor of American Studies and Professor of Music at Smith College, USA. His publications include the books *Instruments of Desire: The Electric Guitar and the Shaping of Musical Experience* (Harvard, 1999), and *This Ain't the Summer of Love: Conflict and Crossover in Heavy Metal and Punk* (U. California, 2009.) With Reebee Garofalo, he co-authored the sixth edition of the rock history textbook, *Rockin' Out:*

*Popular Music in the U.S.A.* (2014), and with Andy Bennett, he co-edited the *Sage Handbook of Popular Music* (2015). S. Waksman has contributed chapters on the electric guitar to the books *Guitar Cultures*, *The Cambridge Companion to the Guitar*, and the *Continuum Encyclopedia of Popular Music of the World* (for which he wrote the main entry on "Guitars.") In 2008, Waksman was the keynote speaker at the Rock and Roll Hall of Fame's American Music Masters event honoring the legacy of guitarist and inventor Les Paul. Currently, he is writing a new book on the cultural history of live music and performance in the U.S., tentatively titled, "Live Music in America: A History, 1850-2000."

**WIENER Oliver**, Wuerzburg (Germany)

Oliver Wiener is the curator of the Study Collection of Musical Instruments and Media at the University of Wuerzburg. With his PhD thesis (on J. N. Forkel and the debate of a system of music) one of his research priorities lies in musical thought, aesthetics and historiography of music in the eighteenth century. A further focus is on the analysis of the relation between contemporary music, musical structure and media concepts.

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## Résumés/Abstracts

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Marc BATTIER, *Lutherie électrique et électronique.*

Le récit du développement de la lutherie électrique et électronique doit être accompagné par les réactions et commentaires publiés dans la



sounds; and even in exhibits for families, where children were encouraged to express themselves freely through improvisation. A study of archival documents, manuscripts, and sound resources from the exposition reveals that the Ondes Martenot articulated a self-consciously stylised image of French modernity, extending from the instrument's construction through musical composition and onstage presentation, and blurring notions of 'domestic' and 'exotic' through sound and image.

Steve WAKSMAN, *Making the Guitar Electric: Early Electric Guitar History*.

As an idea, the electric guitar was the solution to certain practical problems—how to make a guitar louder—but also grew out of broader impulses to apply technical knowledge to the subject of sound. Once realized, the electric guitar did not follow a single line of evolution. Different models of guitar were more suited to distinct musical styles, and players of diverse ethnic and cultural backgrounds in the United States adapted the instrument to a range of purposes, demonstrating its versatility and exploiting its unique expressive and timbral possibilities. By the end of the 1930s, the first decade of commercial electric guitar production, the instrument had become a widely established part of the American soundscape and a crucial medium for combined musical and technological innovation. This article surveys the state of the field in research on early electric guitar history, with an emphasis on three areas of inquiry: How did the electric guitar come to be invented? Who were the earliest players of the instrument? And, how did the electric guitar relate to the larger soundscape of American musical and cultural life as it stood in the 1930s?

Jean-Claude BATAULT, *Constant Martin (1910-1995): pionnier français de la facture instrumentale électronique*.

Il y a maintenant plus d'un siècle que l'homme a commencé à amplifier et à reproduire les sons au moyen de l'électricité. Plusieurs inventions vont voir le jour au début du XX<sup>e</sup> siècle et les musiciens ont à disposition dans les années 1930 des instruments à clavier conçus en Europe ou en Amérique. Citons les pianos électriques Néo-Bechstein et l'Électrochord inventés par Oskar Vierling, le Trautonium de Friedrich Trautwein, sans oublier l'orgue électronique d'Armand Givelet et Édouard Éloi Coupleux, ou encore les Ondes de Maurice Martenot. Certains inventeurs vont essayer d'amplifier l'harmonium encore très populaire à l'époque. Ces recherches vont aboutir à la création aux États-Unis de l'Organotron Everett. Un inventeur français, Constant Martin, va lui aussi s'intéresser à l'Harmonium au début de sa carrière dans la facture instrumentale électronique, en le dotant d'anches libres électrostatiques ou électromagnétiques. Cet inventeur dont le nom est aujourd'hui peu connu, a été au milieu du XX<sup>e</sup> siècle en France et à l'étranger l'un des principaux acteurs ayant participé au développement de la synthèse sonore, tant dans le domaine classique, avec les orgues électroniques liturgiques que dans celui de la variété avec le Clavioline. Il développa également dans son atelier des cloches électroniques qui auront un certain succès après la Seconde Guerre mondiale.

Elena UNGEHEUER and Oliver WIENER, *Between Mass Media, Entertainment Electronics and Experimental Music: Harald Bode's Melochords in the Intersection of Many Interests*.

By talking about the Melochord the

whole range of electrical musical instruments, the concept of modular sound synthesis and the pioneer days of innovating music with innovative techniques can be covered. This article deals with the creative periods of its engineer Harald Bode, compares the different types of Melochord that he designed, and goes into a deeper organological analysis of the particular Melochord that the acoustician Werner Meyer-Eppler commissioned in 1949. Thus showing how the Melochord provides precise indications in accordance to Meyer-Eppler's acoustical philosophy of sound transformation. The first publication of the letter exchange between Meyer-Eppler and Bode (in the original and translated) is attached. The Bode-Melochord can be deemed as one of the most forward-looking musical instruments on the cutting edge of many interests.

Tatjana BÖHME-MEHNER, *La recherche comme compromis esthétique en Allemagne de l'Est: le Subharchord*.

Le Subharchord est un instrument de musique électronique développé de la fin des années cinquante au début des années soixante dix dans un laboratoire du centre radiophonique de Berlin, en RDA, lequel faisait partie de l'Agence centrale de la technologie pour la télécommunication de la radio d'État. L'instrument a été utilisé pour la production musicale, notamment dans des studios de dessin animé et de son radiophonique. Il combine plusieurs composants analogiques ou plus ou moins digitales, indépendants pour le traitement du signal. Son générateur de contrôle est l'un des premiers VCOs (Voltage-Controlled Oscillator). L'article s'intéresse ensuite aux quarante-trois œuvres réalisées entre 1962 et 1974 sur le Subharchord du studio. Elles mêlent les principes et structures contemporaines avec la



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