

EDGARD VARÈSE'S *POÈME ÉLECTRONIQUE*. AN ANALYSIS OF RECENTLY DISCOVERED SOURCES

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ABSTRACT

The article investigates the genesis of *Poème électronique* by Edgard Varèse, analyzing several previously unknown or overlooked sources, which have been recently identified in the Varèse collection at the Paul Sacher Stiftung (Basel). The article examines two types of sources: Varèse's musical manuscripts and the technical plan for the sound spatialization of the entire piece, made by Philips engineers. While Varèse's sketches and drafts for *Poème électronique* had been neglected for years, the complete spatialization plan was once thought to be lost but has been recently rediscovered. These new sources reveal a largely unknown, long and complex process of creation, from the first music sketches to the final performance inside the Philips pavilion, a landmark in architecture designed by Le Corbusier for Brussels Expo in 1958. The article focuses on a short section of the piece, marked by Varèse as section F, that serves as a case study. Varèse composed this section by merging diagrams for electronic sounds, and conventional scores, such as fragments of his unpublished composition *Étude pour Espace* (1947). The spatialization plan for section F, coherent with Varèse's music manuscripts, suggests the vertical movements of drops falling from the ceiling. In future developments of this research, the composer's sketches and the project plan for the sound spatialization, both largely overlooked, could offer fresh insights for a deeper comprehension of the composition process and performance practice of this seminal work.

1. INTRODUCTION

In the tumultuous season of electronic music in the late 1950s, Edgard Varèse's *Poème électronique* (*PÉ*) stands as a striking exception that does not fit into the dominant trends of that period, namely Parisian *musique concrète* on one hand and the production of the Cologne studio on the other. Like his other compositions, Varèse did not provide a key for interpreting *PÉ*, nor did he attempt to explain his

compositional techniques through theoretical writings. From a historiographical perspective, even more than fifty years after its creation, this work continues to pose challenges when trying to contextualize it within the electronic music production of the late 1950s. One of the reasons lies in the presumed lack of written sources relating to this work.

Varèse composed *PÉ* for a multimedia performance at the Philips Pavilion during Expo 58, the Brussels World's Fair of 1958. The visual aspect of the performance was overseen by architect Le Corbusier who also designed the futuristic structure of the building, with the crucial assistance of his collaborator Iannis Xenakis. From September 1957 to April 1958 Varèse worked in a dedicated Philips facility, the garage at Philips' Strijp III complex in Eindhoven, near Philips Research Laboratories. As Kees Tazelaar described in detail [1], Varèse had access to a state-of-the-art laboratory for electronic music production, with the assistance of expert Philips technicians such as Willem Tak, Jan de Bruyn, and Anton Buczynski. Varèse recorded *PÉ* on three mono tapes that were played simultaneously on three tape recorders. A lead-in tape, which contained sync and count, enabled the tapes to be approximately synchronized. When the recordings were completed, a fourth stereo tape was added to the three master tapes, in order to add reverberation. The four tapes were then mixed into a special three-channel perforated 35mm tape used in the film industry. The perforations assured synchronization with the four projected films and with an additional perforated tape containing the control signals for the fully automated performance.

In total, 325 loudspeakers were mounted on the walls, and an additional 25 speakers for low frequencies were positioned around the perimeter. This setup allowed the sound to resonate from all directions, revolving around the spectators or hovering above them from a height of approximately twenty meters, at the highest point of the pavilion. Today, it is no longer possible to experience this work in its original form. The pavilion was demolished shortly after the closure of the Expo, and with it, the only device capable of reproducing this multimedia spectacle was lost. Since the demolition of the pavilion, *PÉ* has primarily been recognized as an independent musical piece. This recognition is largely due to a version created for the

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album *Music of Edgar Varèse* (Columbia Records, 1960, MS 6146), which simplifies the original multi-directional sound spatialization into a stereophonic recording. Studies on the sources of *PE* have mainly focused on the tapes [2], the setup of the audiovisual system [3], [4], and on Le Corbusier's scenario for light projection [5]. However, there are two aspects of this work that remain almost completely unknown: Varèse's compositional process and the sound spatialization during the performance.

This article focuses on these two aspects, referring to written sources that are still almost entirely overlooked: the musical manuscripts that Varèse wrote during the composition of the piece and the project for the sound spatialization of the entire piece. The central purpose of this publication is to outline a philological method for examining the sources relevant to *PE*, encompassing the early sketches to the ultimate plan for sound projection. Since the analysis of the entire *PE* is beyond the scope of this paper, the explanation will focus on a short section of the piece.

2. VARÈSE'S COMPOSITIONAL PROCESS THROUGH THE ANALYSIS OF THE SKETCHES

Varèse's manuscripts became accessible to scholars in 2003. These were part of the Edgar Varèse Collection, which was previously curated by his pupil, the composer Chou Wen-chung. The collection is now housed in the Paul Sacher Foundation in Basel, henceforth referred to as EVC-PSS. Many sketches related to *PE* were overlooked for years as they were dispersed among the composer's numerous unidentified documents. Their extreme heterogeneity has certainly constituted an obstacle to identification. Indeed, this collection of documents features a wide variety of notation styles. It includes multicolored plans for the electronic montage, symbolically written annotations, diagrams on graph paper, draft scores for electronic pitches in standard staff notation, sketches of short rhythmic elements, and the use of Cartesian axes to notate the frequency or the envelope of sounds. The diverse nature of the documents partially reflects the characteristics of the work itself. Compared to most electronic music of that era, it stands out due to the extensive variety of sound materials used.

However, the diverseness of these manuscripts also unveils the various work methods that Varèse adopted in the preparation of *PE*. Through a systematic comparison of different sources, primarily preserved at the Paul Sacher Stiftung (PSS, Basel), I could identify more than fifty manuscripts related to *PE*.¹ Among these, I recognized a small

group of pre-definitive manuscripts, or 'drafts', which Varèse likely used as a reference for the final realization and assembly of the tape. In two sections of the piece (from 3:38 to 4:39, and from 6:44 to 7:06), electronic sounds are almost entirely absent. These sections feature two 'acoustic' episodes: the first one for contralto voice, male choir, percussion, and piano, and the second one for soprano and male choir. To record these two episodes, Varèse prepared a specific score by reworking a piece from 1947, *Étude pour Espace* (*Et.58*, EVC-PSS). This score represented the final attempt to bring an ambitious project to fruition. Since the mid-1920s, Varèse had been chasing the concept of a grand multimedia opera, which he referred to by various titles over time, including *The One-all-alone*, *The Astronome*, *Sirius*, and *Espace* [6], [7].

As a result, the sketches for *PE* include not only electroacoustic diagrams but also some pages in standard notation intended for a small ensemble. Therefore, the central core of the sketches consists of nine electroacoustic diagrams, in addition to the two score excerpts from *Et.58* (Figure 1).

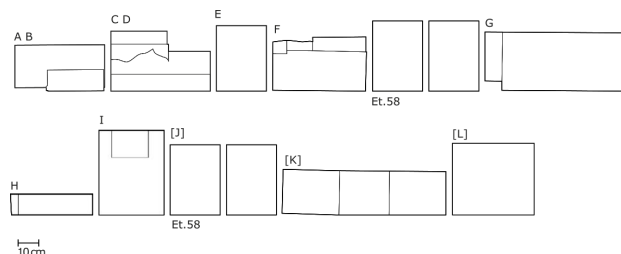


Figure 1. Sequence of *PE* final drafts.

These drafts correspond to various sections of the piece, each lasting from fourteen seconds to a minute and thirty seconds. A comparison with the tape reveals a significant correlation between the notated parts and the recorded sounds. The sequence of the manuscripts is confirmed by a final mark: a capital letter in red pastel, likely added to almost every draft upon completion. Some manuscripts encompass two sections and, consequently, bear two alphabetical markings. Without a comprehensive structural plan for the entire piece, these red letters, spanning from A to I, serve as the sole indicators of the sequence of electroacoustic plans, and thus, the arrangement of the sections in the piece.

The eighth and ninth manuscripts lack the red mark. They were included in the group of final drafts by deduction, as they are the only existing detailed plans corresponding to the final part of *PE*.² By arranging the sketches and the fragments derived from *Et.58* in the correct sequence, one can recognize a written plan for almost the entire piece.

¹ This identification work started in 2008 with a scholarship from the Paul Sacher Foundation, and continued in the following years in other archives, including the Philips Company Archive of Eindhoven and the Fondation Le Corbusier of Paris. Important archival materials relating to *PE* are also held in other institutions: Louis Christiaan Kalff materials of the Getty Research Institute (Los Angeles), the Stanford University Libraries; the Dutch Film museum EYE (Amsterdam), the Institute of Sonology (Den Haag).

² Many evidences suggest that during an advanced stage of composition Varèse decided to reassemble the already recorded sections of the tape. In order to establish a definitive order in the structure, he added the red letters to the existing drafts. Presumably after this reworking, he began to write the last three final drafts, without the need of other alphabetical marks. I explained in more details this stage of composition in the article "La genesi compositiva di 'Poème électronique' di Edgar Varèse" [1].

As Anne Shreffler recalled, “Varèse’s inexperience with tape composition has always been known in electronic music circles” [8]. This assumption influenced also the study of his only electronic work and, as a result, scholarship devoted little interest to his manuscripts for *PE*. One remarkable case is his final draft for section C and D. This manuscript has been known since 1958, when Jean Petit reproduced it in the volume *Le Poème électronique: Le Corbusier* [9]. Later on, it was reproduced in several publications: it appears on the cover of *Edgard Varèse und das ‘Poème électronique’: eine Dokumentation*, edited by D. A. Nanz [10] and in Peter Wever’s *Inside Le Corbusier’s Philips Pavilion: a multimedial space at the 1958 Brussels World’s Fair* [11]. However, its content and the exact relationship with the tape remained unclear, due to the difficulty in understanding it without the other missing pieces, until my research in 2015 [12]. Among the studies devoted to music sketches, the dissertation by Roberta D. Lukes is noteworthy. However, in 1996, she had access only to a few manuscripts held in the Philips Company Archive in Eindhoven [13].

The abundance of Varèse’s sketches and drafts found in PSS attests to his efforts during the composition process of *PE*. At the age of 75, with no previous experience in electronic music production, Varèse was attempting to handle new instruments and confront new technical and musical challenges.

While Varèse’s music manuscripts display detailed information about sound events, they contain almost no annotations about sound spatialization. Varèse noted the spatial possibilities of sound projection in his notebook immediately upon his arrival in Eindhoven, but his drafts for *PE* contain very few annotations for sound distribution. The only written plan for sound spatialization was prepared by Philips technicians, likely after the recording on three tapes was completed. Moreover, Willem Tak asserted that Varèse did not participate in the planning of sound spatialization within the Pavilion, and that the decisions were made by Philips technicians [14].

3. *PE*, SECTION F

In order to clarify Varèse’s compositional process during the creation of *PE*, we can use section F (from 3:25 to 4:39 of the tape) as an exemplary case study. This section is composed of a tape edit of two distinct preparatory sound sources: a sequence of percussive electronic sounds that were planned out on two technical diagrams, which we will refer to as ‘a’ (as shown in Figure 2) and ‘b’, and the first episode derived from *Et.58*, which features a contralto voice, choir, and percussion. Section F begins with these two elements alternating for approximately 50 seconds (from 3:25 to 4:15), followed by the recording of percussion and choir until the end of the section (4:39).

The tape editing and the related sources for the first 50 seconds of section F is shown schematically in Figure 3.

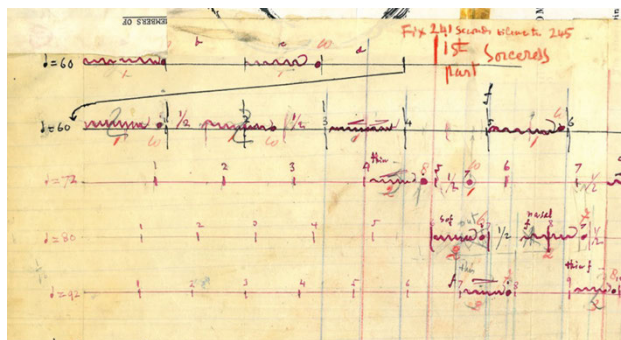


Figure 2. Diagram a, draft for section F of *PE*, excerpt. ECV-PSS. Courtesy of PSS.



Figure 3. Sources and tape editing in section F (3:25–4:20).

Within Varèse’s collection in Basel, there is no evidence of a comprehensive editing plan for *PE*. However, Varèse annotated on the music manuscripts the junctions between the electronic percussive sounds and the vocal part. In the revision of *Et.58*, the initial entry of the contralto is preceded by the annotation “Perc[ussion] – introducing” (Figure 4).

♩ = ad libitum - about 72-80

Perc. introducing

Opening cadenza - [...] - Gouttes
like in trance - incantatory - mumble - chest tones

Alto solo

chest tones hoogaa hoo ba - you

(Choir) A. *mf* wha - o hoo

L.V.

Gong Low

Piano *sf*

Figure 4. *Et.58* (excerpt), diplomatic transcription (EVC-PSS)

An additional annotation at the bottom of the same page specifies: “sporadic p[e]rc[ussion] electronic”. These notes serve presumably as a reminder for Varèse himself: an annotation for a passage to be developed later. In the same document, the term ‘gouttes’ (French for water drops) in pencil describes the overall effect of this percussive “opening cadenza”. The electronic diagram created for section F can thus be interpreted as the realization, in the form of a detailed draft, of the embryonic idea of the “sporadic p[e]rc[ussion] electronic” initially envisaged in *Et.58*.

Conversely, the electronic diagram contains references to the *Et.58* score, inserted as notes for the editing along the upper edge of the diagram. With the phrase “1st Sorceress part” written in red crayon, Varèse notes where to insert the contralto recording. For these reasons, both manuscripts (the electronic diagram and the *Et.58* score) can be considered integral elements of Section F, despite their distinct appearance and sonic result. Like the other final drafts, this electronic diagram also has an alphabetical marking. However, the ‘F’ marked in red crayon is not clearly visible as it is obscured by a strip of paper (this can be slightly discerned in the upper left corner of Figure 2).

4. ELECTRONIC DIAGRAM FOR SECTION F

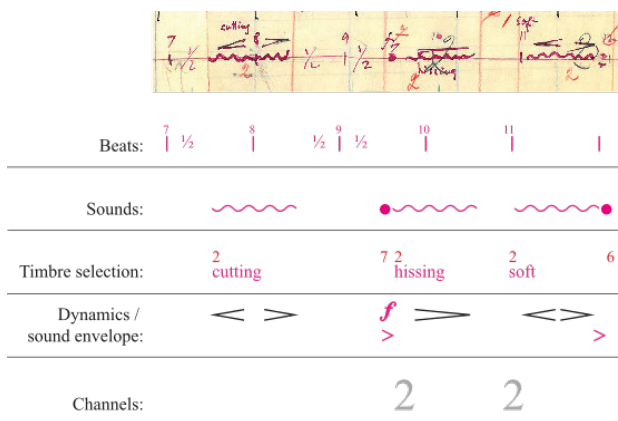


Figure 5. Notation layers in diagram *a* for section F.

In this diagram, Varèse notated four distinct aspects of this electronic episode. The first aspect pertains to the superimposition of simultaneous rhythmic aggregates based on ‘unrelated’ metronomic tempos, a recurring element in the sketches of *PE*. The overlay of percussive entries is structured in accordance with four concurrent metronome tempos, corresponding to 60, 72, 80, and 92 bpm. This polytemporal grid served as a foundation for the preparation of the draft. These four lines were used to notate the individual sounds whose duration, generally, coincides with the tempo stipulated by the metronome mark.³

The second aspect pertains to the timbre and morphology of each sound, reflecting the development of sound over time. With a few exceptions, each ‘drop’ is composed of a pair of sounds: it begins with a sustained noise, notated with a wavy horizontal line, and concludes with a short pulse, represented as a point. The episode involves a process of subtle timbral differentiation among the elements of the electronic percussive sounds.

³ Several years after *PE*, Varèse continued to be attracted by the possibilities of managing complex rhythmic events through electronic means. Interviewed in 1965 about the potential of electronic instruments, Varèse said: “One of the most valuable possibilities that electronics has added to

To select the right sound source, Varèse added a red crayon number (ranging from 1 to 10) beneath each undulated line, likely referring to a reserve of materials at his disposal. Moreover, certain timbral variants are verbally described with adjectives such as “thin”, “cutting”, “hissing”, “soft”, and “nasal”. Figure 5 reproduces a portion of the sketch relating to beats 7–10. The different layers of text, sometimes overlapping each other, are displayed separately in the graphic below: beat numbers and the duration of rests, the type of sound (sustained noise/pulse), the selection of timbres, the dynamics marks, and the recording channel. The third aspect concerns the distribution of sounds in the three channels (or, more precisely, mono tapes). Compared to the other manuscripts, the draft for section F contains particularly detailed information regarding the distribution of sounds in the three channels. In this draft too, as in other music manuscripts, there is no information about the distribution of sound inside the Philips pavilion. Nevertheless, the careful organization of the three channels seems to be preparatory work for the subsequent spatialization. The assignment of sounds to the three channels took place in two stages. First, in diagram *a* (Figure 2) Varèse assigned each element to a channel, drawing a large number in pencil. The sounds noted in the excerpt of Figure 5 are assigned, for example, to channel 2. Afterwards, to facilitate the technical realization of the three mono tapes, Varèse rewrote the entire episode in the new diagram *b*. To make the content of each mono tape clearer, he distributed the sounds in a new layout, grouping them according to the destination channel (Figure 6).

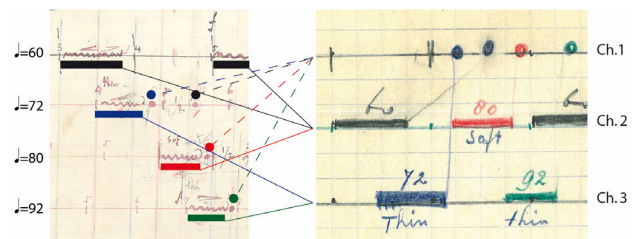


Figure 6. Distribution of sounds in diagram *a* and diagram *b*. Courtesy of PSS.

The graphic elaboration of Figure 6 illustrates the conversion process from diagram *a* (on the left) to diagram *b* (on the right). The prolonged noise sounds, which at first were wavy lines, now become horizontal bars and are assigned to channels 2 and 3. The pulses, on the other hand, are represented with colored points and converge in Channel 1.

musical compositions, at least for me, is that of the possibility of metrically unrelated simultaneity. My music being based on the movement of unrelated sound masses, I have long felt the need and anticipated the effect of having them move simultaneously at different speeds” [15].

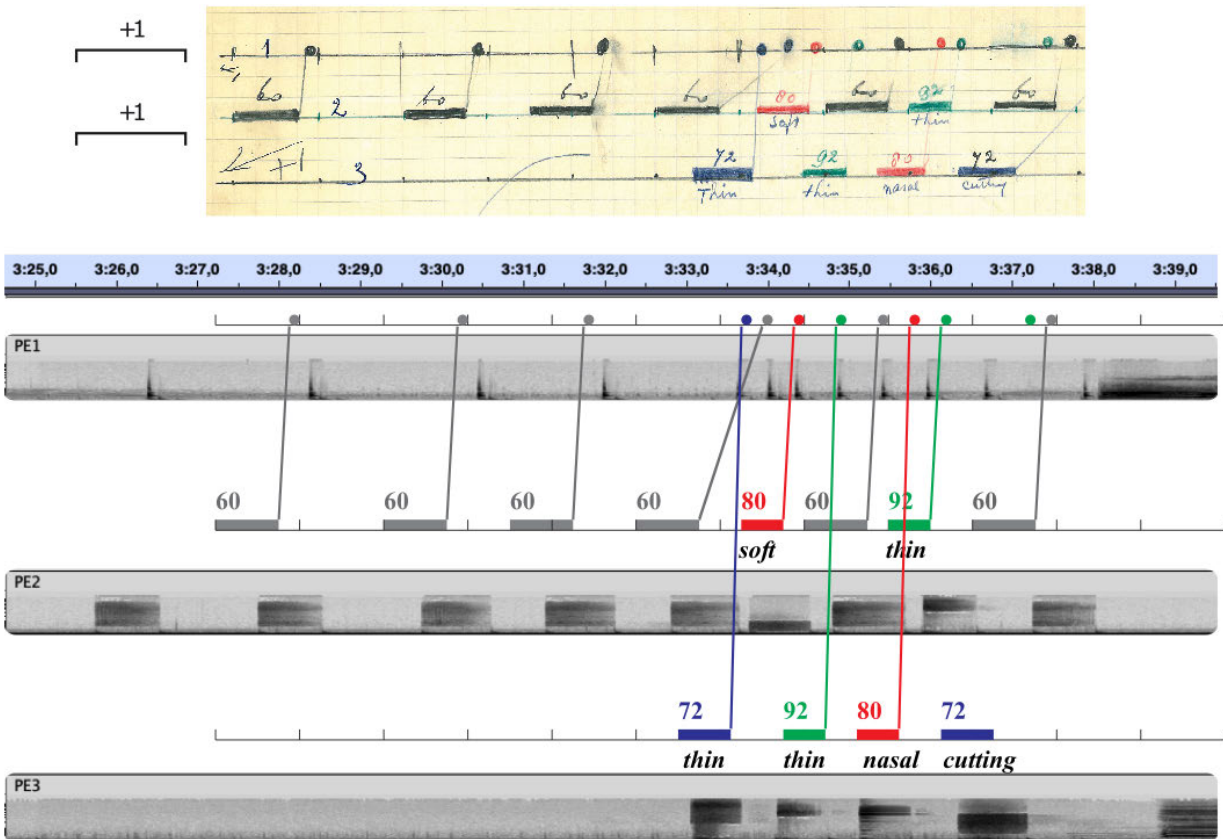


Figure 7. Correspondences between diagram *b* and the tape (from 3:25 to 3:39). Courtesy of PSS.

A color code differentiates the tempo: black for 60 bpm; red for 80 bpm; blue for 72 bpm; green for 92 bpm. In the two drafts, the content remains the same. However, the two graphic renditions highlight either the tempos (in diagram *a*) or the distribution of sounds among the three channels (in diagram *b*). Except for some slight temporal discrepancies, the events recorded on tape faithfully reflect the written traces. The scheme of Figure 7 displays a graphic combination of diagram *b* and the sonogram of the three mono tapes (from 3:25 to 3:39). The corresponding portion of the manuscript is shown above.

5. SOUND PROJECTION

The distribution of sound within the Philips Pavilion represents one of the most innovative and spectacular features of *PE*, yet it is also one of the least documented aspects. The volume *Poème électronique* edited by Jean Petit includes a diagram by Xenakis titled “Les routes du son” (Figure 8) [9]. This drawing provides a brief description of the distribution of the speakers within the Philips Pavilion. The trajectories of the sound are marked with the numbers I–IX, and the letter O, while the position of the speakers is marked with letters A–E, J, and U.

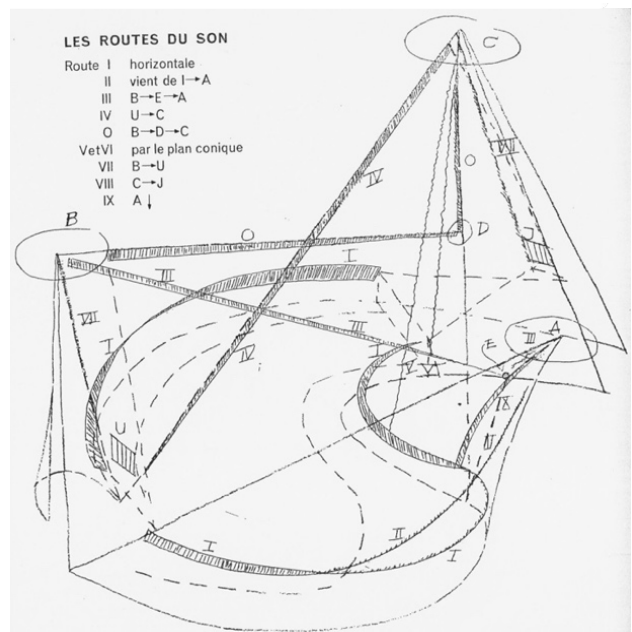


Figure 8. Iannis Xenakis, *Les routes du son*: diagram for the spatialization system in Philips pavilion

This drawing is accompanied by an explanatory legend. The speakers were arranged in two configurations: some groups, referred to as ‘clusters’, served as static sources, while others, referred to as ‘routes’, simulated the movement of sound along a line.

The clusters A, B, and C were located on the three peaks of the building (at 13, 18.5, and 20.5 meters respectively). The clusters J and U were positioned at the entrance and exit as antiphonal sources. Finally, other sources for the lowest sounds surrounded the audience at floor level along the perimeter of the building.

Kees Tazelaar [1] conducted extensive research on the sound projection system inside the Philips pavilion and almost entirely reconstructed the placement of the speakers on the walls.

However, until recently, it was not possible to determine the sequence of the different spatialization scenarios during the performance. For a long time, the only source explaining the sound distribution during the piece had been a diagram written by Philips technicians and published in the journal *Philips Technische Rundschau*, with the caption “Schematische Darstellung der registrierten Klänge” (Schematic representation of the registered sounds) [15]. This diagram illustrates how the control tape could synchronize tape recorders, lights, loudspeakers, and the film projector through a sequence of multiple signals. Unfortunately, it is only an excerpt related to a short portion of the piece: from 2:05 to 2:42. This control diagram has a timeline at the top and is divided into two horizontal stripes. As described by V. Lombardo and other authors, the upper stripe illustrates the contents of the control tape [3].

The sound impulses recorded on the control tape operated on the different devices through a system of filters and relays. The lower stripe schematizes the three audio channels. Each short episode in each channel is symbolized with a horizontal line that defines its duration. The most interesting data in this diagram relates to the spatialization. Every line (or tape segment) is associated with a letter or a number. These symbols refer mostly to Xenakis’s drawing of Figure 8.

Outside of these thirty seconds, there were no other clues about the sound projection during the performance. However, a recently found source, originally held by Wenchung’s heirs and now in PSS, fills this lack of information. It consists of an approximately 10 meters long scroll paper. It is clearly a complete copy of the original technical diagram that was made by Philips technicians for the sound spatialization and later sent to Varèse. As already mentioned, without any other autograph document, it is difficult to establish who made the decision about sound spatialization. Nevertheless, this document is an invaluable source for understanding and reconstructing the performance of *PE*, including the sound projection, as it contains detailed information on the sound sources, the routes, and the timings of each sound event.

In general terms, the sound distribution reflects the articulation of the piece into sections. The diagram shows clearly that spatialization scenarios were used to enhance the contrast between subsequent sections. One recurring means is the opposition between a scenario with several sound sources and a rapidly changing movement of sound, and another scenario with static sound sources. These complementary principles are very clear in the spatialization of sections D and E. The beginning of section D, from

1:10 to 1:30, is particularly dense, with a fast edit of complex noises that differ in morphology, shape and timbre. For this part, the spatialization diagram lists eleven different sound sources (trajectories and speaker clusters) in only twenty seconds. One can imagine the audience listening to scattered noises, with their origins rapidly changing within the pavilion. On the contrary, section E, from 2:40 to 3:25, is characterized by sustained electronic tones. The corresponding sound distribution is limited to the three peaks of the building and to the perimeter, resulting in a more static effect surrounding the audience. Since the analysis of the sound distribution for the entire piece is beyond the scope of this paper, I will focus on section F only, to highlight the correlation between different sources: sketches, tapes, and the technical spatialization plan. The portion of the spatialization diagram related to section F reveals some interesting aspects. Each sound is labeled with a short description, mostly in Dutch, using three types of terms: 1) onomatopoeias and words unrelated to Varèse’s sketches, such as “plop”; 2) descriptions of recorded sounds, such as “piano” or “koor” (‘choir’ in Dutch); 3) quotations from Varèse’s own words, such as “sorc.[eress]” or “drup” (‘drop’ in Dutch, equivalent of ‘goutte’). The information about spatialization reveals clearly the intention to simulate the falling of each electronic ‘drop’ from the ceiling to the floor of the pavilion, especially at the beginning of the section, as shown in Figure 9. The sustained noise sounds (channels 2 and 3) were distributed along *route O*, a line of speakers located above the audience, while the subsequent electronic pulse originated from the line of speakers labeled as ‘L.t.’, situated at the lower perimeter of the building. Here, ‘L.t.’ likely stands for ‘Low tone’. The voice of the contralto singer was projected from the left perimeter of the building (‘I l.[eft]’), while the choir sounds were projected from the perimeter (‘L.t.’) and from one of the peaks of the building (‘A’).

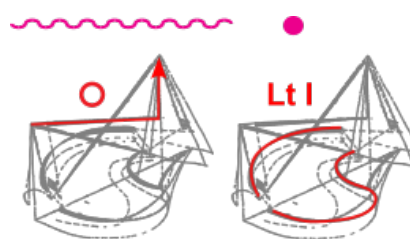


Figure 9. Spatialization of ‘drops’: correspondences between diagram *a* and Xenakis’ *Les routes du son*.

Figure 10 illustrates the sound spatialization for section F. The scheme combines different sources: the spectrograms of the three mono tapes are aligned with the information about the sound projection of each track. This information is transcribed from the control diagram (refer to the horizontal lines: I, II, III). Several miniatures from Xenakis’s drawing are displayed to emphasize the corresponding routes or clusters of speakers within the Pavilion.

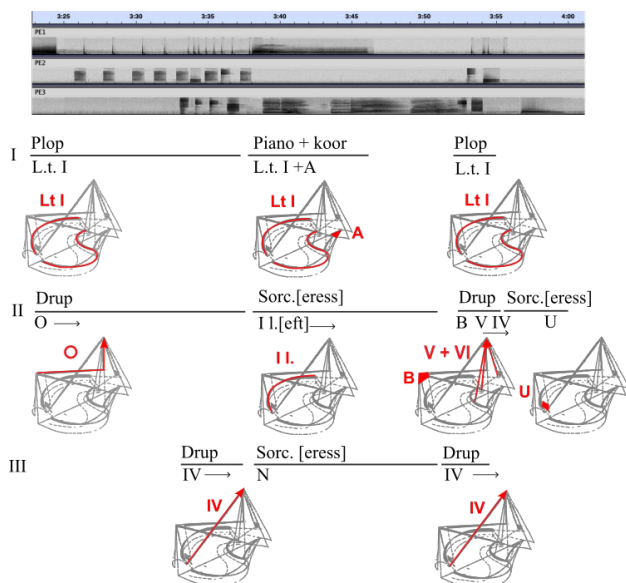


Figure 10. Sound spatialization in *PÉ* (3:25–4:00). Graphic elaboration from Control Diagram, Xenakis' *Les routes du son* and the sonograms of the tree mono tapes.

6. CONCLUSION

Varèse's sketches and drafts and the control diagram for spatialization made by Philips technicians represent a fundamental step forward in the comprehension of this seminal work in the history of electronic music. These sources reveal the internal structure of the composition, including the routing of sound through the complex sound diffusion system of the Philips pavilion. Previous studies on *PÉ* have followed mainly three directions: the structural analysis of the piece through listening to the audio recording [17]; the historical research on the technical system of sound distribution [1] and the architecture and light projection [11]. The discovery of new sources has ushered in a new phase in the study of Varèse's compositional thought. Moreover, these sources provide the opportunity to perform *PÉ* in its original form, grounded on philological research.

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