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POLYTEMPOS - TIME AND SPACES

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CONTENTS of the thesis

INTRODUCTION

This scholarly study is a theoretical analysis and practical insight into the multifaceted relationships of several simultaneous layers of sound in a piece of music-a specific phenomenon in music characterized by the simultaneous, simultaneous movement of two, three, or more disparate tempo lines known as Polytempo.

The term *Polytempo* is relevant to other expressions in art, in particular – dance and theatre. The present work focuses exclusively on the specificity of polytempo processes in music.

The subject of our observations should also be the diverse historical panorama of artistic development, especially in music of the mid-20th century, associated with the emergence of significant polytempo works by composers of the so-called Darmstadt School, related vivid creative manifestations of the so called "Dvořák School". Polish avant-garde; American, Belgian, Italian, Russian, French, Czech, contemporary composers.

The object of this research is the need to clearly distinguish between Polytempo and Controlled polytempo, the latter having emerged as a natural creative-technological evolution in the overall development of polytempo processes in music in the late 1960s and early 1970s.

The subject of observation is also the significant contribution of the Bulgarian composer Iliya Kozhuharov and the apparatus PHOTOPOLYMETRONOM created by him in 1977, registered by the composer as a copyright idea in 1973, with patent number 22966 at the Institute for Inventions and Rationalizations, Sofia, INRA. Within the scope of the theoretical observations, musical works by composers Ilia Kozhuharov, Bozhidar Spasov and Stefan Dragostinov will be examined and analyzed.

The subject of the present scientific research is the theoretical justification of the necessity for the creation of the Photopolymetronome apparatus, providing new, hitherto unknown technological and creative possibilities for the modern composer. The subject of observation and detailed description will be also the basic technological means accompanying the practical operation of the Photopolymetronome apparatus during the performance of a polytempo musical work, the so-called "light tempo signals", permanently transmitting tempo information to each performer (or conductor), playing in one tempo or another, by means of a specially mounted "light indicator" on the console in front of the performer (or conductor).

The object of this study will be, respectively, the specifics, characteristics and distinctive features of the graphic visualization of the simultaneous, tempo-different sound lines on the score sheet.

The subject of observation will be the necessity of bringing new music-theoretical terms, notations and concepts dictated by the specificity of the Controlled Polytempo method, such as: the visual-vertical graphic sign in the score - Semaphore; common inter-tempo verticals in the sound structure of several musical layers running simultaneously; permanent tempo proportions between parallel sounding sound lines in a musical work.

The theoretical contribution of this research consists in the construction of a comprehensive systematic concept describing the Controlled Polytempo method of composition; a detailed outline of the parameters and possibilities offered by the Photopolymetronome apparatus; the development of a complex technological and creative platform containing all the major components of Controlled Polytempo-based compositional techniques.

Practical significance of this research is the real possibility of extensive use of the achieved contributory theoretical results in future academic training of young artists and their acquaintance with the method of composing Controlled Polytempo, respectively, with the technological-creative resource and capacity of the Photopolymetronome apparatus.

The subject of this research will be to defend and defend the thesis that the Controlled Polytempo method creatively corresponds to the widest possible technological, stylistic and aesthetic spaces through which the evolutionary development of music has passed - from the time of the early Baroque, Classicism, Romanticism and Impressionism to contemporary stylistic

directions and currents; from monody, homophony, polyphony and harmony to the aesthetic-technological means in the music of the past 20th century - dodecaphony, pointillism, aleatorics, etc. н.

As a continuation: the subject of the defense is the thesis that the whole rich and diverse stylistic-technological palette - accumulated over the centuries in music - from the Renaissance to today, together with the new technological-creative possibilities of the Controlled Polytempo method, secured by the Photopolymetron apparatus, in a single, monolithic complex - open new creative horizons for the modern composer.

As a basis for the research I will rely on my long-standing, half-century accumulated practical and theoretical experience, as well as my specific observations in the field of Controlled Polytempo and the works created, which have received international recognition at prestigious European composition competitions: "The Fair" cantata (first prize at the Gaudeamus Competition,1978), "Polytempi 3" (first prize at the Arthur Honegger Competition, 1982), "Concerto for Piano and Orchestra No. 1 (first prize at the Karlheinz Stockhausen Competition, 1980).

Hypothesis in the future development of the Controlled Polytempy; it assumes a trinity in the set technological-creative goals, namely:
– First - the need to construct a modern, state-of-the-art Photopolymetron apparatus, based on the vast arsenal of new computer technologies accumulated over the past two decades;
– Second - to create an adequate, modern computer system for composing music based on the creative-technological principles of Controlled Polytempo and its visual-graphic realization on the score, and, respectively, to achieve an adequate full-fledged sound picture of the created new polytempo musical work;
– Third - organizing academic, technological and creative training of contemporary young composers with the principles, characteristics and new possibilities offered by the Controlled Polytemporal, as well as theoretical and practical mastering of the new technological possibilities that are in the resource of the apparatus Photopolymetron.

The following theses are offered in defence:

The Controlled Polytempo method is a technological and creative resource of the future, with an impressively high coefficient of utility in subsequent evolutionary processes of musical, creative and performance development.

The future construction - in the shortest possible timeframe - of a modern, state-of-the-art Photopolymetronome apparatus is an absolute necessity for the full development of the goals and creative aspirations described above, related to the construction, development and refinement of a complex technological-creative platform based on the Controlled Polytemporal Method.

CHAPTER 1 Movement is the basic process in space. Permanent multiplicity of movement in space. Polytempia

In the development of this study, as a synonym for the concept of "multi-speed process", an analogous term will be used: "polytempic process". Respectively, as a synonym for the concept of "multispeed" – analogous in meaning: "polyspeed" and "polytempo". The word "polytempo" is of ancient Greek and Latin origin, adopted in all European languages.

Definitively, "polytempo" in music should be formulated as the simultaneous movement of two (or more) sound lines running at different speeds. The term polytempo, in addition to music, is also relevant to other expressions in art, in particular – dance, theater. In the course of this scientific study, as a synonym for the concept of "sound line" will be used analogous in meaning, like: "musical layer", "sound fabric".

1.1. Polytempia in the millennial cultural development of mankind

Typical of ancient Greek theater is the alternation of speech and music; Speech delivered by costumed actors and music – songs performed by a choir. Characteristic polytempo sound picture, for decades, is widely known from the national folklore fairs held in Bulgaria in Koprivshtitsa and Rozhen; Long and wide – for hours - several vocal and instrumental folklore groups sing, sang and played simultaneously. The author of the current scientific study, as conductor and chief artistic director of the National Ensemble for Folk Songs and Dances "Philip Kutev" in the period 1974-1994 – on the occasion of the 40th anniversary of the founding of the Ensemble in 1991 – has created the choral instrumental suite "Koledari Sacraments", which is built on the basis of the typical for the National Folklore Fairs in Bulgaria polytempereal sound picture.

As can be seen from the attached note 1 – a fragment of the first part of the suite "Christmas Sacraments" – two groups participate in the Christmas celebration: boys and village girls. The two parallel sound layers move at different speeds and are united in a homogeneous polytempic construction. In the suite, such a creative approach can be repeatedly observed. As a summary in the observations and analysis so far in this scientific study: in the millennial evolution and development of human culture, the examples of multidirectional sound processes are impressively diverse.

1.2. Polytempic sound processes in nature

In nature, there are various sound forms of "fauna-polytempism". Essentially, we have the presence of a polytempic structure made up of four multiple-speed polyrhythmic sound layers.

The applied technological example 2 is a construction of four multi-speed lines. The following main characteristics are observed: as evidenced by the four-layer structure of the score, in the first line a permanent movement at the pace of M.M. is realized.♩=48, graphically resembling – a nightingale chirp. In the second line there is a movement in pace M.M.♩=84, with a characteristic rhythmic structure, graphically representing the peculiar knocks of a woodpecker. In the third line there is a movement at a pace M.M.=60, graphically resembling the cuckoo sequence. In the fourth, last multidirectional line there is a movement in pace M.M.=72, graphically similar to the permanently humming frog aleatorics. ♩ ♩ The four multi-speed layers are metrically organized as follows: in the first layer – the lineage of the nightingale – there are 8 quarter pulsations, summed in two strokes of 4/4; respectively, in the first multi-speed layer, according to the rate indexation – M.M.♩=48 – in 60 seconds, 48 quarter-shaped pulsations occur. In the second layer – the line of the woodpecker – there are 14 quarter-scale pulsations, summed in two strokes of 7/4; respectively, in the second multi-speed layer, acc., the rate indexation – M.M.♩=84 — 84 quarter ripples take place in 60 seconds. In the third layer – the cuckoo line – there are 10 quarter pulsations, summed in two beats of 5/4; respectively, in the third multi-speed layer, according to the rate indexation – M.M.♩=60 – 60 quarter ripple runs in 60 seconds. In the fourth layer – the line of the frog aleatorica – there are 12 quarter-shaped pulsations, summed in two strokes of 6/4; respectively, in the fourth multi-speed layer, according to the temperature indexation - M.M.♩=72 – 72 quarter ripples take place in 60 seconds. As a summary: there are numerous examples of the existing polytempic sound processes in nature, moreover – with impressively colorful timbre-sound characteristics and diverse metro-rhythmic structures that could serve as a kind of impulse in the creative palette of the contemporary composer.

CHAPTER 2 The Origins of Polytempic Processes in Music. Development of polyphonic genres in the Late Middle Ages, Renaissance, Baroque, Classicism and Romanticism. The New Polyphonic Forms in Music – a Natural Medium for the Emergence of Polytempia

The original origins and origins of the polytempic processes in music should be sought in the art of the Middle Ages. In the 1820s, Philippe de Vitry created the fundamental scientific treatise "Ars nova"; Estimated year of creation – year 1322. The treatise is a key moment in the future development of music in Europe; It justifies the principles of the new art, dealing mainly with the metro-rhythmic organization of music; new concepts related to the development of polyphony and counterpoint are formulated; in particular, the treatise "Ars nova" for the first time mentions the term "prolation" (prolatio, lat.) and, accordingly, prolation canon.

In the attached example 3, the work has a characteristic isorhythmic structure and a complex internal polyphonic organization of constantly alternating and repeating patterns, which – together – creates in the listener a real sound sense of diversity.

The music created during the period of Ars Nova had a significant influence in the further development of Western European art in the following 200 years - the time of the Renaissance. One of the most popular works of the Early Renaissance era is "Missa Prolationum" by Flemish composer Johannes Okeghem. The work was created in the usual cyclicity: Cyrie, Gloria, Credo, Sanctus & Benedictus, Agnus Dei.

In the attached example 4, this peculiar in its structure polymetric process, embedded in the exposure of the canon, brings to the listener a sense of tangible sound internal two-dimensionality.

In the last, fifth part of Josquin de Prez's work - Agnus Dei - a prolatory canon is exposed. The three voices, presenting the same sonic-verbal statement, start simultaneously, but move at different speeds.

In Example 6, the upper, first voice moves with the highest speed. The third vote – in the bass party – proceeds at an intermediate rate. Resp., there are permanent pace proportions between each pair of votes, as follows: between the first and second vote – 3:1; between the first and third voices – 3:2; between second and third vote – 1:2. Accordingly, the tempo proportions between the first, second and third voices are 3:1:2. In this characteristic polymetric structure, embedded in the canon of Agnus Dei by Josquin de Pré, is essentially a trinity of multi-speed musical process. The three, parallel sound layers move at three different tempos.

The dynamics observed so far in the development of polyphony and counterpoint, as well as in the development of polymetric techniques in the musical art of the Renaissance, continued during the Baroque era. In his piano integrals Das Wohltemperierte Clavier (Well-tempered Piano), The Art of the Fugue (Die Kunst der Fuge) and Musical Sacrifice (Musikalische Opfer), the composer combines all known polyphonic techniques: from mirror inversion and polyrhythmic "hemiola" to "retrograde canon" and polyphonic stretto-exposure.

In the note 8 of "A well-tempered piano", spread over five lines for a better vision – see Figure 8. Tacts, 67-71 – the theme of the joint is exhibited in a 5-vowel stretto starting from the highest voice. Descending to the lowest voice permanent movement, developing progressively after each subsequent half-note, creates a feeling of maximum dramaturgical condensation of the work.

In the music of all three classicists Franz Joseph Haydn (1732–1809), Wolfgang Amadeus Mozart (1756–1791) and Ludwig van Beethoven (1770–1827) permanently present polyphonic expression and characteristic accompanying metro-rhythmic structures, from the small chamber-instrumental form – solo play, trio and string quartet – to the large symphonic canvas, such as the famous fugato of the third part (Scherzo) of the Fifth Symphony by Ludwig van Beethoven, exposed in string instruments.

In the subsequent multifaceted period of Romanticism, by the end of the 19th and the beginning of the 20th century, the music of the Old Continent significantly expanded its spaces; names of composers from Russia appeared – in particular, the members of the so-called. "Mighty Five" (Russian, "Moguchaya Bitch"), artists from Scandinavia, Latin America and the United States. Too wide is the list of composers, in whose creative palette the polyphony is present.

The end of the nineteenth century and the first decades of the coming new twentieth century is a time characterized both by the variety of stylistic currents and the emergence of new aesthetic programs, as well as by new, modern technological directions in music. In this wide amalgam of aesthetic-technological directions, all hitherto known forms of polyphony, counterpoint and characteristic metro-rhythmic structures – known since the Middle Ages, the Renaissance and the Baroque – fit organically into the works of composers from around the world.

CHAPTER 3 The diversity of stylistic currents in the music of the 20th century. New artistic and technological techniques in the realization of polyphonic, polyrhythmic and polytempic constructions

The turbulent twentieth century experienced two catastrophic world wars, with enormous permanent tensions between two diametrically opposed world political systems and opposing military blocs – until the fall of the Berlin Wall in 1989. In this vast time space, contemporary music goes a long way in colossal accumulations: the emergence and development of new artistic and aesthetic programs, including, impressionism, expressionism, neoclassicism, minimalism, primitivism, new simplicity (German, Neue Einfachheit), postmodernism; resp., emergence of new technology platforms – incl., dodecaphony, aleatorics, puantilism; a set of new methods and technological techniques in the realization of polymetric and polytempic sound structures; use of a quarter-tone system. The list of authors who created polyphonic works in the past 20th century is too widespread. Among Igor Stravinsky's most popular works is Symphony of Psalms, a choir and orchestra created in 1930 on Latin texts from the Old Testament – written by Russian conductor Sergei Kusewitzki, music director of the Boston Symphony Orchestra. The work is built in a traditional three-part cycle. The second part of the symphony is a double four-voiced joint. Among the most significant works of the first half of the twentieth century is the piano cycle "Ludus Tonalis" by Paul Hindemith. The work is intended as a contemporary reading of the ideas set out in "A well-tempered piano" by Johann Sebastian Bach and a worship of his work. It is a kind of encyclopedia of contrapuntic techniques.

The palindrome is a compositional and technical technique in the works of a number of contemporary authors, including the three-act opera "Lulu" by Alban Berg, created in the period from 1929 to 1935, which remained unfinished due to the composer's death. In the middle of the 2nd act, as a symphonic transition in the ongoing stage action, an instrumental palindrome is wedged. A peculiar center of palindrome is the decomposed chord in the piano party (example 13): eight ascending 64-tinki notes and their subsequent downward movement, accompanied by a characteristic triol movement in the 1st violins (see, the first half of tact 687), mirrored in 2nd violins (see, second half of tact 687), on a lying chord in woodwind instruments in dynamics *"ppp"* – a kind of harmonious filling. The example observed from the opera "Lulu" by Alban Berg is a filigree built palindrome structure.

In Bela Bartok's "Music for strings, percussion and celestials" the main theme of the joint is built on eight tones of the chromatic range, with characteristic metro-rhythmic asymmetry, abundance of syncope equilibristics and permanent change of clock sizes – 8/8, 12/8, 8/8, 7/8. The multilayered, polyphonic-complimentary structure (Example 16) unfolds gradually with dynamic injection to "fortissimo", as the spectrum of unequal dimensions merges into an

inimitable metro-rhythmic kaleidoscope – 5/8, 6/8, 8/8, 7/8, 9/8, 10/8, 11/8, 12/8 – and through their permanent alternation in the overall stretto-structure, a kind of mobile hetero-rhythmic sequences are formed, so characteristic of the rich Bulgarian metro-rhythmic tradition, to which Bela Bartok has repeatedly turned in his creativity.

The subsequent third example is from joint No 4, from the piano cycle for two pianos "FUGUE INTEGRAL" by Stefan Dragostinov. Fugue No. 4 is titled F-Ut-G-A – Fuga. The theme is a tone series of four notes: "fa-do-sol-la." As can be seen from the attached example 17, the stretto-exposition is a kind of polytonal carousel – the theme passes successively through all 12 tonalities of the quart-quint circle, exposed – mirror, retrograde, inverse – as follows: in F (major) – Si-flat – Mi-flat – La-flat – Re-flat – Sol-flat – Do-flat (enharm., Xi) – Mi – La – Re – Sol – Do. After reaching the F major starting tonal, the polytonal carousel continues its spiraling path again: Fa – C flat – Mi-bemol. It should be noted that the stretto-structure of Fugue No. 4 of the piano cycle "FUGUE INTEGRAL" has no analogue in world musical literature.

Another characteristic polyphonic technique used in the music of a number of composers of the twentieth century is the traditional pro-latory canon, providing a wide amalgam of technological, polymetric creative possibilities through augmentation and diminution. Prolatia can be observed in the works of Dmitri Shostakovich, 15th Symphony, Rodion Shchedrin, "Polyphonic Notebook" (Rus. "Polyphonic Tetrad") for piano, Arvo Pärt, Cantus in Memoriam Benjamin Britten, Stefan Dragostinov, "Fugue Integral" for two pianos, Larry Polanski (born 1954), Canon No. 13, Klaus Lang (born 1971), "Rindenmotette". In this specific polymetric structure, realized in the 1st part of the 15th Symphony by Dmitri Shostakovich – essentially – a trinity of multi-speed musical process is observed. The parallel flow of the three sound layers brings to the listener a sense of tangible three-dimensionality.

As a general conclusion in the observations so far: from 1722, when J. S. Bach wrote the cycle "Well Tempered Piano" (Part 1), three centuries have passed – a period during which many polyphonic pieces have been created, preserved in the treasury of world music. This peculiar spiral of permanent interest in polyphonic structures has been a respectable development over the past century; In particular, particularly impressive is the list of created instrumental polyphonic integrals, type-format "Preludes and Fugues" – (for solo piano, for organ, for two pianos, for solo violin, for solo guitar, for two guitars).

This kind of symbiosis of the inherited from the time of the Middle Ages, the Renaissance and the Baroque forms of polyphony, counterpoint and accompanying metro-rhythmic structures with modern aesthetic-technological means of expression of the twentieth century – serialism, puantilism, aleatorics, electronic music, including the significant innovative achievements of computer technologies over the past four decades – is a unique basis for the future development of music art in the coming Third Millennium.

CHAPTER IV Development of polytempic processes in music of the 20th century

Interest in the polytempic processes in music is noticeable in the works of composers from all over the world, moreover – in the widest range of stylistic directions and directions: from the sound-palette of late romanticism and expressionism, through the a-tonal element characteristic of the period from the second decade of the century to the time after the end of World War II - in particular, the years associated with the so-called "Second World War". Western avant-garde and representatives of the Darmstadt School, on the one hand, and on the other – with the creative processes associated with the so-called Darmstadt School. Polish avant-garde and the large-format sound-showcase of the Warsaw Autumn International Music Festival – up to the years of the last decades of the century, bearing the flavor and appearance of new sound-stylistic characteristics - minimalism, primitivism, new simplicity, postmodernism, etc. –

a kind of creative turning "looking back" in time, in particular, and to the forgotten, but inexhaustible lado-tonal resource.

Polytempic processes in music have definitely one significant and significant characteristic: the advantage of "new expression". This presumed the introduction of a new terminological concept. Polytempism. Polytempism. It should also be explicitly stated that the use of this term occurs for the first time – here in this scientific work. The attached evidence shows that the word "polytempism" – in Bulgarian and, respectively, in English, "polytempism" – does not exist in Google's large-format lexicon.

The series of composers – ranked by year of birth – features creative personalities from around the world as follows: Charles Ives (1874-1954), Elliot Carter (1908-2012), Conlon Nancarrow (1912-1997), Henry Brant (1913-2008), Luigi Nono (1924-1990), Luciano Berio (1925-2003), Pierre Boulez (1925-2016), Karlheinz Stockhausen (1928-2007), Steve Reich (born 1936), Brian Fernihoff (born 1943), Stefan Dragostinov (born 1948), Bozhidar Spasov (born 1949), Iliya Kozhuharov (born 1949), Kenneth Johnson (born 1950), David A. Jaffe (born 1955), Kyle Gahn (born 1955), Magnus Lindbergh (born 1958), Evgeny Kostitsyn (born 1963), Peter Toegersen (born 1967), John Arrigo-Nelson (born 1975), Mikhail Puchkov (born 1984).

The leading creative figure in contemporary American music is the composer Charles Edward Ives. One of the early works of the young 30-year-old composer is the orchestral play "The Unanswered Question", created at the beginning of the century, in 1908 – initially, with the working title "Cosmic Landscape", later revised by the author in 1930-1935, with a World Premiere, only in 1946. The chamber orchestra is divided into two main groups that play music at two different paces, under the guidance of two conductors; The solo trumpet plays independently, with a different – from the two chamber-orchestral groups – tempo characteristic. The string band began to play in tempo *Largo Molto sempre*, with a fixed metronomic indication: M.M.♩=50; the tempo does not change until the end of the work. In the attached Example 20, the woodwind group – against the background of the lying-creeping harmonic structure in the strings – plays at another, more accelerated *tempo – Adagio –* as an exact metronome indication is not indicated. The solo-trumpet – playing with a tempo indication identical to that of the string group – M.M.♩=50 – permanently inserted between the two polytempo layers, with a characteristic polymetric three-way structure, built on the basis of five non-repeating tones; typical series construction. With each subsequent response exhibited in the wind instruments, the pace of their party changes. Starting in *Adagio,* after a short pause-intermedia - in which another series construction in the solo-trumpet sounds - the pace in the brass party accelerates, respectively: *Andante -* Allegretto – Allegro - Allegro Molto.

In the considered Example 21 of the score of "Unanswered Question" by Charles Ives is found the parallel flow of two multidirectional sound layers – in the string group: Largo Molto sempre, with metronomic indication M.M.♩=50, and in the group of winds: initially - in the first line of the example - Allegro - and in the *second line of the example* - Allegro Molto. *In the overall development of the work, all tempo in the group of wind instruments are without specified metronomic indication. This important circumstance implies a certain freedom in the interpretation of the work; tempo* Adagio *could be moved in the parameters from M.M.♩=66 to* M.M.=74 — numerical values are relative; respectively, tempo Andante, in the parameters from M.M. ♩♩=76 to M.M.=90; further, tempo Allegretto - from M.M. ♩♩=114 to M.M.=124; tempo Allegro – from M.M. ♩♩=126 to M.M.=136; and tempo Allegro Molto – from M.M. ♩♩=138 to M.M.=144. ♩Charles Ives' Unanswered Question is a brilliant example of polytempo music, created back in 1908.

One of the brightest contemporary composers who turned to the problems of polytempia is the American Samuel Conlon Nancarrow. The short 13-minute work is built in a classic three-part cycle, respectively, with a duration of 1 part – 2 minutes and 10 seconds, the 2nd part – 5

minutes and 40 seconds and the final third part – 5 minutes and 10 seconds. In example 22, the following features are observed: Nancarrow fixes a basic and constant running speed: Measure – 72. This basic pace is relevant to the clock structure, respectively, in 60 seconds time will flow 72 strokes. The lowest row of the score – the cello party – has a clock size: 3/8. Within one beat there are 3 eight-notes – or, respectively, breaks. The intra-clock osmin permanent pulsation is equal to 216♪ occurring in 60 seconds. Accordingly, in 5 seconds – within 6 beats – there will be 18 eights of notes – or, eight-breaks. The viola party – see, tact No. 13 and beyond – has a clock size of 4/8. Within one beat there are 4 eight-notes - or, respectively, pauses. In the viola party, the intra-clock eight-minute pulsation is equal to 288♪ running for 60 seconds. Accordingly, in 5 seconds – within 6 beats – there will be 24 eights of notes – or, eight-breaks. The osmin pulsations in the forehead and viola are in a ratio of 18:24, respectively, in proportion – 3:4, etc. (details in the dissertation) In the overall construction of the polytempe canon, a characteristic structure is woven between the flowing sound layer in the cello and the newly entering layer in the viola at a faster pace; It plays the role, figuratively speaking, of a kind of springboard, stimulating a spectacular transition between the two tempes. In the example under consideration, there are two more similar transitions: in the inclusion of the 2nd violin, in a polytempic dialogue with the viola, see, tacts 16-18; and in including the 1st fiddle, in a polytempic dialogue with the 2nd fiddle, see, tacts 29, 30 and 31. As a summary: the multi-layered sound fabric in the score of String Quartet No. 3 by Samuel Conlon Nancarrow is an organic alloy between the technological principles embedded in polymetry and polytempe.

The next piece, Unquiet Night, was created in 2004 by contemporary American composer Kyle Gann for mechanical piano. The score of the work – with a total duration of 16 minutes – is exhibited in 5 lines – in some cases, in 4 or 6 lines - in the amount of 4/4 and temp indexation – M.M.♩ =100. In the parallel movement of the five sound lines there is a permanent polymetric pulsation, which gradually, with the smooth dramaturgical development of the work, accelerates and intensifies. In example 23 there is a characteristic vertical cluster of four polymetric structures as follows: in the first row - 4:7; in the second line - 4:9♪; in the third row - 4:13♪; in the fourth row - 4♩♩♩♩:11. Further in the work there is a gradual thickening of the polymetric pulsations. In the attached second example 24 of the work – see, strokes 18, 19, 20 and 21♪ – there are already 5 polymetric structures present,♩ as follows: in the first row - 4♩:7♩; in the second row - 4♩:9♪; in the third row - 4♩:13♪; in the fourth row - 4♩:11♪; in the fifth row - 4♩:5♩; There are 5 different main metric ripples, which are in a permanent ratio: (in base meter 4/4) – 4:5:7:9:11:13. In conclusion: the multifaceted permanent polyrhythmicity and polymetricity embedded in the multi-layered score of the piano play "Restless Night" by Kyle Gann is most related to the technological parameters of polytempa.

One of the most significant figures in twentieth-century music is the German composer Karlheinz Stockhausen, who established himself as a leading figure in the Western vanguard after the end of World War II and an active participant in the notorious Darmstadt School, along with the names of Pierre Boulez, Luigi Nono, Luciano Berio, Bruno Maderna, Yiannis Xenakis, André Bucharestliev et al. Karlheinz Stockhausen created a series of symphonic and chamber works based on polytempa. In the large-scale 22-minute piece "Gruppen", written between 1955 and 1957, Stockhausen used three orchestras, which were conducted by three conductors. In the considered Example 26 there is a characteristic polytempo race between the three orchestral groups, in three different tempes, respectively: in the first orchestral group – pace with metronomic indication ♩ = 80; in the second group – pace = 85; in the third group – pace ♩ ♩ = 95. Accordingly, the three rates are in proportional dependence as follows: 16:17:19. According to this dependence, at the beginning of the subsequent 12-second period – in the first second – a vertical metric unity takes place in all three parallel-flowing polytemporal layers. This specific stratification can be found many times in the score of "Gruppen". In the following example, 27

of Stockhausen's work other inter-speed characteristics are observed. The three multi-speed layers are in a permanent ratio – 18:17:14.2. The three-layer polytempo fabric is an impressive conglomerate of constantly changing metronomic indications as follows: the rate - in quarteraneous pulsation: ♩=70; ♩=71; ♩=75; ♩=80; ♩=85; ♩=90; ♩=95; ♩=101; ♩=107; ♩=120; ♩=127; ♩=142; tempa – in osminka pulsation: =60; =67; =71; =90; =120; =240. In the construction of the polytempo-structures, the clock sizes used, in their rich variety, represent a respectable metric kaleidoscope: 1/4, 2/4, 3/4, 4/4, 5/4, 6/4; 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8; ♪ ♪ ♪ ♪ ♪ 1/16, 3/16, 4/16, 5/16, 7/16, 9/16. As a summary in this study: ♪ the work "Gruppen", as well as the subsequent work for four Carre orchestras – created by Karlheinz Stockhausen in 1959-1960 – are of particular importance for the creative flourishing of the European avant-garde, as well as for the overall future development of polytempic processes in music in the second half of the twentieth century.

The next work, to be examined and analyzed, is by the young Russian composer Mikhail Puchkov. The work, bearing the unusual title "NE", created for a quartet consisting of: bayan (or accordion), saxophone, 4-string domra and cello – with a four-dimensional polytempo structure – has a total duration of nine minutes. According to the explicit instructions of the author, each instrumental party in the quartet should be performed using an individual metronome, installed in front of each contractor. The following linear tempo characteristics are observed in the work; The performers in the quartet play at four different tempos as follows: Bayan (accordion): ♩ =140; clock size – 3/4; Saxophone: ♩ =134; clock size – 4/4; Domra: ♩ =124;clock size – 4/4; Cello: ♩ =128; clock size – 4/4. These 4th tempo pulsations are, respectively, in a constant proportion – 140:134:124:128 – from the beginning to the finish of the work. Each instrumental party has a specific metro-rhythmic and dynamic characteristic. The whole sound palette in the work carries the atmosphere of the modern for the end of the twentieth century creative currents – minimalism, primitivism, postmodernism. Vednó with the technological construction, related to the innovative principles of aleatory polytempa, The work is an interesting object for scientific observation.

In conclusion: The five works by Charles Ives, Samuel Nancarrow, Kyle Gann, Karlheinz Stockhausen and Mikhail Puchkov, created within a century, characterized by multidirectional and diverse stylistics, as well as diversity in technological aspect, give grounds for concluding that polytempia, as a musical-creative direction, is a vast territory – a huge technological resource for the development of musical creativity in the coming Third Millennium.

CHAPTER V. Controlled polytempia. Historical prerequisites for the development of new technological-creative directions. The composer Iliya Kozhuharov and the apparatus created by him Photopolymetronome, providing permanent submission of polytemp information to performers (or conductors) performing music at different tempos

The development of polytempic processes in music, from the late 1960s and early 1970s, to the present day is characterized by dynamic political changes around the world: the collapse of the Berlin Wall, the collapse of the Union of Soviet Socialist Republics, and the so-called Soviet Socialist Republics. The socialist bloc, the termination of the military Warsaw Pact and the cessation of the half-century East-West conflict. It should be noted that these political changes have a significant impact on the bosom of culture – in the widest perimeter: music, theater, cinema, fine arts. The interpenetration of cultures that had been forcibly divided, nearly half a century, from the East-West demarcation line took place – so expected for years after the end of World War II. The huge arsenal of accumulated new computer technologies and the impressive development in the field of electronic music – especially in the last decades of the past twentieth century – are a real prerequisite for the emergence of new creative directions, in particular – controlled polytempo – the latter, which emerged as a natural creative and technological

evolution, in the overall innovative development of contemporary music at the end of the century and the beginning of the Third Millennium.

In the early 1970s, the young Plovdiv composer Iliya Kozhuharov, as a composition student with prof. Marin Goleminov at the Bulgarian State Conservatory developed the original idea of creating a unique mechanism synchronizing simultaneously permanent delivery of light polytempo signals to several musical performers (or, conductors). On March 12, 1973, Iliya Kozhuharov officially registered his author's idea at the Institute for Inventions and Rationalizations (INRA), Sofia, under the title: "Method and device for simultaneous transmission of different tempos to individual orchestral or choral groups and solo performers", with request number 22966.

In the spring of 1977 Iliya Kozhuharov created the world's first equipment providing permanent submission of tempo information to each performer (or conductor), musician at one or another pace, which he named – PHOTOPOLYMETRONOME. In the summer of the same year, at the First International Workshop of the Young Composer, held in the resort of Sunny Beach, organized by the Union of Bulgarian Composers under the auspices of UNESCO, Iliya Kozhuharov made the first technical demonstration of the equipment created by him.

On September 10, 1978, in the Netherlands, Sofia. Hilversum - in the concert hall of studio WARA - at the international composition competition "Gaudeamus" is the world premiere of the cantata "The Fair" (La Foire – Polytempo 1), author – Stefan Dragostinov, realized with the equipment Photopolymetronome. On March 12, 1979, in the hall of the Youth House in Plovdiv, was the first performance of works by Bulgarian composers, realized with the equipment Photopolymetronome: "Canon No 2" by Iliya Kozhuharov, "Temporhythms" by Bozhidar Spassov and "Naddumvane" by Iliya Kozhuharov.

5.1. Description of the apparatus Photopolymetronome. Main technical parameters: three temps – $\downarrow$ =72; =78; $\downarrow$ $\downarrow$ =84. Tempo light indicators, permanently submitting polytempo information to performers (conductors), musicating at different rates

The first Photopolymetronome apparatus, created by Iliya Kozhuharov, is an entirely electro-mechanical construction. There is no electronics in it. (details in the dissertation). Each of the three parallel speed signals reaches each contractor (or conductor) via a specially mounted in front of it Light pace indicator (LPI), the light signals are colored green. Between the constantly-pulsating light signals there are short gaps; respectively, the light of the corresponding indicator permanently flashes and turns off. In this way, a kind of light attack to each subsequent metric ripple is visualized.

5.2. Visualization of polytempic structures on the sheet of score. Main general vertical – total metric moment in the flow of several multi-speed layers. Graphic symbol Semaphore corresponding to the Main General Vertical. Polytempic period – a musical time between two main general verticals.

A technical example of a polytemp structure built in three M.M. temps is considered.=72, M.M.=78 and M.M.=84. In the first line - with a rate indexation M.M.=72 - a quarter metric pulsation runs; in a period of 10 seconds, 12 quarters flow, united in six beats of 2/4. In the second line – with a rate indexation M.M.=78 – in a period of 10 seconds 13 quarters are run, united in five beats of 2/4 and one beat of 3/4. In the third line – with a rate indexation M.M.$\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$=84 – in a period of 10 seconds 14 $\downarrow$ quarters united in seven beats of 2/4. The presence of a common metric moment in the movement of the three rates - $\downarrow$ = 72 is found; $\downarrow$=78; $\downarrow$ =84: Initial total vertical; later in the present scientific study it will be named as – Main General Vertical. (Head common vertical). The running of musical time between two major general verticals, equal to 10 seconds, is a Polytempic Period. (Polytempic period). The two topics – "main general vertical" and "polytempic period" in the methodology of Controlled Polytempia – are particularly

significant and are subject to detailed consideration and analysis later in this scientific study. In the Photopolymetronome apparatus there is a possibility for the Main General Vertical to be visualized – through the three light indicators mounted in front of the three performers – as a Yellow Light Tempo Signal. This yellow signal is preceded in all three light indicators by a continuous green signal, which is actually the last in a series of short light ripples. Despite the visibly limited parameters of the equipment, offering the possibility of simultaneous flow of only 3 temps - ♩ = 72; =78; ♩♩ =84 – in tempo proportions 12:13:14, respectively, 6:61/2:7 – created by Iliya Kozhuharov in 1977, Photopolymetronome marks a new page in the world musical development and new, modern technologies and, in particular, in the field of Controlled Polytempa.

In example 34 of "Canon No. 2" for violin, horn and piano by Iliya Kozhuharov, the three-layer score the instruments are arranged vertically as follows, from top to bottom: violin playing at the fastest tempo M.M.♩ =84; French horn in F-stroy playing in tempo M.M.♩ =78; piano, in tempo M.M.=72. The main theme of the canon, exhibited in the violin, is a seven-stroke slice, in a size of 2/4. After a short pause, equal to 4 eighth pulsations, the theme appears again, with a characteristic inclusion – of "weak eighth time". The theme is a sequence of 12 non-repetitive tones - a series series - as follows: Cis-H-C-Es-B-A-E-Fis-F-D-G-As. ♩ The three polytempo layers start simultaneously. The controllability of the polytemporic process is ensured by the Photopolymetronome apparatus; as evidenced by the beginning of the second line of the example, the chevronic pulsations in the 3 different temps coincide in the Main General Vertical; respectively, the light indicators mounted in front of the three performers light up simultaneously. The author has achieved a creative trinity: of the polyphonic traditions inherited from the time of the Renaissance – prolation, cutting-edge technology in music of the first half of the twentieth century — in this case, serialism — and controlled polytempia.

Example 35 is a fragment of the work "Temporrhythms" by composer Bozhidar Spasov. The work was created for three solo instruments: clarinet (in B), violin and piano. The technological polytempic characteristics are the same as in the previous example of Iliya Kozhuharov's play. There is a trinity of the already known three tempes: M.M.=84 – in the party of the clarinet; M.M.=78 – in the party of the violin; M.M.=72 – the piano party. As can be seen from the example, vertically, at the beginning of the first beat, in all three instruments – playing at three tempos – the first quarter time coincides, respectively, there is a Master General Vertical. ♩ ♩ Again – as in the previous example from Iliya Kozhuharov's play "Canon No2" – the intertemporal ratios are the same: ♩ 14:13:12, resp., 7: 61/2: 6. In the two instruments, clarinet and violin, a characteristic polyrhythmic race is observed; short, bravurian, ascending-descending passages in quintoles, sextols, septols. In contrast to this permanent race between the clarinet and the violin, the piano party is distinguished by sharp chord strokes with a touch "sforzato", marking the metro-pulsation of the slowest pace – M.M.♩=72.

5.3. Technical parameters of the apparatus Photopolymetronome – continuation: three primary rates and description of the multivelocity relationships

In the Photopolymetronome apparatus created by Iliya Kozhuharov and the three tempes set in it – M.M.♩ =72, M.M.=78 and M.M.=84 everywhere in this scientific study they will be named: Three primary rates. They have a particularly important characteristic concerning their multi-speed relationships. The distances between them is a permanent quantity – the number 6. The first pace: 72 + 6 = 78 – these are, already, the numerical parameters of the second pace. ♩ ♩ The numerical calculation in the upward direction finds the following: The second pace: 72 + 6 = 84 – this is the digital expression of the third pace. The apparatus, regardless of the only three temps set in it, =72, =78, =84, although with limited technological parameters, ♩ ♩ ♩ suggests possibilities for additional intertemporal overlay. One of these options is to use twice as fast pace

– M.M. ♩ =144, ♩ =156 and ♩ =168. These three new pace numbers — respectively, twice as fast as the previous 72, 78, 84 — are in the same ratios, respectively, 12:13:14.

Another essential characteristic should be noted: the distances between the new, double-accelerated tempos is always the number 12. The first pace: 144 + 12 = 156; These are the numerical parameters of the second pace. The second pace: 156 + 12 = 168; This is the digital expression of the third pace. As a summary: the numbers of all three "doubly accelerated tempos" — 144, 156, 168 — are divisible by the number 12; the result after fission is – 12, 13 and 14 respectively; this result represents their Intertemporal ratios. The numbers of the three primary tempos — 72, 78, 84, are also divisible by 12; the final result is familiar: 6: 6 1/2: 7; numbers corresponding to their ratios.

The following is another finding: the numerical expressions of the three primary tempos, as well as of the doubly accelerated tempos, discussed in a sequential sequence - the numbers 72, 78, 84, 144, 156, 168 - are divisible by 2, by 3, by 4 and by 6, the final result being – an integer. There is also a divisibility of 7, respectively, at tempa 84 and 168. There is divisibility by 8 – at tempa 72, 144 and 168. There is a divisibility of 9: — tempos 72 and 144.

This diversity in divisibility opens up an extremely wide creative horizon for the contemporary artist who has dived into the ocean of controlled polytempia. What does this diversity in divisibility imply in practice?

In summary: when a group of different tempos have a common multiple – this "common divisor" between two or three, and more "differences" tempos is a kind of Unifying Sign; There is a real opportunity for coordinated communication on the sheet between several simultaneously running pace layers, which – at first glance – have no common relationship with each other. The simplest rhythmic structures of one pace – duola, triol, quintola, septola – communicate with the "basic metric pulsation" of another, parallel pace, or with derived metric structures from it, but already in a completely new proportion.

The implementation of a parallel course of this impressive variety of multi-speed layers can be achieved only through the method of Controlled Polytempia and, respectively, with the help of the Photopolymetronome apparatus.

One of the most important moments in the understanding and creation of the Controlled Polytempia method, as well as the construction of the equipment, is the decision, 40 years ago, of Iliya Kozhuharov to prefer the "distances" between the simultaneously flowing three tempo layers to have constant numerical parameters – the number 6; respectively, the number 12, as the distance between the doubly accelerated three rates.

The theme is very interesting and, accordingly, subject to consideration. What are the advantages of a dozen over the ten? The 10 is divided by 2 and 5. The dozen – 2, 3, 4 and 6. Compared to the number 10, the number 12 is much more flexible. This visible agility and nimbleness of the dozen motivates Iliya Kozhuharov to prefer the number 12 to – 10. As a summary: when divisibility is more multifaceted, accordingly, the possibility of coordinated communication between more different, parallel-flowing tempos increases significantly.

5.4. Main general vertical and its derived structures in the methodology of Controlled Polytempia

The main total vertical, as found above in this scientific study, shall be located at the beginning of each 10 second polytempic period.

Example 38 is a fragment of the miniature "Poly-Drums" by Stefan Dragostinov – written in the autumn of 1978 for the percussion ensemble "Polyrhythmia", commissioned by its creator Prof. Dobri Paliev. In the process of the present observation, the tempata M.M.♩ =72 and M.M.=84, resp., the slowest and fastest pace, will be named: the two extreme temps. As a summary, a vertical unity of the three beats in the three temps is found. This, accordingly,

confirms the existence of a new common vertical in the polytempic construction, which appears just at the beginning of the sixth second of the 10-second period. ♩

In a fragment of the cantata "The Fair" (La Foire – Polytempo 1), by Stefan Dragostinov (example 39), there are similar interrelations between the three tempes. The choral score is built in three multi-speed layers, corresponding to three choral groups, conducted by three conductors, in three tempes: M.M.♩ =72, M.M.=78 and M.M.=84. ♩ ♩ In the middle of the score fragment – respectively, after 6 quarter-star pulsations in the first choral group, in tempo M.M.=72, in the second choral group, after 6 quarters and 1 eighth in tempo M.M.=78, and in the third choral group, after 7 quarters in tempo M.M.♩ ♩=84 – a common vertical moment is observed, with the following characteristics: In the 1st choral group – a quarter note, respectively, with the text: the syllable "de", marked in the score with Latin transcription "de"; in the 2nd choral group – eighth note, ♩ with text: the syllable "de" – (de); In the 3rd choral group – quarter note, ascending glissando, with lyrics: syllable "Ra" - (RA). This again confirms the existence of a common vertical in the polytempic construction, which appears just at the beginning of the sixth second of the 10-second period. The 4 common verticals found should be described in a numerical sequence. In the observations and analysis carried out, it should be noted that the distances between the four common verticals, as time traveled in the 10-second period, are constant – 2.5" (two and a half seconds). There is another, important dependence in the time structure – respectively, in the graphical reflection of the general verticals on the sheet page. There is divisibility into 2 – two equal parts of 5 seconds, in the implementation of the Main General Vertical and the Central General Vertical, respectively – two equal in length parts of the sheet sheet. There is also divisibility into 4-four equal parts of 2.5", in the implementation of the four common verticals, and respectively – four equal in length parts of the sheet page. The distances between the four appearances of the vertical are a constant time quantity – 2.50" (2 seconds and 50 hundredths); 1.25" (the time of the first appearance of the vertical after the start of the polytemp period) + 2.50" = 3.75" (this is the time of the second appearance of the vertical after the start of the polytemp period); 3.75" + 2.50" = 6.25" (this is the time of the third appearance of the vertical after the start of the polytemporal period); 6.25" + 2.50" = 8.25" (this is the time of the fourth appearance of the vertical after the start of the polytemp period).

This new vertical should be defined terminologically as – Intermediate vertical; The four verticals should be designated as: First intermediate vertical, Second intermediate vertical, Third intermediate vertical, and Fourth intermediate vertical.

According to the previous finding of the divisibility of a polytemporal period by 2 and 4, as well as the subsequent divisibility of 8, respectively, there is an apparent geometric progression in this sequence of three numbers—2, 4, and 8—. To the above established sequence of three numbers 2, 4 and 8 – a fourth number – 16 can be added. Theoretically, this chain in geometric progression is infinite.

Като обобщение. Темата – единни, общи вертикали в политемпичното пространство е особено интересна, технологично-творчески интригуваща, обширна и - взряна в бъдещето.

5.5. Technological possibilities for visual-graphical realization of polytempic structures

The works created in the 70s and 80s of the last century by Iliya Kozhuharov, Bozhidar Spasov and Stefan Dragostinov – based on the method of Controlled Polytempia – are written "by hand", and the vertical-graphic outlines on the sheet of the parallel-flowing multi-speed layers are formed by means of prefabricated polytempo templates made on cardboard.

The Photopolymetronome, constructed by Iliya Kozhuharov in 1977, has technical parameters including three tempos – M.M.=72, M.M.=78 and M.M.=84, which are in a ratio of

12:13:14. For each of the three tempos, a separate template is made. ♩ ♩ ♩ The three templates are of equal length, corresponding to the length of the pentolinia, located on the sheet of note, resp., involving the time of one Polytempic period. Each of the cardboard templates is marked respectively in 12, 13 or 14 equal parts, adequate to the main permanent quarters pulsations in the three tempos.

In those distant years — the mid-1970s and early 1980s — writing music on a computer was, figuratively speaking, Terra Incognita. It should be explicitly stated that the creation of the three polytemp templates is laborious work, requiring maximum precision in their production, given that the width of the then existing sheet music was too often with different parameters, respectively, the length of the sheet music was also different – with minimal differences of two or three millimeters – and, accordingly, this made it particularly difficult for the composer to prepare the polytempic stroke-configuration of the score. page.

On the page already prepared for work, the sheet music text is applied with a pencil and after the final completion of the creative process, all pre-mapped points corresponding to the main quarter pulsations are deleted, as well as the two vertical dotted lines corresponding to the Main General Vertical and the Central General Vertical. Orchestral and choral shields are also scored "by hand".

The creation of a polytempo work, in those years, in many cases faced the composer with a number of other technical problems. If the author – after writing the work – considers it necessary to make corrections to the sheet music, then he must restore the polytemporal stroke-configuration previously applied below the pentaline and then make the desired changes – it should be explicitly emphasized, only in cases where the corrections are within the polytempo period. However, if the corrections require the insertion of an additional musical fragment within one, two, or more polytempo periods, respectively, an extension of the work in duration, then the entire score – from the place of the corrections made, onwards – should be recreated. In conclusion of the above: visible from the analysis made, in the 1970s and early 1980s, the technological possibilities for visual-graphical realization of polytemporal structures are too limited.

5.6. Types of technological structures within a single polytempic period. Polytempic Fan

The parallel movement of two, three – and more – polytempo layers, synchronized by the Photopolymetronome apparatus, offers new technological forms of organization of metric structures, previously unknown in modern music. Within a polytemporal period, the main metric pulsations of the multi-speed layers are in permanent metro-rhythmic interconnection and constant subordination. As a summary: the polytempo structure analyzed in the above technical example definitely carries a specific graphic vision, resembling – within one half-period – the dissolution and closure of a fan. Within the framework of this scientific study, a new terminological concept should be introduced: Polytempic Fan.

As can be seen from the example attached above from the cantata La Foire – Polytempo 1, semaphore No38 – within the first part of the polytemp period, a technological construction of a polytemic fan is observed, with the following characteristics: Three multi-speed layers flow, respectively, in three rates as follows:

1. The first layer has a tempo indication – M.M.♩ =96. The metric construction in the entire period is organized in five tactics, respectively: two strokes of 2/4, two strokes of 3/4 and one stroke of 2/4 – a total of 12 quartering pulsations, within the entire polytempic period; this is the slowest rate line.
1. The second layer has a tempo indication – M.M.♩ =104. The metric construction throughout the period is organized in five strokes, respectively: two beats of 2/4, one

beat of 3/4, one beat of 4/4 and one stroke of 2/4 - a total of 13 quarter-pulse within the entire polytempo period; this is the average speed line.

– The third layer has a tempo indication – M.M.♩ =112. The metric construction in the whole period is organized in five tactics, respectively: two beats of 2/4, one beat of 3/4, one beat of 4/4 and one beat of 3/4 - a total of 14 quarter-pulsations, within the entire polytempo period; this is the fastest speed line.

Accordingly, according to the established number of the main quarter pulsations in the three rates – 12, 13 and 14 – the three parallel-flowing multiple-speed lines are in proportional dependence: 12:13:14 – respectively, 6:61/2:7.

5.7. Monotempic structures in polytemp space

A particularly interesting technological device is the conduct of monotempic structures in the polytempo space. По същество, това представлява: Реализация на Монотемпизъм посредством Политемпизъм: Realization of Monotempism through Polytempism. Essentially, in the two parallel-flowing polytempic layers, within the whole period, a monotempic hexagonal pulsation is observed. It should be explicitly noted that this characteristic technological organization can be realized only with the help of the Photopolymetronome apparatus. The realization of monolithic monotemp structures in the wide polytempo space is an innovative technological device that provides the contemporary composer with new, hitherto unknown creative horizons for realization.

The attached Example 47 is a fragment of the choral cantata "Polytempi No 3" by Stefan Dragostinov, semaphore No26 – equal to one polytempic period. The following main characteristics are observed: There are two parallel polytempo choral lines. Each choral group represents a monolithic five-voiced structure. The first choral layer moves at a tempo M.M.♩ =72. The polytempo period is made up of 6 strokes in size 2/4. The second choral layer moves at a pace M.M.♩ =84. The polytempo period is made up of 7 strokes in size 2/4. The two multi-speed choral lines are in the familiar tempo ratios: 12:14, respectively, 6:7. The technological method Monotempo structures in polytempo space and its creative realization is the subject of subsequent observations and detailed analysis in this scientific study, specifically: in the work "Polytempo No4" – Concerto for piano and orchestra by Stefan Dragostinov, see, Chapter Six – 6.2., 6.3., 6.4.: "Creation of a new, improved technological construction of the equipment Photopolymetronome".

5.8. A combination of heterogeneous technological structures within a single polytempic period. Technological combination of Polytempo fan and monotemp structures in polytempo space

The analyzed technological constructions in the previous text of this scientific study – Polytempic Fan and monotempic structures in the polytempic space – offer a number of new creative opportunities for the contemporary composer – in a specific combination of the two technological buildings within one polytempic period. In the examples considered, a characteristic organic combination of Polytempic fan and monotempo structure is observed, occurring in the two multivelocity layers. Such a technological building – combining the so-called. A polytempo fan with a monotempic structure in the parallel flow of two multi-speed layers is also realized in the score of the Concerto for Piano and Orchestra – Polytempo No4, which is the subject of observation later in Chapter Six – 6.2., 6.3., 6.4.: "Creation of a new, improved technological construction of the Photopolymetronome equipment".

CHAPTER VI Creation of a new, improved technological design of the equipment Photopolymetronome

Two years after the world premiere of the cantata "The Fair" (La Foire – Polytempo 1) in the Netherlands, in the spring of 1980 I wrote "Concerto for piano and orchestra" (Polytempi No4) especially for participation in the International Composition Competition in Italy, founded in the name of Karlheinz Stockhausen. In the autumn of that year I had the honor of receiving a letter from Stockhausen. In the letter, Karlheinz Stockhausen announces that the jury – which met under his chairmanship – unanimously awards the First Prize to my work. In the summer of 1981, the World premiere of Polytempi No. 4 took place in Bergamo, performed by the Milan Radio Symphony Orchestra, with soloist Antonio Bacchelli (1944-1986). The renowned Italian publishing house "Ricordi" printed the score of the concert. The premiere of the concert in Bergamo, at the invitation of the Stockhausen Foundation, was attended by Iliya Kozhuharov, as a special guest and author-creator of a technological innovation – the Photopolymetronome equipment. I shared this idea with Eng. Ivan Marangozov (1925-1998), then working at the Institute of Technical Cybernetics and Robotics (ITKR).

6.1. Description of the new instrumentation Photopolymetronome. Main technical parameters

Ing. Ivan Marangozov connected me with two of his young associates electrical engineers working in the field of computer technology, to whom I presented my idea. Specifically, I asked them to construct a new Photopolymetronome offering more technological competencies.

1. First: extended construction of the polytempic numerical cyclogram: - the so-called polytempo digital cyclogram. "primary tempos" to be increased to five in number — resp., M.M.=66, =72, =78, =84 and ♩=90 - with intertemporal proportions, ♩♩♩ respectively 11:12:13:14:15. ♩

2. Second: the apparatus should include the ability to switch the tempo signal from one "tempo layer" to another through a special button for polytempic change - polytempic change-button.

3. Third: the potentiometer built into Iliya Kozhuharov's equipment should be improved by means of a detailed temperature scale, suggesting the possibility of precise acceleration or slowing down - from Largo do Presto.

The concert is written as a classical three-part cycle. Stylistically, the work was built on the basis of the modern for that time – the late 70s and the beginning of the 80s – avant-garde directions: aleatorics, pointillism, series technique. At the same time, as the main thematic material, original metro-rhythmic structures typical of the Shoppe folklore region and the border regions of Western Bulgaria in Yugoslavia, respectively, Serbian and Macedonian folklore traditions were used. Theoretically summarized: homogeneity of avant-garde and Balkan folklore tradition. Based on the expanded polytempo digital cyclogram, the series of technological innovations embedded in the new equipment offered a complex of new creative possibilities in the field of Controlled Polytempia – previously unknown in modern music.

6.2. Analysis of the polytempic structure of the "Concerto for Piano and Orchestra" (Polytempi No4) – Part 1

The overall dramaturgical construction in Polytempi No. 4 is a kind of polytempic dialogue between the solo piano party and the symphony orchestra; Accordingly, all the time, two multi-speed layers run in parallel, which repeatedly change their tempo indications. The author's score, containing 82 handwritten pages, has A2 format, with parameters: height 64.5 cm, width 45 cm. The score includes 79 polytempo periods, each of them is indicated by the graphic sign Semaphore, respectively., contains 79 semaphores.

Analyzing the two consecutive periods of the score, including Semaphore No. 2 and Semaphore No. 3, the question arises: how is the transition between the two tempos in the piano

party technologically realized – respectively, how is the change in the light-tempo signals made? Thanks to the advanced potentiometer, with a detailed speed scale, suggesting the possibility of accelerating or slowing down the tempo, as well as the ability to switch the tempo signal from one "tempo layer" to another – practically, this is done by a technical person-operator working with the equipment during a concert performance (or, rehearsal). (All the follow-up of the structural in the part is done in the dissertation.)

6.3. Analysis of the polytempic structure of the "Concerto for Piano and Orchestra" (Polytempi No4) – Part 2

The second part of "Polytempi No 4" brings the atmosphere of relative calm, with a pronounced melodic expression in the piano party, in dynamic parameters from "pianissimo" to "medzo-forte"; with linear structures created on the basis of serialism and pointillism – a characteristic sound picture, building a kind of bridge-connector between the avant-garde currents in the music of the twentieth century and the impressive Balkan metro-rhythmic tradition.

At the beginning of the second part – two sound layers are observed in the orchestra, with the following characteristics: in the strings – violins, violas – a monolithic layer takes place, in dynamics "piano-pianissimo", realized in pizzicato in the high register of instruments. Against the background of this peculiar quasi pointillistic sound fabric, in the section of the percussion group, the main quarter-inque pulsation flows – one stroke, with a stroke "sforzato", in each instrument, successively: triangolo, vibrafono, bongos, guiro, campana, claves, timpani, blocchi di legno, silofono, gong, frusta. This metric row of 13 strokes – in pace M.M.♩ =66.5 – is in polytempic dialogue with the metric sequence of 12 beats in the solo-party of the piano – tempo M.M.=57. ♩ (All the follow-up of the structural in the part is done in the dissertation.)

6.4. Analysis of the polytempic structure of the "Concerto for Piano and Orchestra" (Polytempi No4) – Part 3

The third part of Polytempi No 4 (Finale) – appearing in the overall construction of the work, a kind of dramaturgical center – starts in two parallel paces. The piano solo party is built as a pointillistic-series series – with short, sharp sixteen-shot strokes with a stroke "sforzato", scattered in the wide piano tésiture – in dynamic amplitude: pianissimo-fortissimo. The orchestral fabric, beginning its construction from pianissimo – in string and wooden instruments – gradually unfolds vertically throughout the orchestral apparatus, with a bright dynamic saturation – in the last beat of the period – to Fortissimo (*fffff*).

In the example observed, the two polytempo layers – in the orchestra and the piano – are essentially a monolithic sound structure, without the perceptibility of metric opposition of the two parallel-running tempo lines. In this characteristic sound stillness there is also a kind of tension, waiting for something to happen – new, radically different. This moment – at the very beginning of the final third part – is a kind of strategic knot in the dramaturgical construction of the entire three-part cycle. In summary, the creative realization of such a polytemporal configuration observed in this example can only be achieved through the Photopolymetronome apparatus.

For the first time in the work was used clock size 1/4. Its inclusion in the overall polytempo panorama has an explicit motivation. Each individual beat corresponds to a single pulse of light transmitted to the conductor by the light-temp device specially installed in front of him. In the example observed – Semaphore No. 57 – the conductor leads the orchestra, marking the first three beats of the period with a rupture, a short gesture – corresponding to the light tempo-pulsation.

A similar type of technological metamorphosis – transformation of two, three or more parallel-flowing polytempic sound layers into a single monotempo structure is possible solely on

the basis of controlled polytempia. These technological processes of transformation are extensively discussed in this scientific study, respectively: in Chapter Five – 5.6. – "Types of technological structures within a polytempic period. Polytempic Fan – Polytempic Fan" and in chapter Nine "Technological implementation of monotempic structures in polytempic space". (All the follow-up of the structural in the part is done in the dissertation.)

6.5. Deduction of the variety of polytempic configurations in the "Concerto for Piano and Orchestra" (Polytempi №4)

After the observations and analysis, the following are relevant summaries: along the entire Piano and Orchestra Concerto – Polytempi 4, the following tempo indications are repeatedly used:=42; =45.50; =49; =57; =61.75; =66.50; =60; =65; ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ =70. These rates are combined in pairs, corresponding to the two parallel flowing velocity layers, as follows:

  – In the first part: M.M.♩ =42 and M.M.=45.50; 42 and 49; 45.50 and 49. ♩
  – In second part: 57 and 61.75 and 66.50.
  – In the third part – Final: 57, 61.75 and 66.50; as well as - 65, 65 and 70.

Tempos 42, 45.50 and 49 are in constant proportional dependence: 12:13:14, respectively, - 6:6.5:7. The next three rates – 57, 61.75 and 66.50 – are also in constant proportional dependence: 12:13:14, respectively - 6:6.5:7.

And the subsequent three rates – observed in the Code of the final third part – 60:65:70 – are in the same proportional relationship: 12:13:14 resp., 6:6.5:7. As found above in this scientific study, these intertemporal ratios – 12:13:14 – are already known from previous observations on works by Iliya Kozhuharov, Bozhidar Spasov and Stefan Dragostinov. In the analyzed examples from the cantata "The Fair" it was found, that one polytempic period in the three multivelocity choral layers - resp., M.M.♩ =72, ♩ =78 and ♩ =84 – runs in ten seconds.

Naturally, a polytempic period in "Polytempi 4", where the rates used have a visibly more moderate main metric pulsation – take place in a wider range of time. At the three rates observed in the Part Three Code – M.M.=60, M.M.=65 and M.M.=70 – a polytempic period runs for twelve seconds. In the second part and the beginning of the third part of "Polytempi 4", the three temps are: M.M. ♩ ♩ ♩ =57, M.M.=61.75 and M.M.=66.50 – with the same constant proportional relationship: 12:13:14. Accordingly, a polytemperate period runs for 12.63 – twelve seconds and 63 hundredths. In the first part, the three rates used are: M.M. ♩ ♩ ♩ ♩ =42, M.M.=45.50 and M.M♩=49 – with the familiar dependence 12:13:14; respectively, a polytempe period lasts for 17.14 – seventeen seconds and 14 hundredths. ♩

In summary, a polytemporaneous period between two Semaphores may have different temporal magnitudes according to the pace of the parallel-moving sound layers.

CHAPTER 7 Different time parameters of a polytempo period, according to the speed of movement of the polytempo structures

The table (shown in the dissertation) shows 12 different time indicators of the course of a polytempo period, respectively, from 5 seconds to 16 seconds, incl. – in the first vertical column of the table. Against each temporal indication, three parallel-flowing rates were applied, in the familiar intertemporal ratios, resp., 12:13:14. There are the following characteristics: two types of numerical indications of the rates applied in the table are observed – integers and fractional numbers. In the order of the applied time indications of the 12 polytempic periods, acc., the table:

1. Polytempic period passing in 5 seconds. The three parallel-flowing temps – M.M.♩ =144, =156 and ♩ =168 – are integers, ♩ in a ratio of 12:13:14.

2. Polytempic period passing in 6 seconds. The three temps – M.M.♩ =120, =130 and ♩ =140 — are, again, integers, ♩ in a ratio of 12:13:14.

3. Polytempic period passing in 7 seconds. The first two temps – M.M.♩ =102.86 and ♩ =111.43 – are fractional numbers; the third pace, =120, is an integer. It should be explicitly mentioned: the first number 102.86 is a decimal, periodic infinite fraction – 102.857142857143 – as evidenced by the repeatability of the 6-digit structure, after the decimal point. Similar is the finding with respect to the second number 111.43; it is also decimal, periodic infinite fraction – 111.428571428571 – with repeatability of the 6-digit structure, ♩ after a decimal point. As a summary: in the trinity of this construction, the intertemporal ratios — 12:13:14 — are visibly disturbed, albeit with a minimum value, resp., 12:12.99:13.99. The differences found in the second and third numbers are with a deviation of – one hundredth.

4. Polytempic period passing in 8 seconds. The three parallel-flowing temps are – M.M.♩ =90, =97.50 and =105. The numerical indications of the first and ♩ third tempo represent integers; the second tempo is – decimal fraction. The proportions between the three temps are preserved, ♩ respectively – 12:13:14.

5. Polytempic period passing in 9 seconds. The three parallel-flowing temps are: M.M.♩ =80, =86.67 and ♩ =93.33. The numerical indication of the first tempo is – an integer; the second tempo represents an infinite fractional number - 86.6666666667; similar are the parameters of the third tempo – 93.333333333333 – infinite fractional. Again, it is necessary to find that in the trinity of the structure, the intertemporal ratios – 12:13:14 – are visibly violated, again, with a minimum value, respectively, 12:12.99:13.99. The differences found, ♩ In the second and third numbers, they have a deviation of – one hundredth.

6. Polytempic period passing in 10 seconds. The three parallel-flowing temps are: M.M.♩ =72, =78 and ♩ =84. This is a familiar territory, ♩ embedded in the construction of the Photopolymetronome apparatus created by the composer Iliya Kozhuharov. The trinity in the intertemporal ratios of 12:13:14 is preserved.

7. Polytempic period passing in 11 seconds. The three parallel-flowing temps are: M.M.♩ =65.45, ♩ =70.91 and ♩ =76.36. All three numerical indications represent decimal, periodic infinite fractional numbers, resp., first number - 65.4545454545455; second number - 70.9090909090909; third number – 76.3636363636364. Again, the intertemporal ratios of 12:13:14 in the triunity of the structure are violated, albeit with a minimum value, respectively: 12:12.99:13.99. The differences found are with a deviation of – around, one hundredth.

8. Polytempic period, you pass in 12 seconds. The three parallel-running temps are: M.M.♩ =60, ♩ =65 and ♩ =70. The familiar triunity in the 12:13:14 intertemporal ratios is preserved.

9. Polytempic period, you pass in 13 seconds. The three parallel-running temps are: M.M.=55.38, =60.00 and =64.62. The second tempo represents – an integer: 60.00. The numerical indication of the first tempo 55.38 represents a decimal, periodic infinite fraction - 55.3846153846154 – evident from the repeatability of the 6-digit structure, after the decimal point. Similar is the finding with respect to the third number - 64.62; it is also decimal, periodic infinite fraction - 64.6153846153846 – with permanent repeatability of the 6-digit structure, ♩ ♩ ♩ after the decimal point. Again, it is necessary to find that in the trinity of the structure, the intertemporal ratios – 12:13:14 – are visibly disturbed, again, with a minimum value, respectively,

11.99:12.00:13.99. The differences found, in the first and third number, are with a deviation of – one hundredth.

10. Polytempic period passing in 14 seconds. The three parallel-flowing temps are: M.M.♩ =51.43, =55.71 and ♩ =60. The third tempo represents – an integer 60.00. The numerical indication of the first tempo 51.43 represents a decimal, periodic infinite fraction - 51.4285714 – evident from the repeatability of the 6-digit structure, after the decimal point. Similar is the finding with respect to the third number – 55.71; it is also decimal, periodic infinite fraction - 55.7142857142857 – with permanent repeatability of the 6-digit structure, ♩ after the decimal point. Again, the intertemporal ratios of 12:13:14 in the triunity of the structure are violated, albeit with a minimum value, respectively: 11.999:12.999:14.00. The differences in the first two numbers are with a deviation of – one thousandth.

11. Polytempic period, you pass in 15 seconds. The three parallel-flowing rates M.M.♩ =48, ♩ =52, and ♩ =56 represent integers; the trinity in the 12:13:14 intertemporal ratios is preserved.

12. Polytempic period, you pass in 16 seconds. The three parallel-flowing temps are: M.M.♩ =45, =48.75 and =52.50. The first tempo represents — an integer. The numerical indications of the second and ♩ third tempo represent — decimal fractional numbers, with no residue. Accordingly, ♩ the trinity in the intertemporal ratios - 12:13:14 - is preserved.

The following table (given in the dissertation) shows eight different time indicators of a polytempo period, respectively, within 4", 5", 6", 8", 10", 12", 15" and 16 seconds, incl. – in the first vertical column of the table. Against each time indication, seven parallel-running tempos were applied, in intertemporal ratios – as follows: 9:10:11:12:13:14:15:16. The total number of rates applied in the table is – 56: respectively, by M.M.♩ =33.75 to M.M.=225. ♩

M.M.33.75; 36.00; 37.50; 40.00; 41.25; 44.00; **45.00;** 48.00; 48.75; 50.00; 52.00; 52.50; 54.00; 55.00; 56.00; 56.25; **60.00**; 65.00; 66.00; 67.50; 70.00; 72.00; **75.00**; 78.00; 82.50; 84.00; **90.00**; 97.50; 100.00; 105.50; 108.00; 110.00; 112.50; **120.00**; 130.00; 135.00; 132.00; 140.00; 144.00; **150.00**; 156.00; 165.00; 168.00; **180.00**; 195.00; 210.00; 225.00.

Each of the marked rates with a stroke "bold" is present in the table twice, e.g.: pace M.M.=45 is observed once in the configuration of the tempa, in the sequence of the polytemp period running for 12 seconds and a second time – in the sequence of the polytemp period running for 16 seconds. The table includes 56 tempo indications – from M.M. ♩♩ =33.75 to M.M.=225 – united in groups of 7 rates occurring in 8 polytempo periods - respectively, for 4", 5", 6", 8", 10", 12", 15" and 16 seconds – also offers extremely interesting additional information on characteristic dependencies of individual pairs of polytemp periods. ♩ In the subsequent observations their specific relationships, respectively, the subordination between each pair will be considered, with a detailed description of the polytemporal structures and, accordingly, their reciprocal interrelation – in numerical terms.

CHAPTER 8 Subordination of two polytempic periods occurring in different time parameters

The chapter continues the observations and analyzes the data from the previous Seventh Chapter – including eight time indicators of the course of a polytempo period and the applied, against each time indication, seven parallel-running tempos, in intertemporal ratios, respectively: 9:10:11:12:13:14:15:16. Again two types of numerical tempos indications are observed — integers and fractional numbers without residue.

8.1. Subordination into two polytempo periods, lasting in 4 and 5 seconds, 4 and 6 seconds, 4 and 8 seconds, 4 and 10 seconds, 4 and 12 seconds, 4 and 15 seconds, 4 and 16 seconds

1. The numerical indications of the seven parallel-running rates in a 4-second period — 135-150-165-180-195-210-225 — represent numbers greater by 1/4, compared to the numbers 108-120-132-144-156-168-180 set in a 5-second period. Resp., the two tempa groups - 135-150-165-180-195-210-225 and 108-120-132-144-156-168-180 - are in permanent proportional dependence – 5:4.

Note: 1/4 of 108 represents the number 27; (27+108=135). 1/4 of 120 represents the number 30; (30+120=150). 1/4 of 132 represents the number 33; (33+132=165). 1/4 of 144 represents the number 36; (36+144=180).1/4 of 156 represents the number 39; (39+156=195). 1/4 of 168 represents the number 42; (42+168=210). 1/4 of 180 represents the number 45; (45+180=225).

2. The same numerical indications of the seven parallel-flowing rates in a period of 4 seconds -135-150-165-180-195-210-225 - represent numbers greater by 1/2, compared to the numbers 90-100-110-120-130-140-150 set in a period of 6 seconds. Resp., the two tempa groups - 135-150-165-180-195-210-225 and 90-100-110-120-130-140-150 - are in permanent proportional dependence - 3:2.

Note: 1/2 of 90 represents the number 45. (45+90= 135). 1/2 out of 100 represents the number – 50; (50+100=150). 1/2 of 110 represents the number 55; (55+110=165). 1/2 of 120 represents the number 60; (60+120=180). 1/2 of 130 represents the number 65; (65+130=195). 1/2 of 140 represents the number 70; (70+140=210). 1/2 of 150 represents the number 75; (75+150=225).

3. The same numerical indications of the seven parallel-flowing rates in a period of 4 seconds - 135-150-165-180-195-210-225 - represent twice as large numbers, compared to the numbers 67.50-75.00-82.50-90-97.50-105-112.50 set in a period of 8 seconds. Resp., the two groups tempa -135-150-165-180-195-210-225 and 67.50-75.00-82.50-90-97.50-105-112.50 - are in permanent proportional dependence – 2:1.

4. The same numerical indications of the seven parallel-flowing rates in a 4-second period — 135-150-165-180-195-210-225 — represent numbers greater by 3/2, compared to the 54-60-66-72-78-84-90 numbers set in a 10-second period. Resp., the two tempa groups - 135-150-165-180-195-210-225 and 54-60-66-72-78-84-90 - are in permanent proportional dependence – 5:2.

Note: 1/2 of 54 represents the number 27, respectively - 3/2 is 81; (81+54=135). 1/2 of 60 is 30, respectively – 3/2 is 90; (90+60=150). 1/2 of 66 is 33, respectively – 3/2 is 99; (99+66=165). 1/2 of 72 is 36, respectively – 3/2 is 108; (108+72=180). 1/2 of 78 is 39, respectively – 3/2 is 117; (117+78=195). 1/2 of 84 is 42, respectively – 3/2 is 126; (126+84=210). 1/2 of 90 represents the number 45, respectively – 3/2 is 135; (135+90=225).

5. The same numerical indications of the seven parallel-flowing rates in a 4-second period — 135-150-165-180-195-210-225 — represent triple the numbers, compared to the 45-50-55-60-65-70-75 numbers set in a 12-second period. Resp., the two tempa groups - 135-150-165-180-195-210-225 and 45-50-55-60-65-70-75 - are in permanent proportional dependence – 3:1.

6. The same numerical indications of the seven parallel-flowing rates in a single 4-second period — 135-150-165-180-195-210-225 — represent numbers greater by 11/4, compared to the 36-40-44-48-52-56-60 numbers set in a 15-second period. Resp., the two tempa groups - 135-150-165-180-195-210-225 and 36-40-44-48-52-56-60 - are in permanent proportional dependence – 15:4.

Note: 1/4 of 36 represents the number 9, respectively – 11/4 is 99; (99+36=135). 1/4 of 40 is 10, respectively – 11/4 is – 110; (110+40=150). 1/4 of 44 is 11, respectively – 11/4 is -121;

(121+44=165). 1/4 of 48 is 12, respectively – 11/4 is 132; (132+48=180). 1/4 of 52 is 13, respectively – 11/4 is 143; (143+52=195). 1/4 of 56 is 14, respectively – 11/4 is 154; (154+56=210). 1/4 of 60 is 15, respectively – 11/4 is 165; (165+60=225).

8.2. Subordination into two polytempo periods, 5 and 6 seconds, 5 and 8 seconds, 5 and 10 seconds, 5 and 12 seconds, 5 and 15 seconds, 5 and 16 seconds

1. The numerical indications of the seven parallel-running rates in a period of 5 seconds – 108-120-132-144-156-168-180 – represent numbers greater by 1/5, compared to the numbers 90-100-110-120-130-140-150 set in a period of 6 seconds. Resp., the two tempa groups – 108-120-132-144-156-168-180 and 90-100-110-120-130-140-150 – are in permanent proportional dependence – 6:5.

Note: 1/5 of 90 represents the number 18; (18+90=108). 1/5 of 100 is 20; (20+100=120). 1/5 of 110 is 22; (22+110=132). 1/5 of 120 represents the number 24; (24+120=144). 1/5 of 130 represents the number 26; (26+130=156). 1/5 of 140 represents the number 28; (28+140=168). 1/5 of 150 is 30; (30+150=180).

2. The same numerical indications of the seven parallel-running rates in a period of 5 seconds – 108-120-132-144-156-168-180 – represent numbers greater by 3/5, compared to the numbers 67.50-75.00-82.50-90.00-97.50-105-112.50 set in a period of 8 seconds. Resp., the two tempa groups - 108-120-132-144-156-168-180 and 67.50-75.00-82.50-90.00-97.50-105-112.50 – are in permanent proportional dependence – 8:5.

Note: 1/5 of 67.50 represents the number 13.50 – resp., 3/5 equals 40.50; (40.50+67.50=108). 1/5 of 75 represents the number 15 – resp., 3/5 equals 45; (45+75=120). 1/5 of 82.50 represents the number 16.50 – resp., 3/5 equals 49.50; (49.50+82.50=132). 1/5 of 90 represents the number 18, respectively, 3/5 equals 54; (54+90=144). 1/5 of 97.5 represents the number 19.5 – resp., 3/5 equals 58.5; (58.5+97.5=156). 1/5 of 105 is the number 21 – resp., 3/5 equals 63; (63+105=168). 1/5 of 112.50 represents the number 22.50 – resp., 3/5 equals 67.50; (67.50+112.50=180).

3. The same numerical indications of the seven parallel-flowing rates in one 5-second period - 108-120-132-144-156-168-180 - represent twice as large numbers, compared to the 54-60-66-72-78-84-90 numbers at stake in the 10-second period. Resp., the two tempa groups - 108-120-132-144-156-168-180 and 54-60-66-72-78-84-90 - are in permanent proportional dependence – 2:1.

4. The same numerical indications of the seven parallel-flowing rates in a 5-second period — 108-120-132-144-156-168-180 — represent numbers greater by 7/5, compared to the 45-50-55-60-65-70-75 numbers set over a 12-second period. Resp., the two tempa groups -108-120-132-144-156-168-180 and 45-50-55-60-65-70-75 – are in permanent proportional dependence – 12:5.

Note: 1/5 of 45 represents the number 9 – resp., 7/5 equals 63; (63+45=108). 1/5 of 50 represents the number 10 – respectively, 7/5 equals 70; (70+50=120. 1/5 of 55 represents the number 11, respectively, 7/5 equals 77; (77+55=132). 1/5 of 60 represents the number 12 – resp., 7/5 equals 84; (84+60=144). 1/5 of 65 represents the number 13 – resp., 7/5 equals 91; (91+65=156). 1/5 of 70 represents the number 14 – resp., 7/5 equals 98; (98+70=168). 1/5 of 75 represents the number 15 – resp., 7/5 equals 105; (105+75=180).

5. The same numerical indications of the seven parallel-flowing rates set in the 5-second period - 108-120-132-144-156-168-180 - represent triple the numbers, compared to the 36-40-44-48-52-56-60 numbers set in a period of 15 seconds. Resp., the two tempa groups - 108-120-132-144-156-168-

180 and 36-40-44-48-52-56-60 - are permanent proportional dependence – 3:1.

6. The same numerical indications of the seven parallel-flowing temps in a 5-second period — 108-120-132-144-156-168-180 — represent numbers greater by 11/5, compared to the numbers 33.75-37.50-41.25-45.00–48.75-52.50-56.25 set in a period of 16 seconds. Resp., the two groups tempa - 108-120-132-144-156-168-180 and 33.75-37.50-41.25-45.00–48.75-52.50-56.25 – are in permanent proportional dependence – 16:5.

Note: 1/5 of 33.75 represents the number 6.75 – respectively, 11/5 equals 74.25; (74.25+33.75=108). 1/5 of 37.50 represents the number 7.50 – respectively, 11/5 equals 82.50; (82.50+37.50=120). 1/5 of 41.25 represents the number 8.25 – resp., 11/5 equals 90.75; (90.75+41.25=132). 1/5 of 45 represents the number 9 - resp., 11/5 equals 99; (99+45=144). 1/5 of 48.75 represents the number 9.75, respectively, 11/5 equals 107.25; (107.25+48.75=156). 1/5 of 52.50 represents the number 10.50 - resp., 11/5 equals 115.50; (115.50+52.50=168). 1/5 of 56.25 represents the number 11.25 – resp., 11/5 equals 123.75; (123.75+56.25=180).

8.3. Subordination into two polytempo periods, lasting in 6 and 8 seconds, 6 and 10 seconds, 6 and 12 seconds, 6 and 15 seconds, 6 and 16 seconds

1. The numerical indications of the seven parallel-running rates in a period of 6 seconds – 90-100-110-120-130-140-150 – represent numbers greater by 1/3 compared to the numbers 67.50-75-82.50-90-97.50-105-112.50 set in a period of 8 seconds. Resp., the two groups tempa - 90-100-110-120-130-140-150 and 67.50-75-82.50-90-97.50-105-112.50 - are in permanent proportional dependence – 4:3.

Note: 1/3 of 67.50 represents the number 22.50; (22.50+67.50=90). 1/3 of 75 represents the number 25; (25+75=100). 1/3 of 82.50 represents the number 27.50; (27.50+82.50=110). 1/3 of 90 represents the number 30; (30+90=120). 1/3 of 97.50 represents the number 32.50; (32.50+97.50=130). 1/3 of 105 is the number 35; (35+105=140).

2. The same numerical indications of the seven parallel-running temps in a 6-second period — 90-100-110-120-130-140-150 — represent numbers greater by 2/3 compared to the 54-60-66-72-78-84-90 numbers set in a 10-second period. Resp., the two tempa groups - 90-100-110-120-130-140-150 and 54-60-66-72-78-84-90 - are in permanent proportional dependence - 5:3.

Note: 1/3 of 54 represents the number 18 – respectively, 2/3 equals 36; (36+54=90). 1/3 of 60 represents the number 20 – resp., 2/3 equals 40; (40+60=100). 1/3 of 66 represents the number 22 – resp., 2/3 equals 44; (44+66=110). 1/3 of 72 represents the number 24 - resp., 2/3 equals 48; (48+72=120). 1/3 of 78 represents the number 26 - resp., 2/3 equals 52; (52+78=130). 1/3 of 84 is the number 28 - resp., 2/3 equals 56; (56+84=140). 1/3 of 90 represents the number 30 – resp., 2/3 equals 60; (60+90=150).

3. The same numerical indications of the seven parallel-flowing rates in a period of 6 seconds - 90-100-110-120-130-140-150 - represent twice as large numbers, compared to the numbers 45-50-55-60-65-70-75 set in a single period of 12 seconds. Resp., the two tempa groups - 90-100-110-120-130-140-150 and 45-50-55-60-65-70-75 - are in permanent proportional dependence – 2:1.

4. The same numerical indications of the seven parallel-running temps in a period of 6 seconds – 90-100-110-120-130-140-150 – represent numbers greater by 3/2 compared to the numbers 36-40-

44-48-52-56-60 set in a period of 15 seconds. Resp., the two tempa groups - 90-100-110-120-130-140-150 and 36-40-44-48-52-56-60 - are in permanent proportional dependence – 5:2.

Note: 1/2 of 36 represents the number 18 – respectively, 3/2 equals 54; (54+36=90). 1/2 of 40 represents the number 20 – resp., 3/2 equals 60; (60+40=100). 1/2 of 44 represents the number 22 – resp., 3/2 equals 66; (66+44=110). 1/2 of 48 represents the number 24; resp., 3/2 equals 72; (72+48=120). 1/2 of 52 represents the number 26; resp., 3/2 equals 78; (78+52=130). 1/2 of 56 equals 28 – resp., 3/2 equals 84; (84+56=140). 1/2 of 60 represents the number 30 – resp., 3/2 equals 90; (90+60=150).

5. The same numerical indications of the seven parallel-flowing rates in a period of 6 seconds – 90-100-110-120-130-140-150 – represent numbers greater by 5/3 compared to the numbers 33.75-37.50-41.25-45-48.75-52.50-56.25 set in a period of 16 seconds. Resp., the two tempa groups - 90-100-110-120-130-140-150 and 33.75-37.50-41.25-45-48.75-52.50-56.25 - are in permanent proportional dependence – 8:3.

Note: 1/3 of 33.75 represents the number 11.25 – resp., 5/3 equals 56.25; (56.25+33.75=90). 1/3 of 37.50 represents the number 12.50 – resp., 5/3 equals 62.50; (62.50+37.50=100). 1/3 of 41.25 represents the number 13.75 – resp., 5/3 equals 68.75; (68.75+41.25=110). 1/3 of 45 represents the number 15 - resp., 5/3 equals 75; (75+45=120). 1/3 of 48.75 represents the number 16.25 - resp., 5/3 equals 81.25; (81.25+48.75=130). 1/3 of 52.50 represents the number 17.50 – resp., 5/3 equals 87.50; (87.50+52.50=140). 1/3 of 56.25 represents the number 18.75 – resp., 5/3 equals 93.75; (93.75+56.25=150).

8.4. Subordination into two polytempo periods, lasting in 8 and 10 seconds, 8 and 12 seconds, 8 and 15 seconds, 8 and 16 seconds

1. The numerical indications of the seven parallel-running rates in a period of 8 seconds – 67.50-75-82.50-90-97.50-105-112.50 – represent numbers greater by 1/4, compared to the numbers 54-60-66-72-78-84-90 set in a period of 10 seconds. Resp., the two tempa groups - 67.50-75-82.50-90-97.50-105-112.50 and 54-60-66-72-78-84-90 - are in permanent proportional dependence – 5:4.

Note: 1/4 of 54 represents the number 13.50; (13.50+50=67.50). 1/4 of 60 represents the number 15; (15+60=75). 1/4 of 66 represents the number 16.50; (16.50+66=82.50). 1/4 of 72 represents the number 18; (18+72=90). 1/4 of 78 represents the number 19.50; (19.50+78=97.5). 1/4 of 84 is the number 21; (21+84=105). 1/4 of 90 represents the number 22.50; (22.50+90=112.50).

2. The same numerical indications of the seven parallel-flowing rates in a period of 8 seconds – 67.50-75-82.50-90-97.50-105-112.50 – represent numbers greater by 1/2, compared to the numbers 45-50-55-60-65-70-75 set in a period of 12 seconds. Resp., the two groups tempa - 67.50-75-82.50-90-97.50-105-112.50 and 45-50-55-60-65-70-75 - are in permanent proportional dependence – 3:2.

Note: 1/2 of 45 represents the number 22.50; (22.50+47=67.50). 1/2 out of 50 represents the number 25 (25+50=75) 1/2 out of 55 represents the number 27.5; (27.50+55=82.50). 1/2 of 60 represents the number 30; (30+60=90). 1/2 of 65 represents the number 32.50; (32.50+65=97.70). 1/2 of 70 is the number 35; (35+70=105). 1/2 of 75 represents the number 37.50. (37.50+75=112.50).

3.   The same numerical indications of the three parallel-running rates in a period of 8 seconds – 67.50-75-82.50-90-97.50-105-112.50 – represent numbers greater by 7/8, compared to the numbers 36-40-44-48-52-56-60 set in a period of 15 seconds. Resp., the two tempa groups - 67.50-75-82.50-90-97.50-105-112.50 and 36-40-44-48-52-56-60 - are in permanent proportional dependence – 15:8.

Note: 1/8 of 36 represents the number 4.50 – resp., 7/8 equals 31.50; (31.50+36=67.50). 1/8 of 40 represents the number 5 – resp., 7/8 equals 35; (35+40=75). 1/8 of 44 represents the number 5.50 – resp., 7/8 equals 38.50; (38.50+44=82.50). 1/8 of 48 represents the number 6 – resp., 7/8 equals 42; (42+48=90). 1/8 of 52 represents the number 6.50 – resp., 7/8 equals 45.50; (45.50+52=97.50). 1/8 of 56 represents the number 7 – resp., 7/8 equals 49; (49+56=105). 1/8 of 60 represents the number 7.50 – resp., 7/8 equals 52.50; (52.50+60=112.50).

4.   The same numerical indications of the seven parallel-running temps in a period of 8 seconds – 67.50-75-82.50-90-97.50-105-112.50 – represent twice as large numbers, compared to the numbers 33.75-37.50-41.25-45.00-48.75-52.50-56.25 set in a period of 16 seconds. Resp., the two groups tempa - 67.50-75-82.50-90-97.50-105-112.50 and 33.75-37.50-41.25-45.00-48.75-52.50-56.25 - are in permanent proportional dependence – 2:1.

8.5. Subordination into two polytempo periods, lasting in 10 and 12 seconds, 10 and 15 seconds, 10 and 16 seconds

1.   The numerical indications of the seven parallel-flowing rates in a 10-second period — 54-60-66-72-78-84-90 — represent numbers greater by 1/5, compared to the 45-50-55-60-65-70-75 numbers set over a 12-second period. Resp., the two tempa groups - 54-60-66-72-78-84-90 and 45-50-55-60-65-70-75 - are in permanent proportional dependence – 6:5.

Note: 1/5 of 45 represents the number 9; (9+45=54). 1/5 of 50 represents the number 10; (10+50=60). 1/5 of 55 represents the number 11; (11+55=66). 1/5 of 60 represents the number 12; (12+60=72). 1/5 of 65 represents the number 13; (13+65=78). 1/5 of 70 represents the number 14; (14+70=84). 1/5 of 75 represents the number 15; (15+75=90).

2.   The same numerical indications of the seven parallel-flowing rates in a 10-second period — 54-60-66-72-78-84-90 — represent numbers greater by 1/2, compared to the 36-40-44-48-52-56-60 numbers at stake in a 15-second period. Resp., the two tempa groups - 54-60-66-72-78-84-90 and 36-40-44-48-52-56-60 - are in permanent proportional dependence – 3:2.

Note: 1/2 of 36 represents the number 27; (18+36=54). 1/2 of 40 represents the number 20; (20+40=60). 1/2 of 44 represents the number 22; (22+44=66). 1/2 of 48 represents the number 24; (24+48=72). 1/2 of 52 represents the number 26; (26+52=78). 1/2 of 56 represents the number 28; (28+56=84). 1/2 of 60 represents the number 30; (30+60=90).

3.   The same numerical indications of the seven parallel-running temps in a period of 10 seconds –

54-60-66-72-78-84-90 – represent numbers greater by 3/5, compared to the numbers 33.75-37.50-41.25-45.00-48.75-52.50-56.25 set in a period of 16 seconds. Resp., the two tempa groups - 54-60-66-72-78-84-90 and 33.75-37.50-41.25-45.00-48.75-52.50-56.25 - are in permanent proportional dependence – 8:5.

Note: 1/5 of 33.75 represents the number 6.75 – resp., 3/5 equals 20.25; (20.25+33.75=54). 1/5 of 37.50 represents the number 7.50 – resp., 3/5 equals 22.50; (22.50+37.50=60). 1/5 of 41.25 represents the number 8.25 – resp., 3/5 equals 24.75; (24.75+41.25=66). 1/5 of 45 represents the number 9 – resp., 3/5 equals 27; (27+45=72). 1/5 of 48.75 represents the number represents the number 9.75 - resp., 3/5 equals 29.25; (29.25+48.75=78). 1/5 of 52.50 represents the number 10.50 – resp., 3/5 equals 31.50; (31.50+52.50=84). 1/5 of 56.25 represents the number 11.25 – resp., 3/5 equals 33.75; (33.75+56.25=90).

8.6. Subordination into two polytempo periods, lasting in 12 and 15 seconds, 12 and 16 seconds

4.   The numerical indications of the seven parallel-flowing rates in a single 12-second period — 45-50-55-60-65-70-75 — represent numbers greater by 1/4, compared to the 36-40-44-48-52-56-60 numbers at stake in a 15-second period. Resp., the two tempa groups - 45-50-55-60-65-70-75 and 36-40-44-48-52-56-60 - are in permanent proportional dependence – 5:4.

Note: 1/4 of 36 represents the number 9; (9+36=45). 1/4 of 40 represents the number 10; (10+40=50). 1/4 of 44 represents the number 11; (11+44=55). 1/4 of 48 represents the number 12; (12+48= 60). 1/4 of 52 represents the number 13; (13+52=65). 1/4 of 56 represents the number 14; (14+56=70). 1/4 of 60 represents the number 15; (15+60=75).

5.   The same numerical indications of the seven parallel-flowing rates in a period of 12 seconds – 45-50-55-60-65-70-75 – represent numbers greater by 1/3, compared to the numbers 33.75-37.50-41.25-45-48.75-52.50- 56.25 set in a period of 16 seconds. Resp., the two tempa groups - 45-50-55-60-65-70-75 60-65-70 and 33.75-37.50-41.25-45-48.75-52.50-56.25 - are in permanent proportional dependence – 4:3.

Note: 1/3 of 33.75 represents the number 11.25; (11.25+33.75=45). 1/3 of 37.50 represents the number 12.50; (12.50+37.50=50). 1/3 of 41.25 represents the number 13.75; (13.75+41.25=55). 1/3 of 45 represents the number 15; (15+45=60). 1/3 of 48.75 represents the number 16.25; (16.25+48.75=65). 1/3 of 52.50 represents the number 17.50; (17.50+52.50=70). 1/3 of 56.25 represents the number 18.75; (18.75+56.25=75).

8.7. Subordination into two polytempo periods, lasting in 15 and 16 seconds

6.   The numerical indications of the seven parallel-running rates in a 15-second period – 36-40-44-48-52-56-60 – represent numbers greater by 1/15, compared to the numbers 33.75-37.50-41.25-45-48.75-52.50-56.25 set over a period of 16 seconds. Resp., the two tempa groups - 36-40-44-48-52-56-60 and 33.75-37.50-41.25-45-

48.75-52.50-56.25 - are in permanent proportional dependence – 16:15.

Note: 1/15 of 33.75 represents the number 2.25; (2.25+33.75=36). 1/15 of 37.50 represents the number 2.50; (2.50+37.50=40). 1/15 of 41.25 represents the number 2.75; (2.75+41.25=44). 1/15 of 45 represents the number 3; (3+45=48). 1/15 of 48.75 represents the number 3.25; (3.25+48.75=52). 1/15 of 52.50 represents the number 3.50; (3.50+52.50=56). 1/15 of 56.25 represents the number 3.75; (3.75+56.25=60).

As a summary: evident from the table including 56 tempo indications, respectively, from M.M.♩ =33.75 to M.M.=225, discussed in the previous chapter Seventh – "Different time parameters of a polytempic period, according to the speed of movement of polytempic structures", as well as from the subsequent observations, analyzes and findings made in this chapter Eighth – a newly constructed, modern equipment Photopolymetronome would offer to the contemporary composer an extremely wide palette of polytempic creative possibilities. ♩

CHAPTER NINE. Technological realization of monotemp structures in the polytemp space

The chapter examines and analyzes specific possibilities for technological metamorphosis-transformation of two, three or more parallel-flowing polytempic sound layers into a single monotempo structure.

The object of observation is a temp sequence of 15 numbers; all tempos have a main metric pulsation – quarter. M.M.♩=36; 48; 60; 72; 84; 96; 108; 120; 132; 144; 156; 168; 180; 192; 204. It should be noted that the distances between each pair of temps are constant – the number 12.

Any deuce from observing the tempo e in a permanent ratio, as follows: M.M.=36 and M.M.=48 – 3:4; M.M.=48 and M.M.=60 – 4:5; M.M.=60 and M.M.=72 – 5:6; M.M.=72 and M.M. =84 – 6:7; M.M.=84 and M.M.=96 – 7:8; M.M.=96 and M.M.=108 – 8:9; M.M.=108 and M.M.=120 – 9:10; M.M.=120 and M.M.=132 – 10:11; M.M.=132 and M.M.=144 – 11:12; M.M.=144 and M.M.=156 – 12:13; M.M.=156 and M.M.=168 – 13:14; M.M.=156 and M.M.=168 –13:14; M.M.=168 and M.M. ♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩♩ =168 ♩ M.M. ♩ = 180 – 14:15; M.M.♩=180 and M.M.♩=192 – 15:16; M.M.♩=192 and M.M. ♩=204 – 16:17.

In the two parallel pacing layers – M.M.♩ =48 and M.M.=60 a monotempic osminal ripple was realized. ♩ In this ripple is particularly impressive the asymmetric alternation of accents corresponding to the strong quarter-strikes in the two tempo lines – see, explicitly marked accents in the two lines of the example annexed - as follows: on the 1st eighth – general emphasis; on the 3rd eighth – accent, in the lower row; on the 5th, 6th and 7th eights, alternately – accents, in the lower, upper and again in the bottom row; on the 9th eighth – accent, in the bottom row; on the 11th eighth – a general accent, in the upper and lower rows; on the 13th eighth – accent, in the bottom row; on the 15th, 16th and 17th eights, successively – accents, in the upper and again in the bottom row; On the 19th eighth – accent, in the bottom row.

The example considered can also be mechanically exposed in the temp, twice as fast observed, respectively, M.M. ♩=96 and M.M. ♩=120. It can also be correlated to the rate - M.M. ♩=144 and M.M. ♩=180 — three times faster than those observed.

This spectacular diversity of asymmetrical alternation of accents in the considered monotempo structure, built on the basis of controlled polytempa, opens up new creative and technological possibilities for the contemporary composer.

As a summary: in the two parallel pacing layers – M.M.♩ =48 and M.M.=84 — a monotempic osminal ripple has been realized. ♩ In this ripple — again, the asymmetric alternation of accents corresponding to the strong quarter-strokes in the two pace lines — see, the explicitly

marked accents in the two lines of the attached example - as follows: on the 1st eighth- a general accent; on the 3rd and 5th eights, in the lower row; on the 7th, 8th and 9th eights, alternately – accents, in the lower, upper and again in the bottom row; on the 11th and 13th eights – accent, in the bottom row; on the 15th eighth – a general accent, in the upper and lower rows; on the 17th and 19th eights – in the bottom row; on the 21st, 22nd and 23rd eights, successively – accents, in the lower, upper, and again in the bottom row; On the 25th and 27th eights – in the bottom row.

The last fourth example in this chapter, as a technological building, is identical to the monotempo structures used in the choral cantata "Polytempi No3" and the Concerto for Piano and Orchestra (Polytempi №4).

In the subsequent fifth example, a flow diagram of three parallel paces and the existing real possibilities for building monotempo structures is discussed. As a summary: in the last, fifth example, in the three parallel pace layers - M.M.♩ =72, M.M.♩ =96 and M.M.=108 - a monotempic hexacystic pulsation was realized. ♩ In it, again, as in the previous four examples, the asymmetric alternation of accents is visible – see, the marked accents in the three lines of the example attached - as follows: on the 1st hexastine – general accent, in the three lines; on the 5th hexastine – accent, in the third row; on the 7th hexastine – accent, in the first row; on the 9th and 10th hexastines, sequentially – highlights, in the third and second row; on the 13th sixteen – a general emphasis in the first and third row; on the 17th sixteen – accent, in the third row; on the 19th sixteen – a general accent, in the first and second row; on the 21st hexastine – accent, in the third row; on the 25th sixteen – a general accent, in the first and third row; on the 28th and 29th Sixths, successively – highlights, in the second and third rows; on the 31st sixteen – accent, in the first order; on the 33rd sixteen – accent, in the third row; On the 37th sixteen - a common emphasis in the three rows.

The fifth example considered can also be mechanically exposed in the tempe rate twice as fast as the observed ones, respectively - M.M.♩ =144, M.M.=192 and M.M.=216. ♩ ♩

As a final summary of the observations and analysis of the five examples discussed above: the extensive possibilities for technological realization of monotempo structures, built on the basis of Controlled Polytempia, reveal new, incomprehensible creative spaces for the contemporary composer.

9.1. Additional techniques / opportunities / for implementation of monotempic structures through transformation of polytempic structures

In the subsequent ten numerical constructions tempos pairs are exposed, which in their parallel course offer opportunities for technical realization of monotemp structures. The specified temp pairs are in permanent ratios as follows: 3:4, 3:5 and 3:7; 4:5, 4:7 and 4:9; 5:6, 5:7 and 5:9; 6:7 – fitted into parameters, from the pace M.M.♩ =35 to tempo M.M. ♩=210. Only integers were used. The ten constructions, respectively, could be considerably extended, when using also tempo pairs with fractional numbers.

9.1.1.First structure

Pairs of tempos are observed, which are in a ratio of – 3:4.

General characteristics: the distances between the first numbers are constant – 3; The distances between the second numbers are also constant – 4. In each of these tempos pairs there is a possibility of realizing a monotempo structure as follows: in the slower pace moves a series of quarter trios – against a series of quarters, at the faster pace. It is possible to technically implement the same monotempo structure and with larger note values: half-triols against half-notes, as, respectively, and with smaller note values – osminal triols vs. eights; Six-Truth Triols vs. Sixteens.

M.M.♩=36 : M.M.♩=48; 39:52; 42:56; 45:60; 48:64; 51:68; 54:72; 57:76; 60:80; 63:84; 66:88; 69:92; 72:96; 75:100; 78:104; 81:108; 84:112; 87:116; 90:120; 93:124; 96:128; 99:132; 102:136; 105:140; 108:144; 111:148; 114:152; 117:156; 120:160; 123:164; 126:168; 129:172; 132:176; 135:180; 138:184; 141:188; 144:192; 147:196; 150:200; 153:204; 156:208.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M. ♩=35 to pace M.M. ♩=210 – is 41. Their total number could be doubled, when using tempos with fractional numbers, for example: M.M. ♩=37.50 vs. M.M.=50; M.M. ♩=40.50 vs. M.M. ♩=54; M.M. ♩=43.50 vs. M.M. ♩=58 — and so on, in an upward sequence — to M.M. ♩=157.50 vs. M.M.♩=210; the total number of additional tempo pairs, ♩ Using fractional numbers is – 41. In total: 82 pairs of tempos, which are in a ratio of 3:4, where there is a real possibility of realization of a monotemp structure.

9.1.2. Second structure

Pairs of tempos are observed, which in a ratio of – 3:5.

General characteristics: the distances between the first numbers are constant – 3; The distances between the second numbers are also constant – 5. At each of these tempos pairs, there is the possibility of realizing a monotempo structure as follows: in the slower pace, a series of quarter quintols moves – against a series of quarter triols, at the faster pace. A technical realization of the same monotempic structure is possible in larger notation values: half-quintols vs. half-triols, as, resp., and in smaller notch values – osminkov quintols vs. osminal triols; Sixteen Quintols vs. Sixteenth Triols.

M.M.♩=36 : M.M.♩=60; 39:65; 42:70; 45:75; 48:80; 51:85; 54:90; 57:95; 60:100; 63:105; 66:110; 69:115; 72:120; 75:125; 78:130; 81:135; 84:140; 87:145; 90:150; 93:155; 96:160; 99:165; 102:170; 105:175; 108:180; 111:185; 114:190; 117:195; 120:200; 123:205; 126:210.

According to the above table, the number of pairs of tempos – placed in the tempo scale of M.M. ♩=36 to a pace M.M. ♩=210 — is 31. Their total number could be considerably greater when using tempos with fractional numbers, for example: M.M. ♩=37.50 vs M.M. ♩ =62.50; M.M. ♩=40.50 vs M.M. ♩=67.50 — etc., in an upward series — to M.M. ♩=124.50 vs. M.M. ♩=207.50; The total number of additional tempo pairs, using fractional numbers is — 30. In total: 61 pairs of tempos, which are in a ratio of 3:5, where there is a real possibility of realization of a monotemp structure.

9.1.3.Treta structure

Наблюдават се двойки темпа́, които са в съотношение – 3:7.

General characteristics: the distances between the first numbers are constant – 3; The distances between the second numbers are also constant – 7. In each of these pairs of tempos there is a possibility of realizing a monotempo structure as follows: in the slower pace moves a series of eight-month septols – against a series of quarter-triols, at the faster pace. A technical implementation of the same monotempo structure is possible in larger note values: quarter-septoli vs. half-triols, as, respectively, and in smaller note values – sixteenth septols vs. eight-point triols.

M.M.♩=36 : M.M.♩=84; 39:91; 42:98; 45:105; 48:112; 51:119; 54:126; 57:133; 60:140; 63:147; 66:154; 69:161; 72:168; 75:175; 78:182; 81:189; 84:196; 87:203; 90:210.

According to the above table, the number of pairs of tempos – placed in the tempo scale of M.M.♩ =35 to a pace M.M. ♩=210 — is 19. Their total number could be considerably greater using tempos with fractional numbers, for example: M.M. ♩=37.50 vs. M.M. ♩=87.50; M.M. ♩=40.50 vs. M.M. ♩=94.50 — and so on, — in ascending series — to M.M. ♩ =88.50 vs. M.M. ♩=206.50; The total number of additional tempo pairs, using fractional numbers is — 18. In total: 37 pairs of tempos, which are in a ratio of 3:7, where there is a real possibility of realization of a monotemp structure.

9.1.4. Fourth structure

There are pairs that are in a ratio of – 4:5.

General characteristics: the distances between the first numbers are constant – 4; The distances between the second numbers are also constant – 5. In each of these pairs of tempos there is the possibility of realizing a monotempo structure as follows: in the slower pace moves a series of quartering quintols – against a series of quarter notes, at the faster pace. It is possible to technically implement the same monotempo structure in larger notation values: half quintols vs. halves, as, respectively, and in smaller note values – eight-point quintols vs. eights; Hexastine Quintols vs. Sixteenths.

M.M.♩=36 : M.M.♩=45; 40:50; 44:55; 48:60; 52:65; 56:70; 60:75; 64:80; 68:85; 72:90; 76:95; 80:100; 84:105; 88:110; 92:115; 96:120; 100:125; 104:130; 108:135; 112:140; 116:145; 120:150; 124:155; 128:160; 132:165; 136:170; 140:175; 144:180; 148:185; 152:190; 156:195; 160:200; 164:205; 168:210.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M. ♩=35 to a pace M.M. ♩=210 — is 34. Their total number could be considerably greater when using tempos with fractional numbers, for example: M.M. ♩=38 vs M.M. ♩=47.50; M.M. ♩=42 vs M.M. ♩=52.50 — and so on — in an ascending series — to M.M. ♩=166 vs M.M. ♩=207.50;   The total number of additional tempo pairs, using fractional numbers is — 33. In total: 67 pairs of tempos, which are in a ratio of 4:5, where there is a real possibility of realization of a monotemp structure.

9.1.5. Fifth structure

Tempo pairs are observed, which are in a ratio of – 4:7.

General characteristics: the distances between the first numbers are constant – 4; The distances between the second numbers are also constant – 7. In each of these pairs of tempos there is the possibility of realizing a monotempic structure as follows: in the slower pace moves a series of quartering septols – against a series of quarter notes, at the faster pace. It is possible to technically implement the same monotempic structure in larger notation values: half-septoli vs. halves, as, respectively, and in smaller note values – osminkov septoli vs. eights; sixteen septoli vs sixteens.

M.M.♩=36 : M.M.♩=63; 40:70; 44:77; 48:84; 52:91; 56:98; 60:105; 64:112; 68:119; 72:126; 76:133; 80:140; 84:147; 88:154; 92:161; 96:168; 100:175; 104:182; 108:189; 112:196; 116:203; 120:210.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M. ♩=35 to a pace M.M. ♩=210 — is 22. Their total number could be considerably greater when using tempos with fractional numbers, for example: M.M. ♩=38 against M.M. ♩=66.50; M.M. ♩=42 vs M.M. ♩=73.50 — and so on — in an ascending series — to M.M. ♩=118 versus M.M. ♩ =206.50;   The total number of additional tempo pairs, using fractional numbers is — 21. In total: 43 pairs of tempos, which are in a ratio of 4:7, where there is a real possibility of realization of a monotempic structure.

9.1.6. Sixth structure

Tempo pairs are observed, which are in a ratio of – 4:9.

General characteristics: the distances between the first numbers are constant – 4; The distances between the second numbers are also constant – 9. In each of these pairs of tempos there is a possibility of realization of a monotempic structure as follows: in the slower pace moves a series of eight-minute "ninets" – against a series of quarters notes, at the faster pace. It is possible to technically implement the same monotempo structure in larger note values: quaternary "ninels" against half notes as, respectively, and in smaller note values - hexagonal "nineballs" against eights notes.

M.M.♩=36 : M.M.♩=81; 40:90; 44:99; 48:108; 52:117; 56:126; 60:135; 64:144; 68:153; 72:162; 76:171; 80:180; 84:189; 88:198; 92:207.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M.♩=35 to a pace M.M. ♩=210 — is 15. Their total number could be considerably larger using tempos with fractional numbers, for example: M.M. ♩=38 vs M.M. ♩=85.50; M.M. ♩=42 vs M.M. ♩=94.50 — and so on - in ascending series - to M.M.♩=90 vs M.M. ♩=202.50; the total number of additional tempo pairs, using fractional numbers is — 14. In total: 29 pairs of tempos, which are in a ratio of 3:4, where there is a real possibility of realization of a monotemp structure.

9.1.7. Seventh structure

There are pairs of temps that are in a ratio of – 5:6.

General characteristics: the distances between the first numbers are constant – 5; The distances between the second numbers are also constant – 6. In each of these pairs of tempos there is the possibility of realizing a monotempo structure as follows: in the slower pace moves a series of quarterwise sextles – against a series of quarter-quintols, at the faster pace. It is possible to technically implement the same monotempo structure in larger note values: half-sextoles vs. half-quintols, as, respectively, and in smaller note values – eighth sextoles vs. eighth quintols; sixteen sextoles vs. sixteenth quintoles.

M.M.♩=35 : M.M.♩=42; 40:48; 45:54; 50:60; 55:66; 60:72; 65:78; 70:84; 75:90; 80:96; 85:102; 90:108; 95:114; 100:120; 105:126; 110:132; 115:138; 120:144; 125:150; 130:156; 135:162; 140:168; 145:174; 150:180; 155:186; 160:192; 165:198; 170:204; 175:210.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M.♩=35 to a pace M.M. ♩=210 — is 29. Their total number could be considerably larger when using tempos with fractional numbers, for example: M.M. ♩=37.50 vs. M.M. ♩=45; M.M. ♩=42.50 vs. M.M. ♩=51 — and so on. - in ascending series - to M.M.♩=172.50 vs. M.M. ♩=207; the total number of additional tempo pairs, using fractional numbers is – 28. In total: 57 pairs of tempos, which are in a ratio of 3:4, where there is a real possibility of realization of a monotemp structure.

9.1.8. Eighth structure

There are pairs of temps, which are in a ratio of – 5:7.

General characteristics: the distances between the first numbers are constant – 5; The distances between the second numbers are also constant – 7. In each of these pairs of tempos there is a possibility of realization of a monotempic structure as follows: in the slower pace moves a series of quartering septols – against a series of quartering quintols, at the faster pace. A technical realization of the same monotemp structure is possible in larger note values: half-septoli vs. half-quintols, as, respectively, and in smaller note values – eighth septols vs. eighth quintols; sixteenth septoli vs. sixteenth quintoles.

M.M.♩=35 : M.M.♩=49; 40:56; 45:63; 50:70; 55:77; 60:84; 65:91; 70:98; 75:105; 80:112; 85:119; 90:126; 95:133; 100:140; 105:147; 110:154; 115:161; 120:168; 125:175; 130:182; 135:189; 140:196; 145:203; 150:210.

As can be seen from the above table, the number of tempo pairs – placed in the tempo scale of M.M. ♩=35 to a pace M.M. ♩=210 — is 24. Their total number could be considerably greater using tempos with fractional numbers, for example: M.M. ♩=37.50 vs M.M. ♩=52.50; M.M. ♩=42.50 vs M.M. ♩=59.50 — etc. — in an ascending series — to M.M. ♩=147.50 vs. M.M. . ♩=206.50; the total number of additional tempo pairs, using fractional numbers is — 23. In total: 47 pairs of tempos, which are in a ratio of 5:7, where there is a real possibility of realization of a monotempic structure.

9.1.9. Nineth structure

There are pairs of tempos that are in a ratio of – 5:9.

General characteristics: the distances between the first numbers are constant – 5; The distances between the second numbers are also constant – 9. In each of these pairs of tempos there is the possibility of realizing a monotempo structure as follows: in the slower pace moves a series of eight-minute "ninets" – against a series of quarter-quintols, at the faster pace. A technical realization of the same monotempo structure is possible in larger note values: quarterwise "ninels" against half-quintols as, respectively, and in smaller note values - sixteenth "ninels" against eight-minute quintols.

M.M.♩=35 : M.M.♩=63; 40:72; 45:81; 50:90; 55:99; 60:108; 65:117; 70:126; 75:135; 80:144; 85:153; 90:162; 95:171; 100:180; 105:189; 110:198; 115:207.

As can be seen from the above table, the number of tempos pairs – placed in the tempo scale of M.M. ♩=35 to pace M.M. ♩=210 – is 17. Their total number could be considerably larger when using tempos with fractional numbers, for example: M.M. ♩=37.50 vs M.M. ♩=67.50; M.M. ♩=42.50 vs M.M. ♩ =76.50 – etc. – in an ascending series – up to M.M. ♩=112.50 vs M.M. ♩ =202.50; the total number of additional tempos pairs, using fractional numbers is – 16. In total: 33 pairs of tempos, which are in a ratio of 5:9, where there is a real possibility of realization of a monotemp structure.

10.1.10. Tenth structure

There are pairs of temps, which are in a ratio of – 6:7.

General characteristics: the distances between the first numbers are constant – 6; The distances between the second numbers are also constant – 7. In each of these pairs of tempos there is the possibility of realization of a monotempic structure as follows: in the slower pace moves a series of quartering septols – against a series of quartering sextols, at the faster pace. It is possible to technically implement the same monotempo structure in larger note values: half-septoli vs. half-septols, as, respectively, and in smaller note values – eighth septoli vs. eighth sextoli; sixteen septoli vs. sixteen sextols.

M.M.♩=36 : M.M.♩=42; 42:49; 48:56; 54:63; 60:70; 66:77; 72:84; 78:91; 84:98; 90:105; 96:112; 102:119; 108:126; 114:133; 120:140; 126:147; 132:154; 138:161; 144:168; 150:175; 156:182; 162:189; 168:196; 174:203; 180:210.

As can be seen from the above table, the number of tempos pairs – placed in the tempo scale of M.M. ♩=35 to a tempo M.M. ♩=210 — is 25. Their total number could be considerably larger using a tempos with fractional numbers, for example: M.M. ♩=39 versus M.M. ♩ =45.50; M.M. ♩=45 versus M.M. ♩=52.50 — and so on — up to M.M. ♩ =177 versus M.M. ♩=206.50; the total number of additional tempo pairs, using fractional numbers is — 24. In total: 49 pairs of tempos, which are in a ratio of 6:7, where there is a real possibility of realization of a monotemp structure.

As a summary: according to the observations and analyses, the total number of tempos pairs – each of which in its parallel course offers real opportunities for technical realization of monotempo structures, exposed in the ten numerical structures, in parameters of the metronomic tempo scale, from a pace M.M.♩=35 to pace M.M. ♩=210 - is 505. As follows: 82 - in first numerical construction; 61 - in second numerical construction; 37 - in third construction; 67 - in fourth construction; 43 - in fifth; 29 - in sixth; 57 - in seventh; 47 - in eighth; 33 - in ninth; 49 - in tenth construction.

In conclusion, the various forms for the possible transformation of several parallel multi-speed layers from polytempic to monotempo structure and vice versa – based on the method Controlled Polytempia and the Photopolymetronome equipment – offer to the contemporary composer incomprehensible new creative territories.

CHAPTER 10. Controlled polytempia and emerging psychological obstacles for conductors and performers

The subsequent text contains detailed information about interesting facts and events related to the rehearsal period and the subsequent concert realization of the cantatas "The Fair" and Polytempi No3, as well as the Polytempi Concerto for Piano and Orchestra No4. My creative cooperation with the great conductor Krikor Chetinyan and the women's choir led by him at the Academy of Music, Dance and Visual Arts "Prof. Asen Diamandiev" – which lasted more than two decades, started with the realization of the cantata Polytempi No3 – in the early 1980s. The occasion for the creation of the cantata was the upcoming participation of the Cetignan Choir at the International Choir Competition in Debrecen, Hungary, in July of the same year. Krikor Cetignan explicitly asked me to write him a spectacular and bravurna, competitive play for two choral groups, conducted by two conductors. Unlike the cantata "The Fair" where the three polytempic choral layers are distributed – respectively – in sopranos, mezzo-sopranos and altas, in Polytempi No3, in both choral groups are located identical vertical five-voice structures as follows: 2 sopranos, 1 – mezzo-sopranos, 2 – alti contra-alts. In this way, a priori, the balance between the two polytempic choral groups, conducted by Krikor Chetinyan and his assistant Sashka Toromanova, was preserved.

Initially, while the singers were studying the complex musical invoice, the rehearsals of the two groups were held separately – under the guidance of Maestro Chetinyan. In this preparatory rehearsal period, problems do not arise. In the spring of 1980, in Plovdiv, in my presence, the first common rehearsal of the two choral groups was held. On the two conductor panels, along with the scores of Polytempi No3, are installed one indicator light, permanently supplying the relevant tempo information from the Photopolymetronome apparatus.

How exactly should the beginning of a polytempo work conducted by two conductors start?

After turning on the equipment, each conductor monitors the pulsation in his or her indicator light. After the appearance of a yellow light signal, marking the beginning of a new polytempo period, the conductor waits for the green light pulsations – respectively, 12 or 14 in number; The last, continuous green signal prepares the inauguration of a new polytempo period, marked by a yellow light signal, coinciding in the score in both parallel-running tempo layers and corresponding to the first semaphore of the work. This is — the start; Be it a rehearsal or a concert.

Then, in the spring of 1980, at the beginning of the first general rehearsal in Plovdiv, specific problems arose. Initially, the two choral groups were arranged in a row, with a distance of about one meter from each other; The limited parameters of the hall did not allow for a greater distance. In this configuration, the sopranos of the second group were located next to the altists of the first group; In essence – there was no mutual audibility between the sopranos of the two groups, respectively, in a similar situation of auditory non-correspondent were the singers from the two altov parties. Moreover, the altists of the first group shared that the high soprano party – dotted with characteristic falsetto cries – prevents them from hearing the overall sound picture.

The rehearsal continued after the two groups lined up - at "right angles", diagonally - like a kind of fan dissolved to the two conductors; The two altov parties were at its core, and the two soprano parties were on both peripheries. In this way, the two altov parties were assured of mutual audibility and correspondentcy. However, this diagonal configuration gave rise to new problems; The singers of the first group, conducted by Krikor Chetinyan, saw the pulsating green signal of the light indicator mounted on the console of the second conductor Sashka Toromanova, as well as her conducting gesture. This, definitely, hindered them. Accordingly, the singers of the second group saw the pulsating signal from the light indicator mounted on the console of Krikor Chetinyan.

The rehearsal had to continue in a larger room. The two choral groups arranged again in a straight row, but at a distance from each other - 3-4 meters. The rehearsal took off. It should be explicitly stated that over time, in the process of regular rehearsals, the difficulties arising from the specifics of the polytemperate race were gradually overcome and the two choral groups lined up – tightly – side by side. During the same first rehearsal, conducting problems arise. Krikor Cetignan said that the pulsating indicator light – to some extent – stiffens the freedom of the conducting gesture. I quote verbatim his words: "I feel like – a metronome".

Immediately after the rehearsal, a thorough analysis of the score of Polytempi No. 3 was made and all common metric points between the two parallel-flowing layers were specified, where the gestures of the two conductors should be in absolute synchrony: the main common vertical, the central vertical, the technological constructions of the so-called Polytempi No. polytempo fan, the fragments with monotempic structures flowing in the two multivelocity layers. Such characteristic episodes were also specified in the score of Polytempi No. 3, where the conductor's gesture – led by the permanent pulses of the light indicator mounted on the console – could have relative liberation.

In the spring and summer of 1980, in the process of two months of regular rehearsals, the two conductors Krikor Chetinyan and Sashka Toromanova gradually adapted and managed to realize maximum creative coordination, overcoming – step by step the initial psychological problems. Even, moreover – which should be explicitly emphasized: further, in the years ahead, during the numerous concert performances of the cantata Polytempi No3, the two conductors – who adapted to the specifics of the permanent light pulsations of the polytempic indicators – demonstrated, during the performance, a unique theatrical-stage dialogue.

During concert performances, Krikor Cetinyan always conducts the first choir, singing at the slower tempo, M.M.♩ =72. In this polytemperate race – passing with a hard, distinct swing the three consecutive metric strokes – Maestro Cetignan usually duplicated his conducting gesture with a threefold, revertent nod with his head, looking playfully from under the eyebrows of the partner-conductor.

In the subsequent two metric blows – closing the polytempo Fan – Sashka Toromanova responded with the same theatrical zastvo. At the moment of the incoming next total metric moment corresponding to the central vertical in the middle of the polytemp period, the two conductors looked at each other smiling at point-blank range and went on; Naturally, they both knew the score in detail, from needle to thread – by heart.

The above-described sign performance, spontaneously created on stage by conductors Krikor Chetinyan and Sashka Toromanova during the performance of the cantata Polytempi No3, is undoubtedly a proof that the realization of a contemporary polytempo work, carried out with the participation of the Photopolymetronome equipment, can bring conductors and performers, besides suffering and – pleasure and creative satisfaction.

Similar stage and creative tribulations accompanied the World premiere of the Concerto for Piano and Orchestra – Polytempi No. 4 by Stefan Dragostinov in Italy in the summer of 1981, performed within the framework of the International Summer Music Festival in Bergamo.

Unlike the realization of the cantata Polytempi No. 3 in 1980 in Bulgaria, in Italy there was an extremely short rehearsal period: two rehearsals with the symphony orchestra of Milan Radio – without the Photopolymetronome equipment – where the orchestrators got acquainted with the complex instrumental invoice of the work; three rehearsals of the orchestra and soloist - the magnificent Italian pianist-virtuoso Antonio Baccelli, respectively, with the participation of the Photopolymetronome equipment. The last, dress rehearsal took place in Bergamo, on the day of the premiere of Polytempi No. 4. Meanwhile, an individual rehearsal was held with pianist Bakelli – with a light indicator mounted on the pupiter of the grand piano – in order for the soloist to get used to and adapt to the permanently flashing light signals. It should be explicitly noted that Antonio Baccelli had studied and mastered to perfection the complex piano solo-party.

Already at the first general rehearsal in Milan, the already familiar difficulties associated with communication arise: conductor – polytempic light signal. At the same time, another serious problem initially appeared: the huge score of Polytempi No4 – A2 format – leafed on the conductor's desk did not fit into its dimensions and, accordingly, there was no free place to install the indicator light. It was necessary to install a second conductor's desk, away from the first, especially for the lamp. This, however, gave rise to other unforeseen problems: a certain concentration of the conductor – a kind of multitasking; What to observe and keep an eye on - the pulsating light signal, the large-format score or communicate with the huge symphony apparatus and at the same time - with the soloist.

During the pause, the kind technical organizers lightly adapted a new conductor's desk, with a wide plane attached to it, on which there was enough space for the score and the indicator light. The conductor was impressively quick in the unusual polytempo situation, although his first reaction after the rehearsal was – I remember verbatim his words: "I hate being conducted!" – "I hate being conducted!". The subsequent two rehearsals passed relatively calmly, and at the general rehearsal in Bergamo, a conductor and soloist already showed remarkable creative consolidation - see, above in this scientific study, a description and analysis of Semaphore No. 73, a fragment of the Code of "Polytempi No. 4".

In the evening, at the premiere, Antonio Bakelli and the conductor demonstrated an impressive sign performance, similar to the one played by Krikor Chetinyan and Sashka Toromanova in the realization of the cantata Polytempi No3, described above.

After the dress rehearsal, in a detailed analysis and, accordingly, in the last preparation for the World Premiere, I explicitly thanked both of them for the sign language dialogue and urged them to try to implement it at the premiere. "We'll do it!" cut off Antonio Bakelli. And he turned with a smile to the conductor, "You are the penultimate one. And for now, I'm second."

The conductor gladly took over the glove thrown to him and during the concert an attractive show-spectacle took place. At the very beginning of the Code in the third part – see above, in Chapter Six "Creation of a new, improved technological construction of the equipment Photopolymetronome", respectively, notation examples, Semaphore No67, Semaphore No68 and on - the two began a pantomimic dialogue, and in the first polytempic periods of the mentioned semaphores the leading figure in the speed race is Antonio Bakelli as the piano solo-party moves at a faster tempo compared to that in the orchestra, respectively: M.M.♩ =65, to M.M.=60. For 12 polytempo periods, from Semaphore No. 67 to Semaphore No. 78 incl., taking place within 2 minutes and 24 seconds, the two demonstrate on stage an amazing, impressive pantomimic spectacle – a kind of duel fight in their polytempic race. ♩

After the concert, the conductor frankly said that the difficulties and problems he experienced during the short rehearsal period, resulting from the communication with the conducting light signal, are nothing compared to the creative satisfaction and pleasure he received from the realization of Polytempi No. 4.

As a summary, after the above analysis of the facts and events set out in Chapter Ten – "Controlled Polytempia and Emerging Psychological Obstacles for Conductors and Performers" – the following should be highlighted: The emerging specific conducting problems in the realization of a modern polytempo work - arising from the fact that in practice the apparatus Photopolymetronome, respectively, the light signal conducts the conductor - can undoubtedly be overcome and overcome, in a longer rehearsal period, gaining the necessary dexterity and experience. After all, polytempo problems can bring the conductor and performers, besides difficulties and – creative joy, pleasure and satisfaction.

CHAPTER ELEVEN. Future prospects in the creative and technological development of the method Controlled polytempia and instrumentation Photopolymetronome

In the development of this scientific study are introduced for the first time a number of new – unknown and previously unused in scientific literature and musicology - creative and technological concepts and terms that are within the scope and parameters of modern technological principles and techniques of the method Controlled polytempia and the equipment Photopolymetronome, namely:

- Controlled polytempo;
- Polytempism;
- Monotempism;
- Semaphore;
- Light pace indicator - LPI;
- Polytempic period;
- Head common vertical;
- Second common vertical;
- Central common vertical;
- Fourth common vertical;
- First intermediate vertical;
- Second intermediate vertical;
- Third intermediate vertical;
- Fourth intermediate vertical;
- Polytempic Fan;
- Realization of Monotempism through Polytempism;
- Polytempic Change-button;
- Integrated Polytempo Installation - I.P.I.;
- Polytempo Navigation Appliance - P.N.A.

One of the goals of the tone of scientific research is to create a real prerequisite for the construction of new, modern, modern equipment Photopolymetronome, based on the huge arsenal of accumulated new computer technologies in recent decades. At the same time – the need to create an adequate, modern computer system for composing music based on the creative and technological principles of the Controlled Polytempia and its visual-graphic realization on the score, as well as, accordingly, to achieve an adequate full-fledged sound picture of the created new musical polytempo work. Constructed in the summer of 1980 second equipment Photopolymetronome, with significantly wider parameters and capabilities for implementation of tempo coordination, compared to the first – in particular: expansion of the construction of the polytempo digital cyclogram with intertemporal proportions, respectively 11:12:13:14:15, installation of a detailed temperature scale, implying the possibility of precise acceleration or slowing of the pace by Largo do Presto, Embedding a special button for polytempic change (polytempic change-button) and, accordingly, with the ability to switch the tempo signal from one "tempo layer" to another - today, in the conditions of extreme development of computer technology over the past three decades, is already with too limited technical resources.

11.1. Creation of Integral Polytempic Installation

The new realities of technological prosperity at the start of the Third Millennium require the urgent creation of a complex, integral device corresponding to the intensity of development and the time in which we live.

This device in its entirety should be – Integrated Polytempic Installation – I.P.I. The term is first introduced in this scientific study. The I.P.I. device should contain several main components that are permanently interconnected, ensuring maximum creative and technological compositing capabilities, based on the method Controlled polytempia – as follows:

1. Modern equipment Photopolymetronome, providing the composer with extensive technological capabilities, including a wide polytempo scale, with parameters including a maximum number of intertemporal ratios. The apparatus should have a special technical application – a device to provide automatic Polytempo Navigation, respectively, switching from one pace to another at the beginning of each subsequent polytempic period, carried out so far through the installed special polytempic change-button, manually triggered by a technical operator during a concert performance or rehearsal. In this special device, which is essentially a Polytempo Navigation Appliance (P.N.A.), should be built a Polytempo Digitogram, including a complete database of all tempo changes in the work already created, adequate in number and time ratio with those set out in the author's score. This mechanism should provide optimal opportunities – during rehearsal, concert or sound recording – for "start", "stop", as well as for the subsequent start of the performed polytempo work, from the beginning of each polytempo period, respectively, at the moment of the inauguration of the so-called. Main general vertical. The terms Polytempo navigation – Polytempo Navigation and Polytempo Navigation Appliance (P.N.A.) are introduced for the first time in this scientific study. Hypothetically, there are a number of other additional possibilities for improvement of the P.N.A-device, such as: starting or stopping the polytempo work exactly in the middle of each Polytempic period, respectively, at the beginning of each polytempic half-period, at the moment of entering the so-called Polytempic Period. Central general vertical – but, only in cases where the parallel multi-speed lines are in pace proportions, which allow the presence of a Central common vertical, of a total quarter time coinciding at both rates. For example, in the tempo pairs: =100 and =110, =110 and =121, =125 and =137.50, =122.50 and ♩ ♩ ♩ ♩ =134.75 – which are in tempo ratios, respectively, 10:♩ 11 – this is not feasible, ♩ ♩ ♩ since there is no availability of such a Central total vertical.

2. Modern computer system for composing music based on the creative and technological principles of Controlled Polytempa. The created dozens of modern software programs – including (listed alphabetically) Denemo, Dorico, Finale, Forte, MagicScore Maestro, MuseScore, Noteflight, Notion, QuickScore Elite Level, Sibelius and others. – offer optimal opportunities for non-typing, including large-format symphony scores, as well as for achieving an adequate sound picture of the written musical text – in the form of midi-sound. At the same time, however, these software programs do not provide the necessary technological scope for composing contemporary polytempo music, respectively, for its visual-graphic realization on the score, as well as for obtaining a corresponding sound picture. The construction of a homogeneous musical structure, including two, three and more, parallel multi-speed musical layers is beyond the technological parameters of the software programs mentioned above, respectively, their techno-tuning has opportunities for non-typing only of monotempo structures, respectively, graphic implementation of music flowing only in one tempo.

As a summary of the observations and analysis made so far: it is necessary to create an I.P.I. device, as well as the accompanying ones, described in this Chapter Eleven, innovative technical applications - Polytempic Navigation Device and Polytempic Digitogram. The construction of a modern, technological-creative construction will unconditionally reveal to the contemporary composer - working in the field of controlled polytempia - new, previously unknown creative territories and will provide maximum opportunities for the visual-graphic realization of the musical text on the score, as well as – respectively - will provide a real prerequisite and opportunity for achieving an adequate complete sound picture of a newly created musical polytempo work.

50 years have passed since the composer Iliya Kozhuharov officially registered his author's idea at the Institute for Inventions and Rationalizations (INRA), Sofia, under the name

"Method and device for simultaneous transmission of different tempos to individual orchestral or choral groups and solo performers" (see, above - Chapter Five) and created the world's first equipment providing permanent submission of polytemp information – Photopolymetronome. This, in essence, marks the beginning of a new creative direction in contemporary music – controlled polytempia – a technological-creative resource of the future, with an impressively high efficiency in subsequent evolutionary processes of musical, creative and executive development; with significant creative potential and "new expression", offering to the contemporary composer wide innovative opportunities for essential musical-artistic creativity - an incomprehensible territory and a vast creative and technological resource for the development of musical creativity in the coming Third Millennium.

CONCLUSION

This dissertation is an attempt for theoretical analysis and practical attention to the diverse relationships of simultaneously flowing several sound layers in a musical work – a specific phenomenon in music, characterized by simultaneous, simultaneous movement of two, three or more diverse tempo lines, known as Polytempo.

The nascent polytempo processes in the development of polyphonic genres from the Middle Ages, the Renaissance, the Baroque, Classicism and Romanticism are examined and analyzed. The diversity of stylistic currents and the innovative artistic and technological techniques in the music of the 20th century are studied and analyzed, as well as the development of polytempo processes in the works of Charles Ives, Samuel Nancarrow, Kyle Gann, Karlheinz Stockhausen and Mikhail Puchkov. The historical prerequisites for the emergence and development of a new technological-creative direction in contemporary music of the second half of the twentieth century – Controlled Polytempia – are described and analyzed.

The Photopolymetronome, created by the composer Iliya Kozhuharov, is presented, providing permanent submission of polytempo information to performers (or conductors), musicians at different temps, with a detailed description and analysis of the technical parameters of the equipment: three primary tempos – ♩=72; ♩=78; ♩=84 – with intertemporal proportions, respectively 12:13:14; Head Common Vertical – total metric moment in the flow of several multi-speed layers –and its derivative structures in the methodology of Controlled Polytempia; Semaphore corresponding to the Head Common Vertical; Polytempic period – a musical time between two main general verticals.

The technological possibilities for visual-graphical realization of polytempo structures on the sheet of paper are described and analyzed, as well as the variety of technological constructions within a polytempic period, including, the so-called Polytempic Fan.

The wide possibilities for organization of monotempo structures in the polytempo space are presented and analyzed in detail, as well as a combination of heterogeneous technological structures within a polytempo period, including a technological combination of Polytempic fan and monotempic structures in the polytempic space.

The second apparatus Photopolymetronome, created in 1980 – with improved technological construction – with description and analysis of the new technical parameters of the equipment: five primary tempos – ♩=66, ♩=72, ♩=78, ♩=84, ♩=90; with intertemporal proportions, respectively 11:12:13:14:15; advanced tempo potentiometer with a detailed speed scale, suggesting the possibility of precise acceleration or slowing down - from Largo to Presto; special polytempic change-button – offering the possibility to switch the tempo signal from one "tempo layer" to another.

The diverse multi-speed constructions and the symbiosis of polytempic and monotempic configurations in the "Concerto for Piano and Orchestra" (Polytempi No 4), as well as in the choral cantatas "Polytempi No 3" and "La Foire – Polytempi No 1" by Stefan Dragostinov are described and analyzed.

Various time parameters of a polytempo period are examined and analyzed in detail – according to the speed of movement of the polytempo structures – classified in tables according to different time indicators of the respective polytempo period.

The subordinations of differentiated pairs of polytempo periods – occurring in different time parameters – according to their intertemporal ratios, as well as the diverse possibilities for technological realization of monotempo structures in the polytempo space – are described and thoroughly analyzed.

Reasoned and theoretically motivated is the need to construct a new, modern equipment Photopolymetronome, based on the huge arsenal of accumulated new computer technologies in recent decades and the need to create an adequate, modern computer system for composing music based on the creative and technological principles of Controlled Polytempia and its visual-graphic realization on the score, as well as, accordingly, to achieve an adequate full-fledged sound picture of the created new musical polytempo work. In conclusion: it is imperative to create an Integral Polytemp Installation, as well as the accompanying innovative technical applications – Polytemp Navigation Device and Polytemp Digitgram. The construction of a modern, technological-creative construction will unconditionally reveal to the contemporary composer – working in the field of controlled polytempia new, hitherto unknown creative territories.

In conclusion, we can find that the specific tasks of the work have been fulfilled.

CONTRIBUTIONS

1. The development and evolution of polytempic processes in twentieth-century music as a historical prerequisite for the emergence of a new technological-creative direction – Controlled Polytempia – are described and analyzed in detail.

2. A systematized methodology of the principles of Controlled Polytempia as a new technological-creative direction in contemporary music is outlined.

3. The technological parameters and a detailed description of the PHOTOPOLYMETRONOME equipment are presented, providing permanent submission of polytemp information to contractors or conductors performing in different tempos.

4. New creative and technological concepts and terms have been introduced – unknown and previously unused in scientific literature and musicology – which are within the scope and parameters of the modern technological principles of the method Controlled polytempia and the equipment Photopolymetronome, namely: Semaphore; Tempo light indicator; polytempic period; Head Common Vertical; Central Common vertical; Polytempic fan; Integral polytemp installation.

5. Different types of time parameters of a polytempo period are described and analyzed in detail – in accordance with the speed of movement of the polytempo structures - systematized in tables according to the different time indicators of the course of the respective polytempo period. Such technological-theoretical treatment has not been realized so far in the scientific literature and musicology and is carried out for the first time in this scientific study.

6. The subordinations of differentiated pairs of polytempo periods – occurring in different time parameters – according to their intertemporal ratios, as well as the diverse possibilities for technological realization of monotempo structures in the polytempo space – are described and thoroughly analyzed. Such a technological-theoretical treatment is realized for the first time in this scientific study.

7. The need to construct modern equipment Photopolymetronome is derived and theoretically motivated, based on the huge arsenal of accumulated new computer technologies in recent decades and the need to create a modern computer system for composing music based on the creative and technological principles of Controlled Polytempa.

8. Practical significance of this study is the real opportunity for extensive use of the achieved theoretical results in the future academic training of young artists and their acquaintance with the method of composition Controlled polytempia, respectively, with the technological-creative resource and capacity of the Photopolymetronome equipment.

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Stefan Dragostinov is a Bulgarian composer, pianist, conductor, pedagogue and public figure. He is the author of cantata-oratory, symphonic, instrumental, choral and vocal music, pop music, ballet, film and theater music. He was born in Sofia. He started studying piano at the age of seven with Sonya Jeleva. He studied composition with Prof. Pancho Vladigerov; harmony and polyphony with Prof. Asen Karastoyanov; piano – with Assoc. Lidia Kuteva, and later with Prof. Bogomil Starshenov and composition with prof. Alexander Raychev. Prez 1970–1972 e student in Leningradskat (dn. St. Petersburg) Conservatory "Nikolai Andreevich Rimsky-Korsakov", who graduated from the class on composition by Prof. Boris Arapov. In 1982 he was awarded a scholarship at the DAAD (Deutscher Akademischer Austauschdienst) in Kjöln, Germany. Winner of the Award at the International Composition Competitions: *Gaudeamus in Hollandia for the cantatata Panair – Polytempi 1, (1978),* Karlheinz Schchochausen *in Italy for* the Concerto for Piano and Orchestra *– Polytempi 4 (1980), Grand Prix for the Fondation France – Arthur Honeger for the cantatata Polytempi 3* (1982), *Simón Bolívar –* Venezuela *for Symphony-Monument* (1984), Fernando Pessoa *– Portugal for* Ode for Moreto *(1986).* From 1974 to 1994 Stefan Dragostinov worked at the State Folklore Ensemble "Philip Kutev" (today's NFA "Philip Kutev") as a conductor, chief artistic director and director. In 1988 in Japan ensemble "Philip Kutev" conducted by Stefan Dragostinov recorded its first 3 CDs, which the publishing house "Victor" circulated in 1 500 000 copies. Stefan Dragostinov's large-scale musical project is "Anthology of Bulgarian Folklore – Sound Icons of Bulgaria and The Key to the Sacrament", which the composer realized together with the choral formation "Dragostin Folk National", which has released 11 CD-albums so far: *Rofinka, Sarakina, Galunka, Danube Music, Love Tale, Christmas Star, Mountain Pristi, Milojka, Sunshine Wedding, Grozdanka and Shinka.* In 2007 in Seoul, Korea, the International World Music Committee announced a decision to award Stefan Dragostinov the Academic title of World Master – World Master, among artists nominated by the whole world, for his overall contribution to the study of the national musical tradition and to the integration of Bulgarian cultural identity into the world treasury of spiritual values. In 2011, at the international choir competition organized by the BBC, Let the Peoples Sing, Dragostin Folk National won Second Prize. Stefan Dragostinov is Professor of Composition, Orchestration, Harmony, Theory and Contemporary Musical Techniques at New Bulgarian University, Sofia. In 2011 he was awarded the title "Honorary Professor of New Bulgarian University" for his contribution as a lecturer in composition and musical analysis. His composer's work is a vivid synthesis between national musical tradition and contemporary compositional techniques and composer technologies. Since 1978 he has been applying in some of his compositions the method *of controlled polytempia.* His series of five works "Polytempe" for different performing ensembles is realized with the help of equipment called "*photopolymetronome*". His works are performed at festivals around the world: "Moscow Autumn", Summer Music Festival in Milan - Bergamo, "Warsaw Autumn", in the halls "Tchaikovsky" and "Bolshoi Theater" - Mozqua, Center "Georges Pompidou" - Paris and others.