SPACE PERCEPTION IN THE COMPUTER AGE

Music and psycho-auditory experiences in space diffusion

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Part I

Music

The music, since 20 years, has experienced the diffusion of music in space. He has realized a Sound Cinema: the "Stella Cine" (Cinema), Rome, 1962-1967, with 70 audio-channels, "Capelle des Bâtiments Blancs" (Catholique University), Louvain, 1967, with 50 audio-channels, and "Sound Dome" (Cité des Électroniques), Brussels, 1969, with 150 audio-channels.

It preparation: the sound coupler for the "Cathedral de Fosse" (October 1968, with around 200 audio-channels).

The author will show, by dispositions with figures and planes, the practical experiences realized, the progression from monophony to stereophony (through stereophony, multichannel, acoustic, stereophony and monophony).

The diffusion of sound automaton (public computer music automatically structured, organized and projected by audio-computers in the room) leads the space, the public, the computer, all kind of different rooms (in Europe and in both cathedrals) to give the author some experiences in the field of space diffusion.

Ex stance of sound automaton and concrete music projection in space

Figure 1: Auguste Vincent Van Gogh

Albertine, Brussels


This sound spread a large room, six different stages and a large entrance room (from where the sounds are stimulated and diffused in space), the high-speakers are distributed all around (in front of the hall) and placed in the entrance room. The public is walking around the high-speakers, the sound-stations are coming from above or far away (70 sound sources), a stereo field perception.

Figure 2: Karlheinz, Mein Stockhausen, Cologne, November 1975.

Public Computer Music and Concert projection in space.

The high-speakers are suspended above the public in a horizontal plane. The public is walking in the room speaking to the electronic, 40 high-speakers for the space projection, high-speakers 0 to 50 are installed on the ceiling.

Figure 3: Pissarro Museum, Rome-Granville, September 1975.

Projections of sound automaton and concert, in relation to the ninety years of the electronic-musical must (70 years of high-speakers used in 1975). For the first time most sound sources are attached at the ceiling. Space diffusion in three dimensions.

Figure 4: Palais des Arts, Brussels, October 1975.

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Figure 5: Auditorium, London, Daily Festival of Audio-Visual (November 1975).

New sound movements are experienced: the sound flows in the room, through the audio-channels line, with a speed faster, equal or higher than the natural sound speed in the air, becomes the room very large, and long off, this is possible by the adaptation of this experience in now as the evolution of a stereo-auditory music diffusion.

Figure 6: Cathédrale Saint-Michel. Brussels.

The public is walking around the cathedrals receiving different space projections and again the quality between the natural velocity of the sound in the air and the performed velocity of the sound on the audio-channels, with very large reproduction.

Figure 7: Grand Auditoire, PPS, Beethoven, Brussels, Concert of the 23 January 1976.

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Two circles surround the public, one circle for the great projection and the second for the live and fine dynamics performances (on close to the public). Some high-speakers behind are suspended on balconies. The room is very dry and excellent for space movements perception.

Figure 8: Sound-musical, Paulus Klusik, Bruxelles, April 1977.

This is the first construction where space is articulated in a room with the three dimensions: the horizontal, vertical and longitudinal plane. The distribution of the sound sources in the space is as equal as possible (76 sound sources). A stereo field perception.

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The sound-musical is the author's attempt to construct not a space effect but to integrate the space in a musical space instrument. The room is not set to a pure projection effect.
in a room, but a space constructed musical instrument to realise space musical structures and articulations. The space percep-
tion in no way an effect in pitch music, but pitch is only an effect in space music. Space is a quality in music expression.

Figure 9: Sound Couplie from Line "2/32 Electronic", September 1984. Henry Gass

Position view of the sound couplie from Line in the "Mister Baul". The construction of this sound device is a program in the direction of the destin-
ation in space diffusivity. It is a great sound couplie with 100 audio-channels on 6 stages ( amplifiers and high-speakers are on each quarter ). Very good integra-
tion of the sound couplie in the room with good isolation to have no reverberation.

Figure 10: Pan in space

The space parameter is a new parameter in music and must be studied scientifically but for all practical. This experimental light plastic dome permits us to study edge problems in a radical view.

Figure 11: View from the sound Couplie of Line. We may understand the attached teglica of the high-speaker, the bridges of sus-
position and the couplie form.

Figure 12: Sound couplie from Line

General view, to include a larger public the form of the couplie is not sphere but has the form of an "egg".

Figure 13: The Line Sound Couplie

An "egg" dome with 6 stages, very symetri-
cal, constructed to realise a crossed crease diffusion. The quantity of 100 audio-channels is the result of our psycho-sonic researches in the space field perception. An interval in space of 100 corresponds for us about a half temperated tom in the pitch scale.

Figure 14: The sound couplie egg

A four channel audio diffusivity system in space. The four colors indicate the four sound coupliae in an "egg" form helping greatly the performer to find some order in their performances with the music pieces ( not yet composed for this space room ).

Figure 15: Sound couplie from Venezia Biennale di Venezia 1986 ( October-Novem-
ber ).Palazzo Sargredo, Venezia, Italy.

Sound art form of construction ( sound sources positions ).

The dimensions of the room: 12,40x12,40x 9 m.

Figure 16: Sound couplie from Venezia

Space view: high-speaker position. For the tape performances in space there are 36 sound sources, but with the sound automatics projections there are around 100 audio-channels.

Conclusion at a first step

In all the examples of space diffusivity ( and there are many more to show ) for all the musician is preoccupied with pitch music projection in a room, we feel the desire to integrate this music as good as possible in the room ( to such classical music is very difficult to be separat-
elized also if they are not constructed for this goal ).

Secondly, the first space projections are to the horizontal plane, then they co over to the vertical plane ( but with the great-
test difficulties because the rooms are unable to give this dimension ; the high-speakers on the balconies is not suf-
cient, if also strange in a classical concert hall ).

After the conquest of the fundamental space planes / horizontal and vertical articulations / the research to find a solu-
tion to construct a space scale in these rooms is much more difficult. The rooms are unadapted and we have no experience in this field of space scales. The growing up of the quantity of the audio-channels, higher and higher, is this necessity to find a scale in the same dimension. With those space points we understood rapidly that space can ever linearly ( also if the pulse points are disjoined ). By the performance of those squares lines ( that bring us to the line-
points ), suddenly also we realise surfaces of sound diffusion and then at the end space volumes. The counterpart and the articulations of all those forms brings us to the final understanding what is space and how to articulate it as music.

Space articulation as a new musical-ex-
pression. Pitch perception and articula-
tion has been very slowly develop and accepted slowly in the sense of the moder-
cut of eunision, the space parameter will develop slowly in the same evolution time. Pitch perception has been constructed in different scales growing up from 1 to 12 tones. The archaic space articulation we perceive today will cre-
ate his own developments if we learn to hear this parameter, organise this perception and practice it consciously. Actually it is still hard to understand, also for music-
ians, that space is not an effect of the pitch dimension, but a parameter very important than pitch or rhymes and other articulations in music.

Psycho-auditory investigation in space perception

We are presenting here on first psycho-
acoustical minimal sound space tests and points perceptions. We have used much time to analyze those minimal space points perception in the different planes of a couplie ( diameter 36 m ) Our goal is to calculate the total number of per-
over the space points in the complete sphere. With the result of this research we could have an idea of our sensitivity to space perception and with this equipment we should construct scales and space machines.

Results

Figure 1: Psycho-auditory tested sound space points.

Horizonal plane of the cupola of the right.
Minimum angle of perception is 1.7°, the maximum 2.5° and the mean value 2.0°. We may observe great popularity for the space perceptions points (49) in this field.

Figure 10: Psycho-auditory tested sound space points.

Horizonal plane: horizontal.
Minimum angle of perception is 1.0°, maximum 6.0° and mean 3.0° with 58 perceived space points.

At 40° exist an irregularity large as 6.0°.

Figure 11: Psycho-auditory tested sound space points.

Vertical plane: right.
Minimum angle 1.0°, maximum 7.0° and mean 4.0° with 31 perceived space points.

The requirement increases larger in the highest arc of the plane.

Figure 12: Psycho-auditory tested sound space points.

Upper right side: behind.
Minimum angle 1.0°, maximum 6.0° and mean 3.2° with 31 perceived space points.

Figure 13: Psycho-auditory tested sound space points.

Vertical plane: right side.
Minimum angle 1.0°, maximum 7.0° and mean 4.0° with 37 perceived space points.

Psycho-auditory observations in the perceived space.

It is impossible to find two identical high-specters in the space perception, because the perception of the sound, its intensity, the spectrum, the area of the sound and the space position are directly in relation with our consciousness. (see precise attention to the sound) A psycho-auditory field means a change in the attention of the space perception and this implies then a change in the intensity, a change in the area and the space position. A fixed sound source in space is never fixed psycho-acoustically. If we listen a night along to a unique sound (a minor sound for example), this sound will move continuously in space. After a long time the listener can no longer detect it.

Figure 14: Psycho-auditory tested sound space points.

Horizonal plane at 1.0° meter high: between right and behind-right.
The minimum angles 1.0° and 2.0°, the maximum angles 1.0° and 2.0°, the mean angles 1.0°.

Figure 15: Psycho-auditory tested sound space points.

Vertial plane at 1.0° meter high: between right and rear-right.
Minimum angle 1.0°, maximum 3.0° and mean 2.0° with 52 perceived space points.

The requirement increases larger in the highest arc of the plane.

Figure 16: Psycho-auditory tested sound space points.

On the right side: behind.
Minimum angle 1.0°, maximum 6.0° and mean 4.0° with 58 perceived space points.

Figure 17: Psycho-auditory tested sound space points.

Upper right side: behind.
Minimum angle 1.0°, maximum 6.0° and mean 3.2° with 31 perceived space points.

Figure 18: Psycho-auditory tested sound space points.

Vertial plane: right side.
Minimum angle 1.0°, maximum 7.0° and mean 4.0° with 37 perceived space points.

The requirement increases larger in the highest arc of the plane.

Figure 19: Psycho-auditory tested sound space points.

Upper right side: behind.
Minimum angle 1.0°, maximum 6.0° and mean 4.0° with 51 perceived space points.

Figure 20: Psycho-auditory tested sound space points.

Vertial plane: right side.
Minimum angle 1.0°, maximum 7.0° and mean 4.0° with 31 perceived space points.

Psycho-auditory observations in the perceived space.

We have measured the interval that in the space perception constantly is the significant interval in pitch perception. We find in 15° of a sphere that the interval for this space perception lies in the calculation of the time of the pitch in the 1° time. We have this same interval. Certainly this interval is the same for the whole sphere interval is variable on a sphere, but the pitch music scale is not changed in this case.

Number of space perceived points on the cupola.

For a cupola of 6 meter diameter, as coincident to our measurements we have determined 15° as the space perceived interval in correlation to the maximum tested of sound space points and with the help of mathematical equations we have determined around 8,526 space points for the cupola. For a complete sphere this would be near 2,600,000 space points possibility.

With this in mind are ready to say now that the function will be once music articulation. Space perception is more related than pitch perception. If we hav
post war so loud in mass history to use space articulation as a music expression, the computer age with the technical possibilities will realize this as a reality in the coming society.

A new space instrument

In a pitch keyboard instrument, we may not separate the keyboard from the pitch, for a space instrument it is the case, we may not separate the instrument from the room; this room is a part of this instrument.

Figure 23: Rhythmophone

( Rhythmophone = sound + voice )
found in movements for space articulation.
The Rhythmophone is a 50 key instrument that creates space articulation. The performer’s body is a part of the instrument. Notice how different forms of the audio-channels are used to articulate space. The attack, decay, sustain and release of the instrument should be manually but also produced by the machine. The Rhythmophone may perform up to four input channels. The audio signal go through the instrument with no distortion or noise.

Figure 22: Side view from the five poured sounds (complete sphere).
15 stereophonic stages (15") with 150 audio-channels for the sphere and 102 for the capsula. One capsa equals 12 spacesomes of ID0. For a sphere there are then 25 octaves in the acoustic field.

Figure 25: Upper view from the five poured sound dome (half sphere projection).
High-speaker position on 7 floats.

Figure 24: Imaginary sound dome

Sound domes should be constructed in each great city with computer installations. In the dome, continuous music diffusion (public-computer-public) should oscillate, day and night, like a technical human nature. Space music patterns (space composed pieces) would be performed in the dome. Then again music should be popular.