



# Serban Nichifor

Composer, Teacher

Roumania, Bucarest

## About the artist

[http://www.voxnovus.com/composer/Serban\\_Nichifor.htm](http://www.voxnovus.com/composer/Serban_Nichifor.htm)

Born: August 25, 1954, in Bucharest, Romania

Married to Liana Alexandra, composer: [http://www.free-scores.com/partitions\\_gratuites\\_lianaalexandra.htm#](http://www.free-scores.com/partitions_gratuites_lianaalexandra.htm#)

### Studies

National University of Music, Bucharest, Doctor in Musicology

Theology Faculty, University of Bucharest

International courses of composition at Darmstadt, Weimar, Breukelen and Munchen

USIA Stipendium (USA)

### Present Position

Professor at the National University of Music, Bucharest (Chamber Music Department);

Member of UCMR (Romania), SABAM (Belgium), ECPMN (Holland)

Vice-president of the ROMANIA-BELGIUM Association

Cellist of the Duo INTERMEDIA and co-director of the NUOVA MUSICA CONSONANTE-LIVING MUSIC FOUNDATION INC.(U.S.A) Festival, with Liana ALEXANDRA

### Selected Works

OPERA, SYMPHONIC, VOCAL-SYMPHONIC AND CONCERTANTE MUSIC:

Constellations for Orchestra (1977)

Symphony I Shadows (1980)

Cantata Sources (1977)

Cantata Gloria Heroum Holocausti (1978)

Opera Miss Christina (libretto by Mircea ELIADE, 1981... (more online)

**Qualification:** PROFESSOR DOCTOR IN COMPOSITION AND MUSICOLOGY

**Personal web:** <http://romania-on-line.net/whoswho/NichiforSerban.htm>

**Associate:** SABAM - IPI code of the artist : I-000391194-0

## About the piece



**Title:** INTRODUCTION TO COMPUTER MUSIC

**Composer:** Nichifor, Serban

**Licence:** Copyright (c) Serban Nichifor

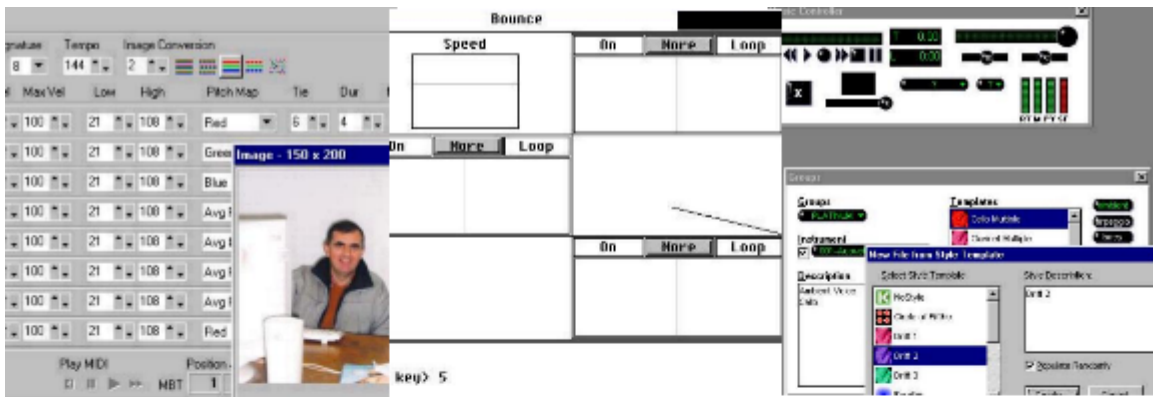
**Instrumentation:** Music theory

**Style:** Contemporary

Serban Nichifor on [free-scores.com](http://www.free-scores.com)

- Contact the artist
- Write feedback comments
- Share your MP3 recording
- Web page and online audio access with QR Code :

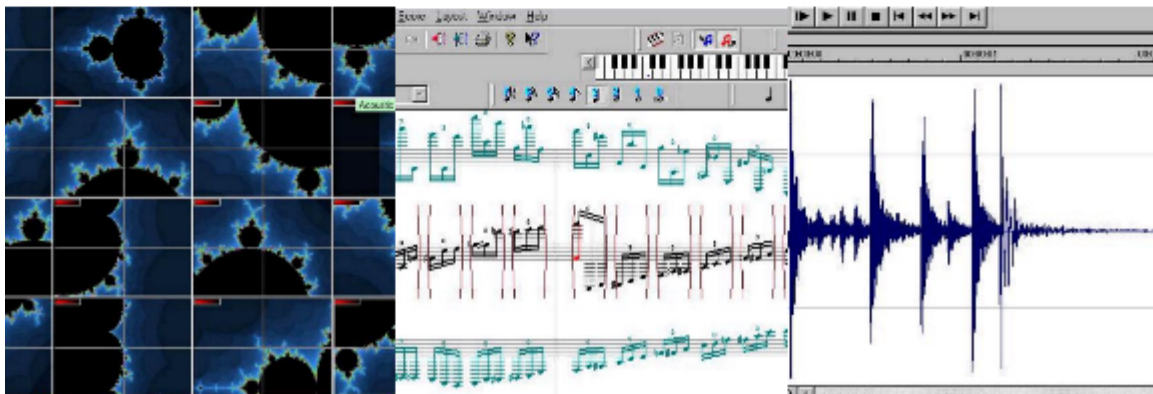




**Serban NICHIFOR**

**INTRODUCERE IN COMPUTER MUSIC**

**INTRODUCTION TO COMPUTER MUSIC**



*Thank you so much for sending me your updated Introduction to Computer Music. It is a great achievement, and will be of much use to your students and people working in the field. Congratulations.*

**BARRY SCHRADER**

**Professor - CALARTS: California Arts School of Music**

*Dear Serban,*

*Thank you very much for sending your book. I appreciate it very much.*

**BEN BIERMAN**

**Professor - Center for Computer Music at Brooklyn College**

# INTRODUCERE IN COMPUTER MUSIC

## Compendium

**Conf.univ.Dr.Serban NICHIFOR**  
 Facultatea de Interpretare Muzicala  
 Universitatea Nationala de Muzica din Bucuresti  
 serbannichifor@yahoo.com ; serbannichifor@gmail.com ;  
<http://romania-on-line.net/whoswho/NichiforSerban.htm>  
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### CUPRINS

#### - INTRODUCERE

#### - Cap. A – EVOLUTIA MIJLOACELOR DE PRELUCRARE A INFORMATIEI, CU APLICATIE IN ARTA SUNETELOR

(Mijloace manuale si mecanice in sistem zecimal; Calculatoarele din generatia O; Calculatoare electronice in sistem binar; generatia I; generatia II; generatia III; generatia IV; generatia V)

#### - Cap. B – ELABORAREA AUDIO-NUMERICA

- 1.) Prolegomene; - 2.) Sinteza sunetului digital; - 3.) Tipuri de fisiere digitale audio; - 4.) Principalele fisiere digitale audio; - 5.) Programe de convertire utilizate in acest curs;

- 6.) Programe muzicale;

- Programe audio in sistemul de operare LINUX

- Programe audio in sistemul de operare MACINTOSH

- Programe audio in sistemul de operare WINDOWS (functii)

- a.) Programe MIDI de redactare muzicala - „Mozart 6“; „Finale 2003“; „Sibelius 2“; „NoteWorty Composer 1.75“; „Lime 8.00“; „Encore 4.5.5“; „Score“;

- b.) Programe WAV de editare muzicala - „Sound Forge 4.5“; „Audacity 1.2.0-pre2“; „Pro Tools 5.0.1.471“;

- c.) Convertere

- WAV-MP3-WMA: „MusicMatch Jukebox 6.00“; „Shuffler 4.2“;

- WAV in MIDI: „AmazingMIDI 1.70“;

- MIDI in WAV (sau MP3) : „Acid Pro 4.0“;

- Imaginea partiturii in sunet: „SharpEye 1.15“;

- Text scris in sunet (voce): „River Past Talkative 1.5.1.31216“;

- Imaginea fotografica in sunet: „MIDImage 2.4.4.1“;

- d.) Programe de editare multi-tracks

- „Acid Pro 4.0“;

- e.) Programe complementare

- „KB Piano 1.1“; „Praat 4.1.12“; „Fractal Tune Smithy 2.21“;

#### - Cap. C – MUZICA DE CAMERA ASISTATA DE CALCULATOR

- 1.) Aspecte intonationale

- 2.) Interpretarea comparata

- 3.) Politempia structurala

- 4.) Efectul de intarziere in practica ansamblurilor – cu aplicatie la proiectul „Sound WIRE“

- 5.) Configurarea toposului acustic (de la spatiul arhitectonic la spatiul virtual)

- 6.) Configurarea acusticii instrumentale

- 7.) Alte domenii abordate la IRCAM
- 8.) Procedee de sinteza si transformare digitala a sunetului utilizate si in aplicatii camerale live-electronice („Phase Shifting“, „The Phase Vocoder“, „Convolution“, „Sampling“, „Localizare/Spatializare“, „Prelucrari grafice“, „Sinteza aditiva“, „Filtrari“, „Waveshaping“, „Amplitude Modulation“, „Frequency Modulation“, „Morphing“, „Sinteza granulara“)
- Cap. D - MUZICA FRACTALA (ALGORITMICA, GENERATIVA)
- Cap. E - LIVE COMPUTER MUSIC – O NOUA IPOSTAZA A ARTEI INTERACTIVE -
- BIBLIOGRAFIE GENERALA SELECTIVA
- APPENDIX: „Principalele comenzi in sistemul de operare PS-DOS -

### INTRODUCERE

Adresat in principal studentilor Universitatii Nationale de Muzica din Bucuresti, dar si tuturor celor interesati in investigarea complexului fenomen „COMPUTER MUSIC“, acest *compendium* incearca sa surprinda, intr-o imagine eminenta sintetica, coordonatele unui nou gen muzical aflat in plina evolutie - cu consecinte majore in prezentul, dar mai ales viitorul artei sunetelor. Nascut, ca si jazz-ul, in atat de fecundul spatiu cultural nord-american (ponderea muzicienilor din U.S.A fiind de peste 90 % !), genul „*Computer Music*“ reprezinta acum o dimensiune unanim recunoscuta – dinamica dezvoltarii sale fiind impresionanta, mai ales printr-o perpetua expansiune in cele mai inedite domenii ale cunoasterii, determinand si elaborarea unor proiecte inter-disciplinare – in planurile creatiei, interpretarii si cercetarii - imposibil de realizat cu mijloacele traditionale. De aceea, prezentul compendiu nu poate avea un caracter exhaustiv – el reflectand in mod pragmatic, din perspectiva practicii muzicale, doar trei elemente constitutive, ce sunt structurate in capitolele: (A) „*Evolutia mijloacelor de prelucrare a informatiei, cu aplicatie la arta sunetelor*“, (B) „*Elaborarea audio-numerică*“ si (C) „*Muzica de camera asistata de calculator*“. Avand o configuratie interactiva (determinata si de evolutia extraordinar de rapida a genului, in multiplele lui ipostaze), compendium-ul evidentiaza in acest sens si o serie de legaturi („*links*“-uri) cu unele dintre cele mai documentate surse de informare accesibile prin Internet. *Dedic aceasta lucrare mamei mele, Dr. Livia NICHIFOR si sotiei mele, distinsei compozitoare si profesoare Liana ALEXANDRA (<http://romania-on-line.net/whoswho/AlexandraLiana.htm>).*

#### *- Capitolul A -*

### EVOLUTIA MIJLOACELOR DE PRELUCRARE A INFORMATIEI, CU APLICATIE IN ARTA SUNETELOR

- I.)- a.) Mijloace manuale in sistem zecimal: 1.) Abacul (inventat in China antica si preluat de cultura greco-romana); 2.) Instrumentele de navigatie;- b.) Mijloace mecanice in sistem zecimal: 1.) Rigla de calcul (1620, William OUGHTRED, logaritmi); 2.) Masina de calcul inventata de Leonardo DA VINCI (sec.XV, operationala cu numere pana la 13 cifre); 3.) „*Arca Musarithmica*“- sintetizorul pneumatic (cu partitura montata pe un tambur-program) imaginat in 1640 de Athanasius KIRCHER (teoretician al manieristilor si autor al primei enciclopedii) in „*Musurgia Universalis*“; 4.) Masina de calcul inventata de Blaise PASCAL (1642 – bazata pe adunare si scadere); 5.) Aritmometrul inventat de Gottfried VON LEIBNITZ (1671 – cu cele 4 operatii aritmetice) si perfectionat de Xavier THOMAS (1820) si Charles BABBAGE (1822 – „*Analytical Engine*“ - masina diferentiaza cu cartele perforate, operationala pana la 8 secimale si capabila sa genereze structuri muzicale, asa cum remarca in 1847 Lady Ada LOVELACE) - evoluand pana la diferitele masini de calcul mecanice si electromecanice utilizate inclusiv in a doua jumătate a sec. XX (bazate pe principiul rotilor Odhner si pe stocarea informatiei pe banda de hartie perforata); 6.) „*Würfelspiel*“ („*Joc de zaruri*“) de Wolfgang Amadeus MOZART (1756-1791) – primul experiment de aleatorism controlat in muzica (*Appendix 3*); 7.) Sisteme mecanice cu program: a.) Razboiul de tesut cu cartele perforate (1802, Joseph JACQUARD); b.) Echipamentul mecanografic cu cartele perforate inventat de americanul Herman HOLLERITH si folosit in 1890 la prelucrarea datelor referitoare la recensamanatul populatiei din S.U.A.;
- II.) Calculatoarele din generatia 0 (1931-1944), cu program si in sistem zecimal: 1.) calculatoarele electromecanice Z1 – Z3 (1931-1941, Konrad ZUSE); 2.) calculatorul „Colossus“ (cu 2000 de tuburi electronice, realizat in 1943 la British Intelligence Establishment si utilizat in descifrarea codului secret german „Enigma“); 3.) calculatorul cu relee electromagnetice si

cartele perforate ASCC (Automatic Sequence Controller Computer) realizat in 1937, la Universitatea Harvard, de Howard AITKEN si perfectionat cu sprijinul IBM in 1944, prin calculatorul "Mark 1 Harvard" (primul calculator electromecanic complet automatizat si dirijat prin program – operational pana in 1949).

**- III.) Calculatoare electronice in sistem binar:**

- **1.) Calculatoarele electronice din generatia 1 (1946-1958)**, bazate pe o arhitectura sintetizata de americanul John VON NEUMANN (in sistem binar si logica booreana): a.) ENIAC/Electronic Numerical Integrator and Calculator (1946, U.S.A., John V. MANCHLY, J. Presper ECKERT, John VIN NEUMANN – Universitatea Pennsylvania – operational pana in 1955); in anul 1957 Departamentul Apararii din S.U.A. organizeaza initiaza proiectul ARPA, reprezentand prima retea cibernetica de comunicatii; b.) UNIVAC-1/Universal Automatic Computer (1950, U.S.A. – primul calculator electronic comercializat); c.) MANCHESTER MARK 1 (1948, Marea Britanie – cu program memorat); d.) EDSAC/Electronic Digital Sequential Automatic Computer (1949, Universitatea din Cambridge – folosind efectiv primul sistem de operare); e.) *apar primele studiouri de computer music – in 1957 la Bell Laboratories din Murray Hill (New Jersey), iar in 1958 la Illinois University, unde este elaborata prima compozitie muzicala pe computer – "Illiac Suite" for string quartet (1956) de Lejaren HILLER si Leonard ISAACSON; apar primele programe din seria "MUSIC" realizate de Max MATTHEWS la Bell Labs;* f.) in Romania – CIFA/Calculatorul Institutului de Fizica Atomica, 1957), MECIPT (Institutul Politehnic din Timisoara) si DACICC 1 (Institutul de Calcul din Cluj);

- **2.) Calculatoarele electronice din generatia a II-a (1959-1963)** - bazate pe tranzistori (in locul tuburilor electronice) si pe limbajele de nivel inalt COBOL si FORTRAN – au fost realizate de companiile americane Honeywell, IBM, Burroughs si Univac; in 1962, US Air Force realizeaza prima retea decentralizata (prin fragmentarea informatiilor trimise, ce sunt reasamblate, in ordine, la receptor) ; in 1959 sunt infiintate "The Columbia-Princeton Electronic Music Center"(dotat cu un RCA Mark II Synthesizer si coordonat de Vladimir USSACHEVSKY, Otto LUENING si Milton BABITT) si "The San FranciscoTape Music Center" (fondat de Morton SUBOTNICK, Ramon SENDER, Pauline OLIVEROS si Terry RILEY – studioul fiind echipat cu sistemul electronic "100-series" proiectat de Donald BUCHLA); experimentele sonore realizate de Max MATHEWS la Bell Labs (cu RCA Mark II si IBM 7090) sunt gravate pe discul "Music from Mathematics" (Decca DL 79103); apar noi compozitii generate pe calculator - "Stochastic Quartet" de James TENNEY (1963, Bell Labs) si "Computer Cantata" de Lejaren HILLER si Robert BAKER (1963, Illinois University); in Romania apar computerele MECIPT II (Institutul Politehnic Timisoara), CET 500 5LP.A. Bucuresti) si DACICC 200 (Institutul de Calcul din Cluj);

- **3.) Calculatoarele electronice din generatia a III-a (1964-1970)** – bazate pe circuite integrate, pe limbajele de nivel foarte inalt PASCAL, LISP si pe limbajele cu interfata grafica – au fost produse in S.U.A. de firmele IBM (International Business Machines) si DEC (Digital Equipment Corporation); la Princeton Studio apare "Quartets in Pairs" (1964) de J.K. RANDALL – o lucrare muzicala ce trateaza computerul ca instrument in timp real; la Bells Lab este elaborata – in baza programului "MUSIC V" – lucrarea "Mutations I" (1969) de Jean-Claude RISSET (relationand frecventa si timbrul sonor), iar la "San FranciscoTape Music Center" sunt realizate 3 piese antologice semnate de Morton SUBOTNICK: "Silver Apples if the Moon" (1966), "The Wild Bull" (1967) si "Touch" (1968) – toate beneficiind de oportunitatile echipamentului Buchla; programul "MUSIC 360", creat de Barry VERCOE la Princeton Studio, va determina si aparitia unor noi si importante compozitii – "Synthesism" de Barry VERCOE (1969) si "Earth's Magnetic Field" de Charles DODGE (1970 – lucrare bazata pe "diagrama Bartels", ce ilustreaza schimbarile activitatii magnetice a Pamantului); in aceasta perioada apar si sintetizatoarele analogice concepute de Paolo Ketoff ("Syn-Ket" – utilizat de John EATON) si Robert A. MOOG (introdus de Walter/Wendy CARLOS in muzica populara) – sistemele acestora fiind ulterior comercializate pe scara larga de firmele ARP, Korg/Unicord, Oberheim, Roland si EML; in 1969 UCLA organizeaza reseaua ARPANET (precursoarea INTERNET-ului), la care se conecteaza principalele universitati americane; este infiintat – in cadrul Stanford University – renumitul Center for Computer Research in Music and Acoustics, sub coordonarea lui John CHOWNING (compozitor si inovator in domeniile modulatiei de frecventa si spatializarii); in cadrul cercetarilor efectuate la acest prestigios centru, compozitorul Prof. Emeritus Leland SMITH creeaza "SCORE", primul program de redactare a partiturilor muzicale, ce este utilizat si astazi la cele mai importante edituri din lume; in Franta se infiinteaza in anul 1970, sub coordonarea compozitorilor Françoise BARRIERE si Christian CLOZIER, celebrul "Groupe de Musique Expérimentale de Bourges" (GMEB), devenit

mai tarziu “Institut International de Musique Electroacoustique de Bourges” (IMEB), cu o prodigioasa activitate in difuzarea muzicii electronice (festivaluri, concursuri, concerte, cursuri de specializare, editare de discuri, etc.); in Romania au aparut calculatoare foarte performante, precum FELIX C-256 (1971, realizat, dupa licenta franceza IRIS-50, la Fabrica de Calculatoare Electronice Felix din Bucuresti), CORAL- 4011 (minicalculator dupa licenta americana DEC, realizat de F.C.E.Felix-Bucuresti) si INDEPENDENT-I-100 (minicalculator proiectat integral la Institutul de Tehnica de Calcul din Bucuresti si realizat de F.C.E. Felix-Bucuresti); in domeniul interferentelor informaticii cu arta, se remarca contributiile extrem de pretioase datorate matematicienilor romani Grigore C. MOISIL si Solomon MARCUS, ce au colaborat in aceasta directie si cu importanti compozitori, precum Anatol VIERU si Aurel STROE;

- 4.) Calculatoarele electronice din generatia a IV-a (1971-prezent) – bazate pe microprocesoare (procesoare integrate intr-un circuit integrat – CIP, inventat in 1971 de americanul Marcian Ted Hoff si realizat de firma INTEL) – se numesc microcalculatoare, utilizand memoriile cu bule magnetice, discurile optice, programe de tip ADA si programe orientate pe obiecte; in 1971, la Bell Labs se experimenteaza sinteza digitala a vocii umane – printr-o tehnica originala aplicata pentru prima data in compozitia “Speech Songs” de Charles Dodge; in 1972, compozitorul Jon APPLETON impreuna cu inginerii Sydney ALONSO si Cameron JONES construiesc primul sintetizor digital – DDS (Dartmouth Digital Synthesizer) – perfectionat in 1976 prin seria “Synclavier”, dezvoltata in paralel cu “Con Brio ADS 200”, “Fairlight Computer Music Instrument”, “Crumar General Development System” si “Alpha Syntauri” – toate aceste instrumente oferind importante facilitati in travaliul componistic, dar si in domeniul performantei in timp real (“live/electronic music”); pionier al muzicii interactive, renumitul compozitor american Rodney OAKES initiaza o serie de experimente extrem de interesante cu “MIDI-Trombonul”; la Paris este infiintat – dupa reutabilul model oferit de catre Stanford-CCRMA ([www.ccrma.stanford.edu/planetccrma/](http://www.ccrma.stanford.edu/planetccrma/)) – mult apreciatul IRCAM (Institut de Recherche et Coordination Acoustique/Musique – [www.ircam.fr](http://www.ircam.fr)) condus, sub patronaj american, de compozitorul francez Pierre BOULEZ; deosebit de active sunt si institutiile similare din Belgia (renumitul Instituut voor Psychoacustica en Elektronische Muziek-IPEM din Gent, precum si nu mai putin notoriul Institut « Musiques & Recherches » din Bruxelles coordonat de compozitoarea Annette VANDE GORNE - [www.musiques-recherches.org](http://www.musiques-recherches.org)), Olanda (Institute of Sonology din Utrecht), Anglia (BBC Studio), Italia (RAI Studio), Polonia (Studio of Polish Radio), Ungaria (Studio of Radio Budapest), Germania (NWDR Studio din Köln) si Japonia (NHK Studio) – ce au urmat cu consecventa modelul american, ilustrand adevarata avangarda si in acest domeniu; marele matematician american Benoit MANDELROT (cercetator la IBM’s Watson Research Center si profesor la Yale University) elaboreaza providentiala Teorie a Fractalilor, expusa pentru prima data in “Les objets fractals, forme, hasard et dimension” (1975) – cu deosebit de fecunde aplicatii si in domeniul muzicii, unde se remarca aparitia ulterioara a unor numeroase programe de compozitie fractala (algoritmica, generativa) implementate pe toate sistemele de operare; in perioada 1972-1979, “Working Group” din S.U.A. (coordonat de Vinton Cerf) sintetizeaza fundamentele protocoalelor TCP (Transmission Control Protocol) si IP (Internet Protocol) referitoare la transferurile de fisiere intre grupurile de dialog (“newsgroups”) si la posta electronica; din 1983 ARPANET-ul (la care s-au conectat institutiile guvernamentale, universitatile, bibliotecile si muzeele americane) ramane o retea exclusiv civila - Pentagonul utilizand propria retea MILNET; in perioada 1987-1993, INTERNET-ul (coordonat de MICHIGAN UNIVERSITY, de IBM si de MCI) se extinde catre Europa si apoi in intreaga lume – prin aparitia WORLD WIDE WEB (www), ca sistem unanim recunoscut de navigare cu ajutorul unor programe speciale (MOZAIC, NETSCAPE, INTERNET EXPLORER); tot in S.U.A se dezvolta principalele sisteme de operare pentru supercalculatoare (UNIX, cu extensiile Berkeley-1986 si cu programul derivat LINUX; realizat in 1991 de studentul Linus Torvalds), pentru mainframe-uri (IMB OS/400), pentru minicalculatoare (RSX11M, cu versiunea romaneasca MIX), pentru microcalculatoare IBM-PC (MICROSOFT-DISC OPERATING SYSTEM/MS-DOS, din care a derivat seria WINDOWS) si Apple MacIntosh (Mac OS) si pentru calculatoarele portabile miniaturizate (WINDOWS CE); apar in U.S.A. doua lucrari teoretice de referinta in domeniul muzicii electro- acustice: “Electronic Music. Systems, Techniques, and Controls” de Allen STRANGE si “Introduction To Electro-Acoustic Music” de Barry SCHRADER; in U.S.A., disciplina “Computer Music” este inclusa in programele curente de studiu ale celor mai importante universitati si colegii, precum:

- Stanford University-CCRMA [www.ccrma.stanford.edu/planetccrma/](http://www.ccrma.stanford.edu/planetccrma/);

- MIT Media Lab <http://sound.media.mit.edu> ;

- Brooklin College Center for Computer Music [www.brooklvn.cuny.edu](http://www.brooklvn.cuny.edu) :

- Columbia-Princeton Electronic Music Center <http://www.columbia.edu> ;
- Cal State Univ/Northridge Music [http://www.csun.edu/~dwh50750/tech\\_classes/MUS191/](http://www.csun.edu/~dwh50750/tech_classes/MUS191/);
- Northwestern University <http://faculty-web.at.nwu.edu/music/webster/D34/>;
- Rutgers University <http://mmlweb.rutgers.edu/imtmw.html>;
- Furman University <http://www.furman.edu/~dkoppelm/Tech/17/mus17.html>; \_
- Dartmouth College - Bregman Electronic Music Studio <http://music.dartmouth.edu> ;
- University of Northern Colorado <http://arts.unco.edu/musictech/mus209/index.html>;
- SUNY Plattsburgh [http://faculty.plattsburgh.edu/richard.davies/courses/mus\\_305syl.htm](http://faculty.plattsburgh.edu/richard.davies/courses/mus_305syl.htm);
- Univ of Southern Cal [http://www-rcf.usc.edu/~kds/courses/mued\\_452.pdf](http://www-rcf.usc.edu/~kds/courses/mued_452.pdf);
- Southwest Texas State <http://147.26.106.74/tech/MusTechsyllabus.html>;
- Lebanon Valley College <http://csunix1.lvc.edu/~snyder/mme803/mtfesyl.htm>;
- Louisiana Tech Univ. <http://performingarts.latech.edu/music/MusicTechnology/TechnologySyllabusLankford.html>;
- Metropolitan State College of Denver <http://clem.mscd.edu/~worster/mtech1/1900syl.html>;
- University of Washington <http://depts.washington.edu/smccweb/courses/400/syl.html>;
- Kennesaw State University <http://ksuemail.kennesaw.edu/~lsherr/2100syllabus.html>;
- Palomar College <http://www.palomar.edu/performingarts/midilab/music180.html>;
- University of Illinois, Champaign-Urbana <http://www-camil.music.uiuc.edu/classes/210/syllabus/syllabus.html>;
- Brown University <http://www.brown.edu/Departments/Music/Music11/syllabus.html>;
- University of Texas at San Antonio <http://music.utsa.edu/technology/mat/>;
- University of South Carolina <http://www.music.sc.edu/ea/mued/mued554/syllabus.html>;
- University of Wisconsin at Whitewater <http://facstaff.uww.edu/craggsj/techsyl.html>;
- Northern State University (Aberdeen, SD) <http://lupus.northern.edu:90/wieland/mus321.htm>;
- Eastern Kentucky University <http://www.music.eku.edu/faculty/davis/Mus584Syllabus.html>;
- Cal State, Chico <http://www.csuchico.edu/~seppanen/103/syllabus103.pdf>;
- Auburn University <http://www.auburn.edu/~wallski/CTM650/CTM650syllabus.html>;
- Radford University <http://www.runet.edu/~rscohen/Music127/syllabus.htm>;
- McMurray <http://cs1.mcm.edu/~dshea/comped.html>;
- Case Western Reserve University <http://www-midischool.cwru.edu/MUSC308/syllabus.html>;
- Dordt College (IA) <http://homepages.dordt.edu/~hduitman/musicstudent/musictechnology.html>;
- Alma College <http://www.alma.edu/academics/music/mus215/syllabus.htm>;
- Youngstown State University <http://www.fpa.yzu.edu/music/crist/came.pdf>;
- Georgia State University <http://www.trombonelessons.com/syllabus.html>;
- East Carolina State <http://www.music.ecu.edu/courses/6300/6300syllabus.html>;
- University of North Carolina, Greensboro <http://www.uncg.edu/~vltrolli/courses.html>;
- Elmhurst College (IL) <http://www.elmhurst.edu/~markh/musicedtech/>;
- Central Michigan State [http://blackboard.cmich.edu:80/bin/common/course.pl?course\\_id=39\\_1&frame=](http://blackboard.cmich.edu:80/bin/common/course.pl?course_id=39_1&frame=;);
- University of Delaware <http://amy.music.udel.edu/faculty/mmorgan/index.html>;
- Berklee School of Music <http://classes.berklee.edu/mbierylo/mtec111.html>;
- Florida State University <http://otto.cmr.fsu.edu/%7Eemus2360/Schedules/Syllabus.html>;
- James Madison University <http://www.lib.jmu.edu/users/cockbuba/mus150/>;
- Peabody <http://mambo.peabody.jhu.edu/%7Eemdboom/itc/>;
- University of Montevallo <http://www.cfa.montevallo.edu/mtech/Su2000/mu676/syllabus.htm>;
- SUNY at Stony Brook <http://www.sinc.sunysb.edu/Class/Ita208/syllabus.html>;
- University of California at Irvine [http://www.arts.uci.edu/music/mzed/Music\\_51/M51\\_syllabus.html](http://www.arts.uci.edu/music/mzed/Music_51/M51_syllabus.html);
- University of Central Florida <http://pegasus.cc.ucf.edu/~jgardner/m&t.html>;
- University of Michigan <http://www-personal.umich.edu/~msimoni/Sp98PAT201.html>;
- Alma College <http://academics.alma.edu/music/mus214/syllabus.html>;
- Penn State University Music [http://www.courses.psu.edu/courseweb/courses/index.cgi?course=music497d\\_meb26](http://www.courses.psu.edu/courseweb/courses/index.cgi?course=music497d_meb26;);
- University of Hawaii at Manoa <http://www.outreach.hawaii.edu/programs/2001/EVENT-L04269.htm>;
- Dakota State University [http://www.homepages.dsu.edu/mortensd/MUS\\_600/MUS600syl.htm](http://www.homepages.dsu.edu/mortensd/MUS_600/MUS600syl.htm);
- St. Cloud State <http://www.stcloudstate.edu/~slmiller/101syllabus.htm>;
- St. Olaf College <http://www.stolaf.edu/people/hamlin/elmus/em99/syllabus.htm>;
- Univ. of Texas San Antonio <http://multimedia.utsa.edu/index-mp.html>;
- New York University <http://www.nyu.edu/classes/gilbert/cai/> ;
- University of Michigan <http://www-personal.umich.edu/~msimoni/F97PAT441.html>;
- UC Berkeley <http://media2.bmrc.berkeley.edu/classes/m198/>;
- Northwestern <http://www.northwestern.edu/musicschool/classes/webAuthoring/>;
- University of Utah <http://www.finearts.utah.edu/artstech/FA3000/index.html>;
- Loyola New Orleans <http://music.loyno.edu/cd/mugnm450.pdf>;
- University of Houston <http://www.uh.edu/~tkoozin/techseminar.html>;

*compozitorul Dwight WINENGER înfiinteaza în U.S.A renumita "LIVING MUSIC FOUNDATION" (http://www.e-universe.com/lmfhome/) - unul dintre cele mai importante centre internaționale de promovare a muzicii noi (inclusiv în genul "Computer Music"), ce este coordonat actualmente de către compozitorul și profesorul Charles Norman MASON; dintre membrii L.M.F. menționăm pe Liana ALEXANDRA, Charles ARGERSINGER, Christy BANKS, Rusty BANKS, Heskell BRISMAN, Madeline BYRNE, Barry L. COHEN, Dinos CONSTANTINIDES, George CRUMB, Greg D'ALESSIO, David DEL TREDICI, Aurelio DE LA VEGA, Carlos DELGADO, Emma Lou DIEMER, Violeta DINESCU, Donna Kelly EASTMAN, Grant FLETCHER, Lukas FOSS, Orlando GARCIA, David McGUIRE, Dorothy HINDMAN, Craig HULTGREN, Ladislav*



KUBIK, Dennis KAM, Hye Kyung LEE, David LIPTAK, Tom LOPEZ, Serban NICHIFOR, Rodney OAKES, Pauline OLIVEROS, Aaron J. RABUSHKA, Bruce REIPRICH, Wieslaw RENTOWSKI, Andrew RINDLFLEISCH, Elliott SCHWARTZ, Nicolas SLONIMSKY, Gregg SMITH, Erich H. STEM, Augusta READ THOMAS, Catherine TOWBIN, Mary Jeanne VAN APPLIEDORN, David VAYO, Rob VOISEY, Olly WILSON, Paul WITNEY, Scott WYATT; in anul 1984 se infiinteazanu mai putin celebra SOCIETATEA DE MUZICA ELECTRO-ACUSTICA DIN STATELE UNITE/THE SOCIETY FOR ELECTRO-ACOUSTIC MUSIC IN THE UNITED STATES-SEAMUS (<http://seamus.Isu.edu>), avand ca presedinte fondator pe compozitorul Barry SCHRADER, profesor la California Institute of the Arts; sunt dezvoltate noi programe speciale de redactare a partiturilor (CAKEWALK, ENCORE, FINALE, NOTE WORTHY, MUSIC WRITE, MUSIC PUBLISHER si INTELLISCORE – printre altele - in S.U.A.; MOZART si SIBELIUS in Anglia; PIZZICATO in Belgia), precum si numeroase programe de editare muzicala, in baza sistemelor de operare WINDOWS (ca de pilda bogata serie a aplicatiilor elaborate de firmele americane SONIC FOUNDRY, REAL, DIGIDESIGN si ADOBE, precum si de firma germana MUSICMATCH) si APPLE (in aceasta directie recentul program american “MetaSynth” ilustrand noi modalitati de convertire a imaginii in sunet); in Noiembrie 2003 se desfasoara in Romania primul festival de COMPUTER MUSIC, coordonat de compozitorii Liana ALEXANDRA si Serban NICHIFOR in cadrul Universitatii Nationale de Muzica din Bucuresti, sub genericul “NUOVA MUSICA CONSONANTE-LIVING MUSIC FOUNDATION” – fiind prezentate lucrari apartinand unor compozitori din U.S.A. (Ben BIERMAN, George BRUNNER, Madelyne BYRNE, Chris CHAFE, Douglas COHEN, Bob FANELLI, Matthew HAY, John J.A. JANNONE, Peter KIRN, Tom LOPEZ, Miguel MACIAS, Charles Norman MASON, David McGUIRE, Rodney OAKES, Marco OPPEDISANO, Udi PLADOTT, Mark PRIEST, Patricia REPAR, Barry SCHRADER, Martin SIMON, Dirk Johan STROMBERG, Robert VOISEY, Dwight WINENGER, Amnon WOLMAN), Belgia (Kris DE BAEDERMACKER, Joris DE LAET, Raoul DE SMET, Todor TODOROFF, Dick VEVLEMANS, Wilfried WESTERLINCK), Anglia (David WEBBER), Italia (Gianluca CANGEMI) si Romania (Liana ALEXANDRA, Octavian NEMESCU, Serban NICHIFOR, Livia TEODORESCU, Sever TIPEI, Dan VOICULESCU); apare pe Internet primul curs interactiv in domeniul “MUSIC AND COMPUTERS”, conceput la Dartmouth College (U.S.A.) – sub coordonarea compozitorului si profesorului Jon APPLETON – de catre Phil BURK, Larry POLANSKY, Douglas REPETTO, Mary ROBERTS si Dan ROCKMORE (<http://eamusic.dartmouth.edu/~book/MATCpages/tableofcontents.html>); Prof. Diana S. DABBY (de la Massachusetts Institute of Technology) aplica in 1994, cu ajutorul computerului, o serie de coordonate ale “Lorenz Attractor” la Preludiul I (in Do Major) din Caietul I al “Clavecinului Bine Temperat” de J.S. BACH, pentru a compune “Bach to Chaos: Chaotic Variations on a Classical Theme”; Facultatea de Interpretare Muzicala din cadrul Universitatii Nationale de Muzica din Bucuresti initiaza, in anul universitar 2003-2004, primul curs de Computer Music din Romania;

- 5.) Calculatoarele electronice din generatia a V-a se bazeaza pe dezvoltarea -incepand din 1981, in S.U.A. si in Japonia - a inteligentei artificiale dupa modelul uman (interfata vocala, sensibilitate vizuala, auditiva, tactila) - ele fiind inca in faza experimentală. O alta dimensiune este determinata de perspectivele fascinante ale INTERNET-ului. In prezent, redutabilul compozitor si profesor Chris CHAFE – director al Stanford-CCRMA – a initiat impresionantul experiment SoundWIRE, utilizand o serie de aplicatii originale ale sistemului LINUX in realizarea pe INTERNET a unor legaturi audio complexe (permitand, de pilda, interpretilor sa cante impreuna in timp real, de la mari distante, in conditii acustice ideale – realizandu-se astfel un proces de audio-teleportare !). In acest context, aplicandu-se standardul ping (ca metoda de testare a conectivitatii computerelor, ce consta in masurarea RTT=round trip time), s-a observat ca reseaua (respectiv, INTERNET-ul) reactioneaza la fluxul (traficul) variabil de mesaje ca o coarda muzicala (avand lungimea direct proportionala cu distanta dintre cele doua computere conectate) – aceasta coarda virtuala producand (la excitarea ei prin mijloace specifice tehnicii SoundWIRE) diferite sunete (waves) in functie de “modul de atac” prin ping-uri in real-time. Inaltimea (deci frecventa=f) acestor sunete este invers proportionala cu RTT-ul ping-ului:

$$f = 1/sR', \text{ unde } s = \{1 : R < 5\text{ms} \quad k : R > 5\text{ms}\} \quad k = 0,025.$$

(cf. Chris CHAFE and Randal LEISTIKOW – Levels of Temporal Resolution in Sonification of Network Performance, CCRMA, Music Department, Stanford University, Stanford, CA USA

94305, cc@ccrma.stanford.edu randal@ccrma.stanford.edu )

Reteaua (INTERNET-ul) devine astfel si un autentic instrument muzical ce executa o partitura conceputa prin conectarea specifica a doua computere aflate la o distanta cat mai mare (pentru a se sintetiza o coarda virtuala cat mai ampla ca spectru armonic) – compozitia rezultata fiind difuzata public in timp real. Totodata, tehnica *SoundWIRE* reprezinta si o confirmare a viabilitatii perceptiei holistice quasi-acustice a Universului – demonstrand o data in plus caracterul cosmogonic al Vibratiei Transcendentale.

- Capitolul B -  
ELABORAREA AUDIO-NUMERICA

1.) PROLEGOMENE

– Ciclul creatiei prin analogie (in perspectiva panenteista si prin reductie fenomenologica):  
DUMNEZEU (« LOGOSUL CREATOR », « MARELE ARHITECT AL UNIVERSULUI ») > Continuumul realitatii informational-energetice (« *Panarmonios Kosmou Sintaxis* », « *Musica Caelestis* » - cf. *Appendix 2*) > Creatia Muzicala (componistica si interpretativa) > Creatia Instrumentala > Creatia Electro-Acustica > Computer Music.

– Definirea Informatiei : a.) ontologic (sub aspect existential) = componenta a traidei « informatie-energie-materie » ( ca principiu universal) ; b.) cibernetic (matematic, prin analogie formală) = cantitatea de noutate (dependenta si de gradul de interes al receptorului) ; epistemologic (prin cunoastere stiintifica) = componenta a dihotomiei « realitate-informatie » (realitatea manifestandu-se prin informatie in procesul delimitarii « adevar/eroare ») ; semiotic (sub aspectul logicii simbolice) = un ansamblu logic de semne (sau « semnificanti ») purtatoare de sensuri (sau « semnificati »), in contextul comunicarii.

– Comunicarea Muzicala : DUMNEZEU – CREATORUL >[comunicarea unui Sens Mistic, soteriologic –exprimat prin Semn Divin]> Compozitor >[a.) decodificarea quasi-hermeneutica a Semnului Divin prin descoperirea « irationala » (pnevmatologica) a Sensului Mistic (« *mysterium tremendum* »); 2.) codificarea Sensului Mistic in semn grafic muzical (partitura), prin procesul de « creatie componistica »; 3.) comunicarea partituri (in manuscris sau prin intermediul editorului)]> Interpret [a.) decodificarea partituri (rationala la nivel formal, intuitiva/« irationala » la nivel conceptual) si decelarea Sensului Mistic-muzical; b.) codificarea Sensului Mistic-muzical in semn acustic (sunet), prin procesul de « creatie interpretativa » ; c.) comunicarea interpretarii (prin concert sau inregistrare)] > Public [a.) decodificarea individuala (in functie de cultura muzicala, dar si de intuitie) a semnului acustic in Sens Mistic ; b.) asimilarea personala dar si in comuniune (« ab alio in alis ») a Sensului Mistic al muzicii in procesul soteriologic al perfectionarii spirituale, conform Planului Divin].

– Dimensiuni sonore : 1.) fizice (obiective) : spatiul sonor [frecventa (audibilă la om : 16 20000Hz) x amplitudine (perceptibila/suportabila la om : de la 10 la puterea –16 W/cm<sup>2</sup> pana la 12 W/cm<sup>2</sup>) x structura spectrala (« naturala » si « artificiala » - acustica/electroacustica) x locatie (inchisa/deschisa)] x timpul fizic-infinit (‘, ’, h, d, m, y, etc.) ; 2.) muzicale (subiective) : spatiul muzical [inaltime (netemperata - in sistemele extraeuropene si in cele europene de sorginte pitagoreica ; temperata in sistemul european occidental, incepand din sec.al XVIII-lea) x intensitate (relativa : ppppp-fffff, valorile depinzand de sursa, stil, acustica topos-ului, etc.) x timbru (vocal, instrumental-acustic/electroacustic, mixt) x topos (amplasamentul sursei : scenic/extra-scenic, mono-/stereo-/quodronic/panoramic/multi-dimensional)] x timpul



specifici. De pilda, aplicand principiul de codificare “mu-law” (conform caruia auzul uman este mult mai sensibil la schimbarile joase de amplitudine decat la cele inalte), formatul MP3 reduce spatiul ocupat de fluxul sonor “citindu-l” printr-o grila cu numai 256 de elemente.

### – 3.) TIPURI DE FISIERE DIGITALE AUDIO

ACID Project Files (acd, acd-bak), ACID Projekt With Embedded Media (acd-zip), Ad Lib Sample (smp), Amigo SVX (svx, iff), Audacity projects (aup), Audition Loop (cel), CAKEWALK Files (wrk, bun), CD Audio (cda), Covox V8 (v8), Creative Labs VOC (voc), Dialogic VOX ADPCM (vox), Gravis Patch (pat), ENCORE File (enc), FINALE Coda Notation File (mus), FINALE ENIGMA Transportable File (etf), FINALE Coda Template File (ftm), InterVoice (ivc), IRCAM Files (snd), Main Concept MPEG 1 (mpg, mpeg, m1a), Main Concept MPEG 2 (mpg, mpeg, m2a), Macintosh Audio Interchange File Format/AIFF (aif, snd), Macintosh Resource (snd), Macromedia Flash (swf), MIDI SDS (sds), MIDI Files – Format 1 [all instruments saved to separate tracks] si Format 2 [all instruments saved into a single track] (mid, smf, rmi), MidiScan File (mnd), MOZART File (mz), MP3 Audio (mp3), Mp3PRO FhG (mp3), OggVorbis (ogg), Music Write 2000 File (mwk), NeXT/Sun (Java) File (au, snd), NoteWorthy Composer (nwc), PIZZICATO File (piz), QuickScore File (qsd), Quick Time (mov, qt, dv, gif), Raw File (raw), RealMedia (rm, ra), RealNetwork G2 (rm), RHAPSODY File (rhp), Sample Vision (smp), SmartScore File (fin), SCORE File (pge, pag, mus), SIBELIUS File (sib), SIBELIUS Scorch Web Page (htm), Sonic Foundry (sfr), Sound Designer 1 (dig, sd), Sounder/Sound Tool (snd), Video for Windows (avi), Tune Smithy Fractal Tunes (ts), TwinVQ ver 2.0 format (vqf), Windows Media Audio (wma), Windows Media Format (asf), NIFF (Notation Interchange File Format - format standard pentru notatia muzicala).

### – 4.) PRINCIPALELE FISIERE DIGITALE AUDIO UTILIZATE IN ACEST CURS:

- MIDI [Musical Instrument Digital Interface] (mid) a aparut in 1983 (lansarea sa a avut loc la Los Angeles – The First North American Manufacturers Show) si cuprinde: (1) Protocolul de comunicatii (limbajul codificat in forma binara), (2) Conectorul (interfata hardware – ce este de tipul „5 pins DIN MIDI“) si (3) Formatorul de distributie „Standard MIDI Files“ ( SMF sau „mid“), ce contine „Status Byte“ (format din „Note On“, „Note Off“, „System Exclusive“, „SysEx“ si „Path Change“) configurat in „Chains“ si „Loops“ distribuite pe cele 16 canale – „MIDI Channels 0-15“ – fie in forma mixata intr-un singur traiekt („MIDI O“), fie in cea spatializata pe 16 voci separate („MIDI I“). Fisierul este foarte redus, iar celelalte coordonate (dinamica, timbrul, panoramarea) sunt mobile, putand fi precizate de catre utilizator – aceste aspecte constituind principalele diferente in raport cu celelalte tipuri de fisier audio (wav, mp3, aiff, rm, etc.), ce sunt cu mult mai voluminoase (deci mai greu de transmis prin Internet) si au toti parametrii inamovibili. Formatul MIDI are numeroase aplicatii: instrumente muzicale electronice, sintetizoare digitale, sequencers, programe de redactare muzicala („MIDI Notation Software“ – ca de pilda „MOZART“, „FINALE“, „CAKEWALK“, „SIBELIUS“, etc.), „MIDI Show Control“ (in spectacole), „MIDI Machine Control“ (in studiourile de inregistrari) – toate putand fi interconectate prin noile protocoale „GENERAL MIDI 1“ (GM1 din 1991) si „GENERAL MIDI 2“ (GM2 din 1999) stabilite de catre „MIDI Manufacturers Association Incorporated“ din Los Angeles.
- WAVE (wav) – formatul standard audio-digital necomprimat CD-DA [aplicat in realizarea CD-urilor – format CD-Audio (cda)], ce a fost asimilat in sistemele de operare MICROSOFT WINDOWS. Este formatul cel mai voluminos (1 minut = 10 MB – contraindicat asadar in transmisiile prin Internet), dar si cel mai fidel sub aspect acustic – fiind singurul format utilizat in procesul de editare a CD-urilor. In sistemul Macintosh, formatul standard necompresat (deci echivalentul formatului “Wave” din Windows) este “AIFF” (Audio Interchange File Format).
- MP3 [MPEG I – layer 3 Audio Codec] (mp3, mpeg, mpg) este unul dintre cele mai eficiente si mai populare fisier de compresie audio - “compresia Hoffman” utilizata implicand analiza muzicii prin grila pragurilor de audibilitate umana (2 Hz – 20 KHz) si eliminarea elementelor inaudibile. Marimea fisierului este determinata de numarul de kilobiti per secunda (8, 16, 18, 20, 24, 32, 40, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256,

320 kbps – configuratia optima - in raportul fidelitate/dimensiune - fiind cea de 128 kbps). Acest tip de fisier este format din milioane de cadre, fiecare cadru continand titlul (de identificare a punctelor de reper), eticheta (cu informatii despre muzica respectiva) si datele propriu-zise (compresate si inregistrate sub forma de biti).

O alternativa free la MP3 este reprezentata de formatul “Ogg Vorbis” (marcat prin sufixul “ogg”).

#### - 5.) PROGRAME DE CONVERTIRE UTILIZATE IN ACEST CURS:

- MIDI-WAV (Midi2Wav Demo - [www.midi2wav.com](http://www.midi2wav.com) );
- WAV-MIDI (IntelliScore Poliphonic Demo – [www.intelliscore.net](http://www.intelliscore.net); AmazingMIDI Demo - [www.pluto.dti.ne.jp/~araki/amazingmidi/](http://www.pluto.dti.ne.jp/~araki/amazingmidi/));
- WAV-MP3-WMA (Shuffler Music Converter – [www.illustrate.org](http://www.illustrate.org) ; MusicMatch Jukebox Demo - <http://mmjb.musicmatch.com> ; Sound Forge 4.5 Demo - [www.sonicfoundry.com](http://www.sonicfoundry.com) ; ACID Pro 4.0 Demo - <http://sonicfoundry.com/acid> ; Adobe Audition 1.0 Demo - [www.adobe.com/audition](http://www.adobe.com/audition) );
- WAV-AIFF si WAV-OggVorbis-WAV (Audacity 1.2.0.-pre2 Free Digital Audio Editor – [www.sourceforge.net](http://www.sourceforge.net) )

1 minut de muzica stereo = 10 MB WAV = 10 MB AIF = 973 KB OGG = 950 KB WMA (128 kbps) = 937 KB MP3 (128 kbps) = 253 KB AUD (Audacity Projects) = 122 KB RM (16 kbps).

1’ WAV = 1’ AIF = 10,27’ OGG = 10,53’ WMA (128 kbps) = 10,67’ MP3 (128 kbps) = 39,53’ AUD = 82’ RM (16 kbps) = 1100,1’ MIDI (format 0) = 10 MB.

#### - 6.) PROGRAME MUZICALE

NB - Prezentul compendium are un caracter strict didactic. Programele de calculator analizate fac obiectul dispozitiilor legale (interne si internationale) in materie de copyright – utilizarea lor impunand respectarea conditiilor specificate de producatori pe site-urile indicate la fiecare software.

##### - a.) Programe de redactat partituri (Music Notation Programs):

ABC, Braeburn Software products (Noteworthy 2, Music Publisher, Music Publisher 32), Brahms (Koobase), Cakewalk family, Capella, CodaMusic products (Finale, Finale Allegro, PrintMusic), CSound, CuBase, Graphire, Music Press , GVOX products (Encore, MusicTime Deluxe), Igor , LilyPond , Lime , Melody Assistant , MidiScore , Mosaic , Mozart , MTX , MUP , Muse , Musicator , MusicEase , MusicWrite , MusiXTeX , NIFF , Nightingale , Noteworthy Composer , Object Composer , Opcode products (Fermata, Studio Vision Pro 4.5.1, Vision DSP 4.5.1 – pentru Macintosh -, la [www.opcode.com](http://www.opcode.com)) , OpusTeX , Personal Composer , PMX , Rosegarden , Sibelius, Sionsoft (QuickScore Elite 9.0, Copyst 6.0).

(cf. <http://www.mulveyfamily.com/Katy/Music/Notation/contents.html>)

Site-urile principalelor programe: Mozart ([www.mozart.co.uk](http://www.mozart.co.uk)), Finale ([www.codamusic.com](http://www.codamusic.com)), Sibelius ([www.sibelius.com](http://www.sibelius.com)), Score ([www.scoremus.com](http://www.scoremus.com) , <http://ace.acadiau.ca/score> si adresa autorului Prof. Leland SMITH [lcs@ccrma.stanford.edu](mailto:lcs@ccrma.stanford.edu)), Encore ([www.gvox.com](http://www.gvox.com)), Pizzicato ([www.arpagemusic.com](http://www.arpagemusic.com)), Sion QuickScore Elite([www.sionsoft.com](http://www.sionsoft.com)), Nightingale Music Notation Software for Macintosh Entrance ([www.ngale.com](http://www.ngale.com)), MusEdit Powerful Notation Software ([www.musedit.com](http://www.musedit.com)) , Music Publisher ([www.braeburn.co.uk](http://www.braeburn.co.uk)), NoteWorthy ([www.braeburn.demon.co.uk](http://www.braeburn.demon.co.uk)), MusicWrite Professional ([www.voyetra-turtle-beach.com](http://www.voyetra-turtle-beach.com)), NoteWorthy Composer ([www.noteworthysoftware.com](http://www.noteworthysoftware.com)) , Opcode ([www.opcode.com](http://www.opcode.com)), Sionsoft ([www.sionsoft.com](http://www.sionsoft.com)) , OpusTeX (<ftp://ftp.tex.ac.uk/incoming/opustex/arwork>), Csound, Rosegarden si SNDAN ([www.csound.com](http://www.csound.com)), NIFF (Notation Interchange File Format) Notation File Standard ([www.musitek.com/niff.html](http://www.musitek.com/niff.html)), Lime Notation Software ([www.cerlsoundgroup.org](http://www.cerlsoundgroup.org) )

##### - b.) Programe audio de fonotecare (Music Editors):

AudioEdit Deluxed , Digitonix Element, DubIt , FruityLoops , Midi Quartet , Midi Works, Mobius, Music Publisher 32, QUARTET X2 Music Studio, Song Writer, TablEdit Tablature  
[free-scores.com](http://free-scores.com)

Editor, XG-Gold, Blaze Media Pro, ezMP3edit, MP3 Audio Mixer, MP3 File Editor, Advanced MP3 Cutter, AAA Wave, Ace of WAV 2.6, Acoustic Labs Mixer 2.5, Adobe Audition, All Editor 2.2, Anvil Studio 2003, Audio Edit 3.4, AudioEdit Deluxe, AVI Splitter, AVS Audio Utilities, Blaze Audio RipEditBurn, Blaze Media Pro, BlazeAudio Wave Creator, BPS Audio Converter Pro, Cakewalk, Claudio Complete luxury audio recorder with MP3, Cool Edit 2000 1.1, Cool Edit Pro 2.0, DART XP, Digidesign, GoldWave, MagicScore, n-Track Studio, Wave Splitter, Midi Tracker, Sound Forge, Native Instruments, Propellerhead, Steinberg, etc.  
(cf. <http://www.freefunfiles.com>)

Site-urile principalelor programe: Sound Forge ([www.sonicfoundry.com](http://www.sonicfoundry.com)), Pro Tools ([www.digidesign.com](http://www.digidesign.com)), Audacity (<http://audacity.sourceforge.net>), MusicMatch Jukebox (<http://www.musicmatch.com>), Real ([www.real.com](http://www.real.com)), Cakewalk ([www.cakewalk.com](http://www.cakewalk.com)), Voyetra Digital Orchestrator Pro ([www.voyetra.com](http://www.voyetra.com)), Adobe Audition ([www.adobe.com](http://www.adobe.com)), Magix ([www.magix.com](http://www.magix.com)).

Alte site-uri cu programe muzicale : [www.rocketdownload.com](http://www.rocketdownload.com), [www.zdnet.com](http://www.zdnet.com), [www.hitsquad.com](http://www.hitsquad.com), [www.sonicspot.com](http://www.sonicspot.com), [www.asp-shareware.org](http://www.asp-shareware.org), [www.square1music.com](http://www.square1music.com), <http://garbo.uwasa.fi>, [www.freefunfiles.com](http://www.freefunfiles.com), [www.simplythebest.net/shareware/music](http://www.simplythebest.net/shareware/music).

### PROGRAME AUDIO IN SISTEMUL DE OPERARE LINUX

(Audio software for LINUX)

Majoritatea sunt prezentate pe site-ul <http://linux-sound.org/>, cele mai utilizate fiind :

- **Ardour** (free software multi-channel – <http://ardour.sourceforge.net/>);
- **FinalScratch** (generator de sunete ce ruleaza atat pe Linux cat si pe MacOS X – [www.finalscratch.com/fs4/](http://www.finalscratch.com/fs4/));
- **MusE** (sequencer MIDI/Audio pe Red Hat, ce proceseaza date MIDI controland device-urile de sunet - realizat la Center for Computer Research in Music and Acoustics (CCRMA) - Department of Music, Stanford University (USA) - [www.ccrma.stanford.edu/planetccrma/software/](http://www.ccrma.stanford.edu/planetccrma/software/));
- **Rosegarden 4** (editor de partituri, de tip KDE3 – bazat pe bibliotecile « kdelibs3 » - [www.all-day-breakfast.com/rosegarden/](http://www.all-day-breakfast.com/rosegarden/));
- **Sweep** (editor de sunet - inclus in distributia « SuSE 8.2 » - utilizat pentru post-procesarea inregistrarilor digitale prin lectorul virtual « Scrubby » - [www.metadecks.org/software/sweep](http://www.metadecks.org/software/sweep));
- **NoteEdit** (editor de partituri si sintetizor de instrumente muzicale virtuale – inclus in distributia « SuSE » - <http://rnvs.informatik.tu-chemnitz.de/~jan/noteedit/noteedit.html>);
- **FluidSynth** (sintetizor software bazat pe samples/ « wavetable synthesis » - [www.fluidsynth.org](http://www.fluidsynth.org));
- **AlsaModularSynth** [sintetizorul software ALSA (« Advanced Linux Sound Architecture ») utilizeaza module pre-definite, precum MCV (« MIDI Controlled Voltage Supply » - ce converteste timbrele MIDI in valori de tensiune), VCO (« Voltage Controlled Oscillator » - generator de sunete determinate de valorile de tensiune), PMC (« Pulse Code Modulation » - converter analog/digital si digital/analog, ca interfata pentru difuzoare) si VCA (« Voltage Controlled Amplifier » - amplificator bazat pe valorile de tensiune) - <http://alsamodular.sourceforge.net/>];
- **NB** – revista « *LINUX MAGAZIN* » ([www.linux-magazin.ro](http://www.linux-magazin.ro)) Nr.4/Decembrie 2003 (pag.21-35) include o prezentare amanuntita a acestor noi programe audio.

### PROGRAME AUDIO IN SISTEMUL DE OPERARE MACINTOSH

(Apple MacIntosh – Mac OS Audio Software)

Numeroase programe specifice pot fi procurate pe Internet, ca de pilda pe site-ul [www.hitsquad.com/smm/mac](http://www.hitsquad.com/smm/mac), atat in categoria « *Music Notation* » (Cubase Score 5; Lime Music Notation Software 8.08; NoteAbility Pro v.1.996; ScoreWriter 2; Sibelius 3.1; Finale 2003; Vivaldi Gold Mac; Sonata 4.0, etc.), cat si in categoria « *Audio Editors* » [Ableton Live 3.0.2 (real-time audio production); Amadeus II 3.6.1 (direct-to-disk sound editor and analyser with MP3 support); Audacity 1.1.1 for Mac (free cross-platform multi-track sound editor); Sound Sculptor II (multi-track sound editor), Peak (<http://eamusic.darmouth.edu/masters.courses/Music24/software.htm>), etc.].

**PROGRAMME AUDIO IN SISTEMUL DE OPERARE WINDOWS****(Windows Audio Software)****NB- Sunt prezentate doar programe disponibile in versiunile „Free“ si „Demo“****- a.) PROGRAME MIDI DE REDACTARE MUZICALA****„MOZART VIRTUOSO 6“ THE MUSIC PROCESSOR BY DAVID WEBBER****© David WEBBER 1994-2004****<http://www.mozart.co.uk>****[dave@mozart.co.uk](mailto:dave@mozart.co.uk)****484 Warrington Rd., Culcheth, Warrington, WA3 5RA, UK****FUNCTIILE PROGRAMULUI „MOZART 6“****I. GENERALE**

- **File:** *New* (+ *Template: None, Alto Sax Jazz Quartet, Brass Band, Brass, Quintet, Clarinet and Piano, Clarinet Choir, Clarinet Jazz Quartet, Clarinet Quartet, Crumhorn Quartet, default Part., Fake Book, Flute and Piano, Flute Jazz Quartet, Guitar, Jazz Band 1, Jazz Band 2, Oboe and Piano, Orchestra [2 Fl., 2 Ob., 1 C:I., 2 Cl., 1 Cl.B., 2 Fg., 4 Hr., 3 Trbe, 3 Trbn., Tuba, Timp., 2 Perc., Archi = 29 staves], Piano solo, Recorder Consort, Recorder Quartet, Sax Quartet, Solo bass clef, Solo treble cleff, Song Sheeet, Soprano Sax Jazz Quartet, String Quartet, Tenor Sax Jazz Quartet, Trombone and Piano, Trumpet and Piano, Trumpet Jazz Quartet, Viola and Piano, Violin and Piano, Voice and Piano, Wind Band, Wind Octet, Wind Quintet*), *Open*, *Import* (Open clipboard, Play in new piece, Re-import played-in piece, Import MIDI), *Print Setup*, *Stop playing*, *Exit*.

- **View:** *Tool bars, Keyboard shortcuts, Colour scheme, Global preferences: Metronome, Chord symbols, Autosave, Settings, Music, Playback, MIDI echo, MIDI port*.

- **Help:** Mozart help topics, Search for help, Lesing help, Command list, Editing commands, Getting started, Tip of day, Optaining support, About Mozart.

**II.) SPECIALE**

- **File:** *New, Open, Close, Save, Save as, Import* (Open clipboard, Play in new piece, Re-import played-in piece, Import MIDI), *Export* (Save MIDI, Save MIDI as, Save Template), *Duplicate, Print, Print preview, Print setup, Play* (Play & track, Play, Play & track forward, Play forward), *Send, Exit*.

- **Edit:** *Undo, Redo, Cut Copy, Paste, Copy image, Copy print image, Insert bars, Delate bars, Cut bars, Insert beat, Delate beat, Select all staves, Select whole piece, Go to bar*.

- **View:** *Music font, Zoom in, Zoom out, Tool bars, Keyboard shorcuts, Visible music items, Colour scheme, Global preferences, MIDI options, Swing, MIDI in connection, MIDI out connection, Tune properties, Refresh*.

- **Item:** *Note* (Enter note, Enter rest, Sharpen, Flatten, Accidental, Enharmonic, Enharmonic default, Dot, Double dot, Octave up, Octave down, Pitch, Convert to note, Convert to rest), *Partition* (Merge notes, Split note (#), Split note (^), Split note (\), Multiplet, Triplet, Soublet, Remove multiplet), *Tails* (Joint, Invert, Default direction, Flip note head), *Accents* (Accent, Attack, Staccato, Tenuto, Open, Closed, Pause, Accent below, Attack below, Staccato stem, Tenuto stem, Pause below), *Ornaments* (Trill, Mordent, Inverted Mordent, Turn, Inverted Turn, Appoggiatura, Grace note, Reiteration-0,1 /, 2 //, 3 ///), *Phrasing* (Phrase mark, Phrase mark below, Tie, Tie..., Invert Tie), *Bar lines* (Bar line, Repeat, Final bar line, Line break, Music break, Number, Rehearsal mark, First time. Second time), *Dynamics* (fz, fff, ff, f, mf, mp, p pp ppp, cresc., dim., swell, fade), *Symbol* (Chord symbol, Chord repeat, Text, Down bow, Up bow, Pedal, Pedal off, Break, Tempo), *Control* (Mute, Unmute), *Properties* (Offset, Hide/Show, Properties), *Spacing* (Insert, Compress end).

- **Bar:** *Joint Tails, Invert Tails, Default Tails direction, Accidents, Enharmonic default, Octave up, Octave down, Compress bar, Whole bar repeat (./), Whole bar rest, n bar rest, Pad with rests*.

- **Score:** *Transpose piece, Key, Time signature, Tempo, Stave, Clef, Instrument, Concert octave (up, down), Combine strands, Separate strands, Score layout, Lyric lines (Add lyric line, Remove lyric line, Move lyric line up, Move lyric line down), Style options (Chord symbols, Clefs), Written pitch*.

- **Layout:** *Titles, Page format, Music font, Bar numbering, Print empty stave, Justify*.

- **Window:** *New window, Cascade, Title, Arrange items, Close all, Next window, Previous window, n Mozart n.*
- **Help:** *Mozart help topics, Search for help, Lesing help, Command list, Editing commands, Getting started, Tip of day, Obtaining support, About Mozart.*

### OPERATII CURENTE

#### 1.) O noua lucrare: \_

*File-New- precizand Template/Formatul de solist sau ansamblu pre-existent, Key/Tonalitate, Time/Masura, Tempo -OK; apoi:*

*Layout Titles (precizand Title/Titlu, Composer/Compozitor, Reference/Denumirea si/sau caracterul Tempo-ului);*

- sau:

*File-New- precizand Template <None>, Staves (Portative) "n" (de la 1 la 64)-OK; apoi*

*Score-Clef/Cheie, Instrument, Score layout (precizand Score si Style), eventual Lyric lines; apoi:*

*Layout Titles (precizand Title/Titlu, Composer/Compozitor, Reference/Denumirea si/sau caracterul Tempo-ului);*

#### 2.) O lucrare pre-existenta:

**File-Open;** sau **File-Import MIDI.**

#### 3.) Redactarea textului muzical:

Scrierea efectiva a notelor implica urmatoarele trei operatii: **precizarea duratei** (longa = 0, nota intraga = 1, doimea = 2, patimea = 3, optimea = 4, saispzeciimea = 5, etc.), **precizarea inaltimei** cu butonul stang al mouse-ului (sau cu tastele de orientare sus/jos/stanga/dreapta, sau cu claviatura virtuala ce apare in imaginea programului) si **fixarea notei** prin apasarea tastei de spatiu a keyboard-ului. Pentru **stergerea rapida** a unei note se utilizeaza tastele de orientare si apoi tasta Delete, iar pentru stergerea mai multor note, acestea se selecteaza cu mouse-ul, dupa care se apasa aceeasi tasta Delete. Pentru anularea unei/unor masuri se utilizeaza comanda Edit-Delete bars, iar pentru adaugarea unei/unor masuri - comanda Edit-Insert bars.

#### 4. Alte operatii frecvente:

ItemPartitionMultiplet (pentru formule ritmice exceptionale), ItemTails (pentru orientarea "cozilor"), ItemAccents (pentru accente), ItemOrnaments (pentru ornamente), ItemPhrasing (pentru indicarea legaturilor de frazare), ItemBarline (pentru barele de masura, de repetitie, precum si pentru bara finala), ItemDynamics (pentru nuante), ItemSymbolText (pentru textele integrate in partitura, ca de pilda indicatiile de expresie), ScoreTranspose (pentru transpunerea lucrarii). Schimbarile de tonalitate, masura, tempo si chei se realizeaza cu comenzile din Score: Key, Time signature, Tempo si, respectiv, Clef. Transpunerile la octava superioara sau la cea inferioara - prin comenzile din Bar: Octave up si Octave down, numerotarea masurilor - prin comanda Layout - Bar numbering, repetarea masurilor ("lenesii") - prin Bar-Whole bar repeat, extragerea stimelor - prin File-Duplicate, iar tiparirea - prin File-Print. Explicatii suplimentare se pot obtine prin activarea functiei Help, sau prin accesarea site-ului [www.mozart.co.uk](http://www.mozart.co.uk)

#### Functiile programului

FINALE 2003

The Art of Music Notation

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Coda Music Technologies

[www.codamusic.com](http://www.codamusic.com)

#### "Keyboard Shortcuts and Special Mouse Clicks" \_

(material extras din "Finale User Manual")

- **File Menu:** New (Ctrl-N), Open (Ctrl-O), Close (Ctrl-W), Save (Ctrl-S), Import (Ctrl-I), Print Score (Ctrl-P), Quit (Alt-F4);

- **Edit Menu:** Undo (Ctrl-Z), Redo (Ctrl-Y), Undo List (Ctrl-shift-Z), Cut (Ctrl-X), Cut-create



Clip file (Press ctrl when choosing Cut),Cut-display Items to Clip dialog box (Press shift when choosing Cut),Cut-create Clip file *and specify* items (Press ctrl-shift when choosing Cut),Copy (Ctrl-C),Copy-create Clip file (Press ctrl when choosing Copy),Copy-display Items to Clip dialog box (Press shift when choosing Copy),Copy-create Clip file *and specify* items (Press ctrl-shift when choosing Copy),Insert-insert from a Clip file (Press ctrl when choosing Insert),Replace Entries Ctrl-V),Replace Entries-paste from a Clip file (Press ctrl when choosing Replace Entries Select All Ctrl-A),Update Layout (Ctrl-U),Update Layout and remove measure groupings (Press shift when choosing Update Layout);

- **View Menu:**Page View (Ctrl-E),Scroll View (Ctrl-E),Home Position (Home key),End Position (End key),Redraw Screen (Ctrl-D),View at 400% (Ctrl-4),View At 200% (Ctrl-2),View At 100% (Ctrl-1),View At 75% (Ctrl-7),View At 50% (Ctrl-5),View At X % (Ctrl-0),View At Last Size (Double-right-click on the score),Define a Staff Set (Press Ctrl when choosing Staff Set-in Scroll View only),Change layers (Alt-Shift-layer number 1-4);

- **General Keyboard Shortcuts:** *OK all open dialog boxes (Ctrl-click the OK button),Cancel all open dialog boxes (Ctrl-click the Cancel button), Redraw Interrupt (Esc),Apply a Metatool (Press a number or letter and click the score),Program a Metatool (Press shift-number or shift-letter),Program a keyboard equivalent for a tool (Press shift-Function key F2-F12),Switch to a tool you've programmed (Press Function key F2-F12),Select Yes or No in dialog boxes (Type N for "no" and Y for "Yes"),Move to top of page/score (Page Up),Move to bottom of page/score (Page Down),Next or Previous Page (Ctl-PageUp or Ctl-PageDown),Change layers (Alt-Shift-layer number);*

- **Articulation Tool:**Display the Articulation Selection dialog box (Click on, above, or below a note or rest that doesn't have an articulation attached, or click on a note whose articulation handles are visible,OR drag-enclose a group of notes),Display articulation handle (Click a note to which an articulation has been attached),Select an ( Click, or shift-click the handle),Move an articulation (Drag the handle -ctrl-drag the handle to move without using dynamic drawing),Delete an articulation (Select the handle and press delete, or right-click the handle and select Delete from the contextual menu. Drag-enclose a group of notes while holding delete to delete articulations on all the notes),Display the Articulation Designer dialog box (Double-click an articulation handle, or right-click the handle and select Edit Articulation Definition from the contextual menu);

- **Chord Tool:**Display positioning arrows (Click the staff - but not on a note or rest),Display the Chord Definition dialog box (Click a note with no chord symbol attached - with Manual Input selected in the Chord Menu -, or double-click a chord symbol handle,or right-click the handle and select Edit Chord Definition from the contextual menu),Display a handle on chord symbols (Click a note with a chord symbol attached or select Show All Chord Handles from the Chord Menu -when Manual Input is selected in the Chord Menu), Delete a chord symbol (Select the handle and press delete, or right-click the handle and select Delete from the contextual menu),Move a chord symbol (With Manual Input selected in the Chord Menu, drag the symbol handle or ctrl-drag the handle to move without using dynamic drawing),Input chord symbols using MIDI keyboard (With MIDI Input selected click a note and play chord on the MIDI keyboard),Analyze chord in one or two staves (With One- or Two-Staff Analysis selected in the Chord Menu, click on a note in the chord);

- **Clef Tool:**Display the Change Clef dialog box (Click a measure without a mid-measure clef), Display handles in mid-measure clefs (Click a measure with a mid-measure clef),Adjust the mid-measure clef position (Drag the handle of the mid-measure clef),Delete a mid-measure clef (Select the handle and press delete, or right-click the handle and select Delete from the contextual menu),Change a mid-measure clef to another clef (Double-click the mid-measure clef's handle and drag left or right, or right-click the handle and select Edit Clef Definition),To insert another mid-measure clef (Double-click in the measure),Display the mid-measure clef dialog box (Ctrl-click a mid-measure clef's handle, or right-click the handle and select Edit Clef Definition from the contextual menu);

- **Expression Tool:**Display the Expression Selection dialog box (Double-click on, above, or below a measure or note that doesn't have an expression attached),Display an expression handles (Click on a measure or note with an xpression attached - when show all handles is not selected);Select an expression handle (Click, or shift-click to select multiple handles or press ctrl-A to select all available handles),Move selected expressions (Drag the selected handles),Move selected expressions without using dynamic drawing (Ctrl-drag the selected handles),Delete

selected expressions (Press delete, or right-click the handle and select Delete from the contextual menu), Resize a shape expression (Double-click an expression handle, or right-click the handle and select Edit Score Shape Expression Graphically from the contextual menu), Display the Text Expression Designer dialog box (Double-click an expression handle - text expression -, or right-click the handle and select Edit Text Expression Definition from the contextual menu), Display the Shape Expression Designer dialog box (Ctrl-double-click an expression handle - shape expression -, or rightclick the handle and select Edit Shape Expression Definition from the contextual menu), Display the Measure or Note Expression Assignment dialog box (Shift-double-click an expression handle, or right-click the handle and select Edit Expression Assignment from the contextual menu);

- **Graphics Tool:**Align Left (Ctrl-Shift- [ -left square bracket), Center Horizontally (Ctrl-Shift- ' -apostrophe), Align Right Ctrl-Shift- ] -right square bracket), Align Top (Ctrl- - -minus), Center Vertically (Ctrl-Shift- = -equals), Align Bottom Ctrl-Shift- - -minus), Place a graphic in the Shape Designer (Click in the Shape Designer display area, the Place Graphics dialog box appears), Select a graphic or graphics (Click a graphic or drag-enclose graphics, shift-click a graphic), Display the Graphic Attributes dialog box (Ctrl-Shift- T or double-click a graphic), Place a graphic in the score (Double-click in the score, the Place Graphics dialog box appears), Select a region containing the musical example to Export (Double-click and drag to enclose a region in Page View), Delete the selected graphics (Press delete for one or more selected graphics), Adjust the graphic's position in the score (Drag a selected graphic), Resize the graphic horizontally or vertically (Drag a graphic's bounding handle);

- **Hand Grabber Tool:**Temporarily switch to Hand Grabber Tool (Press the right-button);

- **HyperScribe Tool:**Indicate where to begin transcription (Click a measure), End HyperScribe in the middle of measure (Ctrl-click anywhere on the score);

- **Transcription Tool:**Display the Transcription window (Click a measure or ctrl-click a measure if you had Transcribe in Measures selected while transcribing), Transcribe a measure at a time (Click a measure with Transcribe in Measures selected);

- **Lyrics Tool:**Click Assign lyrics one syllable at a time (Click within the staff lines at the position of the note), Click Assign lyrics all at once (Ctrl-click within the staff lines at the position of the first note), Display a Word Extension handle (Click within the staff lines at the position of the sustained syllable With), Edit Word Extension selected from the Lyric Menu), Move Syllables Click within the staff lines at the position of the syllable with Adjust Syllables selected from the Lyric Menu), Move to the previous or next verse, chorus or section ("up arrow" or "down arrow" using Type into Score), Left Justify syllable (Ctrl- [ -left square bracket), Right Justify syllable (Ctrl- ] -right square bracket), Center Justify syllable (Ctrl- ' -apostrophe), Align syllable block to the Left (Ctrl-Shift- [ -left square bracket), Center syllable block Horizontally (Ctrl-Shift- ' -apostrophe), Align syllable block to the Right Ctrl-Shift- ] -right square bracket);

- **Mass Edit Tool:**Display the Fit Measures dialog (Ctrl- M -with measures selected in Page View), Lock currently selected systems (L), Unlock currently selected systems (U), Select a measure or measures (If "Select Partial Measures" is selected in the Edit Menu, doubleclick a measure; If "Select Partial Measures" is off, a single click selects a measure; drag-enclose a region), Extend a selection of measures vertically (Double-click a selected measure to include the entire vertical measure "stack" -that measure in all staves; If "Select Partial Measures" is turned on, the first double-click selects a single full measure, and the second double-click selects the measure stack; Shift-click a measure or a beat within a measure), Extend a selection of measure horizontally to end or beginning (While holding down Shift, press "right arrow" or "left arrow". If "Select Partial Measures" is turned on, Shift-"right arrow" or Shift-"left arrow" selects the end or beginning of the measure, then to the end or beginning of the score), Select a staff or staves Click to the left of a staff; Shift-click to the left of a staff to extend the selection), Move or Copy a selected section of music (Drag the region so it is superimposed on the beginning of an unselected region, which elements and whether you are moving or copying are selected in the Mass Edit Menu before you drag; Ctrl-shiftclick the place where the selected elements should be copied or moved to), Display the Items to Clip dialog box (Press ctrl or shift while choosing Cut or Copy from the Edit Menu), Display the Paste dialog box (Press ctrl while choosing Insert or Replace Entries in the Edit Menu), Delete selected music (Press delete), Move selected measures to the previous or next staff system ("up arrow" or "down arrow"), Erase selected music (Press backspace), Cancel a Mass Edit operation (Press esc), Implode Music -displays the Implode Music dialog box (Select the measures you want to affect, then press 1 on your computer

keyboard), Drag-Implode Music for multiple staves -displays the Implode Music dialog box(Press I while dragging selected measures to their destination), Drag-Explode Music for multiple staves -displays the Explode Music dialog box (Select the measures you want to affect, then press 2 on your computer keyboard), Explode Music -displays the Explode Music dialog box(Press E while dragging selected measures to their destination), Respace notes, lyrics, and accidentals -Apply Beat Spacing command - using the settings in Document Options-Music Spacing (Select the measures you want to affect, then press 3 on your computer keyboard), Respace notes, lyrics, and accidentals - Apply Note Spacing command - using the settings in Document Options-Music Spacing (Select the measures you want to affect, then press 4 on your computer keyboard), Show elapsed time based on current tempo –displays the Elapsed Time dialog box(Select the measures you want to affect, then press 5 on your computer keyboard), Transpose –programmable(Select the measures you want to affect, then press any number between 6 and 9 on your computer keyboard), Select or deselect the SmartFind Source Region (Control-F), Display the Apply SmartFind and Paint dialog box (Control-Shift-F);

- **Measure Tool:** Display the Add Measures dialog box (Ctrl-click the Measure Tool, or right-click the Measure Tool and select Add Measures from the context menu), Add single blank measure to the score (Double-click the Measure Tool, or right-click the Measure Tool and select Add One Measure from the context menu), Display the Measure Attributes dialog box (Double-click the top barline handle or measure, or right-click the handle -or upper handle- and select Edit Measure Attributes from the contextual menu), Make the Measure wider or narrower (Drag the top barline handle right or left), Display a beat chart Click the second barline -or middle if there are three- handle, or rightclick the handle and select Edit Beat Chart from the contextual menu), Display a split-point bar (Click the third –bottom- barline handle, or right-click the handle and select Edit Split Points from the contextual menu), Move a beat horizontally in all staves (Drag one of the lower handles in the beat chart), Move a beat and all subsequent beats horizontally in all staves(Shift-drag one of the lower handles in the beat chart), Add another pair of beat positioning handles (Double-click between two upper handles of a beat chart), Display the Beat Chart Element dialog box (Double-click an upper handle in the beat chart), Delete a beat chart pair from the beat chart (Click on an upper handle to select it and press delete), Change a barline (Right-click the handle and select the desired barline type -Normal, Double, Final, Solid, Dashed, Invisible, Tick- from the contextual menu), Display a handle on every measure number (Click the Measure Tool), Reset measure number positioning (Press backspace, or right-click the handle and select Restore Default Position from the contextual menu), Delete a measure number (Press delete, or right-click the handle and select Delete from the contextual menu), Move a measure number Drag the measure number’s handle Display the Enclosure Designer dialog box (Double-click a measure number’s handle, or right-click the handle and select Edit Enclosure from the contextual menu), Force a measure number to appear (Ctrl-click a measure without a measure number), Force measure numbers on a measure in all staves of a staff system(Ctrl-shift-click on a measure • Break a multimeasure rest (Right-click the handle and select Break a multimeasure rest from the contextual menu);

- **Mirror Tool:** Display Mirror and Placeholder icons (Click the Mirror Tool), Display the Placeholder dialog box (Click a measure with notes or with a Placeholder icon), Display the Tilting Mirror dialog box (Click an empty measure or a measure with a Mirror icon), Display the Mirror Attributes dialog box (Shift-click a measure with a Mirror icon);

- **Note Mover Tool:** Display a handle on every notehead in the measure (Click a measure); Select a handle or handles (Click, shift-click, drag-enclose or shift-drag-enclose the handles), Delete selected notes -still in their original measure (Press delete, or right-click the handle and select Delete from the contextual Menu), Move or Copy notes to another measure (Drag a note or a group of notes to the end of the measure and the selected action in the Note Mover Menu will take place), Copy notes to the beginning of a measure (Drag a note or a group of notes to the beginning of the measure –if the measure isn’t rhythmically full);

- **Ossia Tool:** Display handles on every ossia measure (Click the Ossia Tool in Page View), Display a handle on a measure-assigned ossia measure (Click the Ossia Tool in Scroll View and click the measure to which the Ossia measure is attached), Display the Ossia Measure Designer dialog box (In Page View, double-click anywhere on the document; In Scroll View click a measure with no ossia measure attached, or double-click a measure with an ossia measure attached; Double-click a floating measure’s handle, or right-click the handle and select Edit Ossia Definition from the contextual menu), Select an ossia measure (Click the ossia measure’s handle);

Move a selected ossia measure (Drag the handle),Delete a selected ossia measure (Press delete, or right-click the handle and select Delete from the contextual menu),Display the Page Assignment for Ossia Measure dialog box (Shift-double-click a page-assigned floating measure's handle, or right-click the handle and select Edit Ossia Assignment from the contextual menu -in Page View),Display the Measure Assignment for Ossia Measure dialog box (Shift-double-click a measure-assigned floating measure's handle, or right-click the handle and select Edit Ossia Assignment from the contextual menu);

- **Page Layout Tool:**Display Page and System margins (Click the Page Layout Tool), Resize page, margins or system (Drag a handle in Page View), Move a system (Drag the system in Page View), Move a system without moving other systems( Hold down Ctrl and drag the center of a staff system), Select handles (Drag-enclose to select handles),Select all handles (Ctrl-A);

- **Repeat Tool:**Display the Repeat Selection dialog box (Click a measure without a repeat or double-click a measure with a repeat), Display handles on a repeat (Click a measure with a repeat), Delete a text repeat, repeat barline (Click on the handle and press delete, or right-click the handle and select Delete from the contextual menu), Move a text repeat (Select the handle and drag), Change the size of a repeat barline's bracket (Drag the repeat bracket handle up or down, left or right), Display the Repeat Designer dialog box (Double-click a text repeat handle, or right-click the handle and select Edit Repeat Definition from the contextual menu), Display the Backward Repeat Bar Assignment dialog Box (Double-click a repeat barline handle, or right-click the handle and select Edit Repeat Assignment from the contextual menu), Display the Ending Repeat Bar Assignment dialog box (Double-click a repeat ending number handle, or right-click the handle and select Edit Repeat Assignment from the contextual menu), Display the Repeat Assignment dialog box (Shift-double-click a text repeat handle, or right-click the handle and select Edit Repeat Assignment from the contextual menu);

- **Resize Tool:**Reduce or enlarge a notehead (Click on the notehead or right-click and select Resize Notehead from the contextual menu),Reduce or enlarge an entire note or beam group (Click on the note stem or right-click and select Resize Note or Rest from the contextual menu), Reduce or enlarge a staff (In Page View, click to the left of the staff or right-click and select Resize Staff from the contextual menu), Reduce or enlarge a system (In Page View, click between any two staves in the system or rightclick and select Resize System from the contextual menu), Reduce or enlarge a page, or a range of pages (In Page View, click the upper-left corner of the page or right-click and select Resize Page from the contextual menu);

- **Selection Tool:**Switch to Selection Tool (Ctrl-Shift-A),Select an item (Click on the item), Select the appropriate tool to edit item With item selected, double-click or press enter), Select between overlapping items (Click on the item then press plus or minus to cycle through overlapping items);

- **Simple Entry Tool:**128th Note through Double Whole ( 0-8 )• 128th Rest through Double Whole Rest(Shift and a number key (0-7) or Enter-0 through Enter-8 on the Number Keypad) • Switch Tools and clear other selections (Double-click tool or quickly repeat tool selection keyboard shortcut) • Erase selected Note or Rest or select the Eraser Tool to delete accidentals, ties, dots or tuplets (Delete) • Make a selected note sharp or select the Sharp Tool (S or + plus) • Make a selected note flat or select the Flat Tool (F or - minus) • Make a selected note natural or select the Natural Tool (Shift-8 or N or \* asterisk) • Add double-flat to selected note(V) • Add double-sharp to selected note (X) • Lower selected note by half step or select the Half Step Down Tool (Shift-F or Enter- -minus With selection,"down arrow")• Raise selected note by half step or select the Half Step Up Tool (Shift-S or Enter+ plus With selection,"up arrow")• Change selected note to a rest or toggle between Note and Rest Tools ® • Add an augmentation dot to the selected note or select the Dot Tool (. period) • Tie selected note to the next note or select the Tie Tool (T or = equals or Enter-/ )• Tie selected note to the previous note or select the Tie Tool (Shift-T) • Toggle grace note state of selected note or select the Grace Note Tool (G or / backslash) • Toggle tuplet state (create new one or erase existing tuplet) of selected note or select the Tuplet Tool (9) • Access Simple Entry Tuplet Definition dialog box for duplet, septuplets or other tuplets (With the Tuplet Tool, shift-click the staff )• Show/Hide a courtesy accidental on selected note (A) • Break/Join Beam on selected note (B) • Restore default beaming (Shift-B) • Show/Hide selected note or rest (H) • Flip stem on selected note (L) • Restore stem direction to "floating" status on selected note (Shift-L) • Flatten beams for selected note (M) • Add or remove parentheses around accidentals for selected note (P) • Select a note or rest (Control-click the note or rest) • Select a note or rest within a chord without clearing previous selection (Control-shift-click the note or

rest) • Move selection one note/rest to the left If no selection, select the last edited note/rest (“left arrow”) • Move selection one note/rest to the right (“right arrow”) • Move selection one note up, if chord selected Control -”up arrow”) • Move selection one note down, if chord selected Control-“down arrow”) • Select all notes in selected chord (Ctrl-A-click the chord) • Clear selection (Escape or Backspace);

- **Smart Shape Tool:** Flip a selected Slur (Ctrl- F), Change a selected Slur back to Automatic (Ctrl-Shift- F), Display handles on all smart shapes (Click the Smart Shape Tool, Edit or Delete a Smart Shape Click the handle of the Smart Shape) • Control-A (Select all Smart Shapes on the page) • Drag or nudge an endpoint handle Change the slur’s ending or starting note • Drag or nudge a center curve handle Change the slur’s arc height • Shift-drag a center curve handle Change the slur’s arc height and angle • Drag or nudge an inner curve handle (Change the slur’s arc and inset asymmetrically) • Control-drag an inner curve handle (Change the slur’s arc and inset symmetrically) • Control-double-click and drag (Create an inverted bracket with the hook pointing away from the staff instead of toward the staff. It will also change the text for an 8va or 15ma below the staff or 8vb or 15mb above the staff), Display the Smart Line Style Selection dialog box (Ctrl-click the Custom Line Tool), Add a slur (S) • Add a dashed slur (V), Add a crescendo (<), Add a decrescendo (>) • Add a trill (T) • Add a trill extension (E) • Add an 8va or 8vb marking (8) • Add a 15ma or 15mb marking (1) • Add a double-ended bracket (O) • Add a dashed double-ended bracket (H) • Add a bracket (K) • Add a dashed bracket ® • Add a line (L) • Add a dashed line (D) • Add a glissando (G) • Add a bend (N) • Add a tab slide (A) • Add a custom line (C);

- **Speedy Entry Tool:** Display the Edit Frame dialog box (Ctrl-click any measure that contains music), Remove note, rest or chord (delete), Hide/show note or rest (letter O or H), Add or remove accidental parentheses (P), Jump to previous measure ([ -left square bracket- or shift “left arrow”), Jump to next measure (] -right square bracket- or shift “right arrow”), Flip stem in opposite direction (L), Restore stem direction to “floating” status (Ctrl-L) • Change to/from a grace note (; -semicolon- or G) • Change to/from a slashed flagged grace note (˘ -accent- or ; -semicolon- or G), Voice 1/2 ( ' -apostrophe) Switch to next layer (shift-' -apostrophe) Move editing frame down a staff (shift “down arrow”), Move editing frame up a staff (shift “up arrow”), Add or change note 64th–double whole note (1–8), Add or change 128th note (ctrl-0 -zero) Insert 64th note–whole note (shift-1 through shift-7 -on keyboard only-with MIDI, while playing note) Insert 128th note -without MIDI (ctrl-0 –zero-in insert mode only), Add 64th rest–whole rest -with MIDI (shift-1 through shift-7 without pressing note). Add rest -with or without MIDI (ctrl-shift-1-7 on keyboard only) Add 128th rest with MIDI (ctrl-0 -zero) Add a rest with Hands-Free MIDI (play any three note cluster), Toggle Insert mode (insert or shift-0 -zero) Constrain dragging a note horizontal/vertical (shift-drag), Begin a tuplet -duplet–octuplet (ctrl-2 through ctrl-8), Define a tuplet (ctrl-1) • Raise by a half step (+ plus or shift-S) • Lower by a half step (– minus or shift-F), Raise by a half step for entire measure (ctrl- + plus) Lower by a half step for entire measure (ctrl- – minus) • Flat note (F) • Sharp note (S) • Natural note (N) • Double-sharp (X) • Double-flat (V), Previous note (“left arrow”), Next note (“right arrow”), Move to first note or rest in measure (ctrl-“left arrow”), Move just beyond last note or rest in measure (ctrl-“right arrow”), Down a step (“down arrow”), Up a step (“up arrow”), Remove note from chord (backspace) • Change single note to rest (backspace or R) • Tie/untie to next note (= equals or T) • Tie/untie to previous note (ctrl = equals or shift-T), Flip a tie (ctrl-F), Restore tie direction to automatic (ctrl-shift-F) • Break/join beam from previous note (/ -backslash or B) • Restore default beaming (Shift-B) • Flatten a beam (\ -forward slash or M), Show/hide any accidental (\* asterisk) • Show/hide a courtesy accidental (A), Restore courtesy accidental to optional status (ctrl-\* asterisk) Return a rest to its default position (\* asterisk), Exit measure and redraw/re-enter measure (0 zero) Flip a note to its enharmonic equivalent (9), Flip enharmonic throughout measure (ctrl-9 - cursor on first note in measure), Add a dot (. period) Add a note to a chord (enter), Change a rest to a note (enter) • Specify a pitch, high C–B without MIDI (Q-W-E-R-T-Y-U - with Caps Lock) • Specify a pitch, middle C–B without MIDI (A-S-D-F-G-H-J - with Caps Lock) • Specify a pitch, low C–B without MIDI (Z-X-C-V-B-N-M - with Caps Lock) • Raise all pitch keys an octave (, comma with Caps Lock) • Lower all pitch keys an octave (I -letter I with Caps Lock) • Restore all pitch keys to normal register (K with Caps Lock);

- **Special Tools Tool:** Display handles in the measure (Click the Special Tool you want to use and click on the measure), Select a handle or handles (Click, shift-click or drag-enclose, or

ctrl-A), Reset the note to its original state (Press delete or backspace), Move selected items very slightly (Use the arrow keys), Flip a selected tie (Ctrl-F), Restore tie direction to automatic (Ctrl-shift-F);

- **Staff Tool:** Display the Staff Menu and handles (Click the Staff Tool), Select a staff or staves (Click a staff or a staff handle, or drag-enclose staff handles), Add the staff to the selection. If a staff is already selected, remove the staff from the selection (Shift-click a staff or a staff handle), Display the Staff Attributes dialog box (Double-click a staff or a staff handle, or double-click a full or abbreviated staff name handle, or right-click the handle and select Edit Staff Attributes from the contextual menu), Add a staff without repositioning the lower staves to make room for the new staff. (Double-click in the score in Scroll View), Insert a staff between staves, repositioning the lower staves to make room for the new staff (Shift-double-click below a staff in the score in Scroll View), Display the Group Attributes dialog box (Double-click a group handle, or double-click a bracket handle, or right-click the group or bracket handle and select Edit Group Attributes from the contextual menu. right-click the staff handle and select Add Group and Bracket from the contextual menu), Delete the selected staves without repositioning the remaining staves (Press delete for selected staves, or right-click the handle and select Delete Staves from the contextual menu), Delete the selected staves and reposition the remaining staves (Press shift-delete for selected staves, or right-click the handle and select Delete Staves and Reposition from the contextual menu). Adjust the staff's position in Scroll View only. The placement of staves remains unchanged in Page View. When you choose Special Part Extraction from the Edit Menu, Finale removes the checkmark by the command, and displays the full score using the new positioning in Scroll View. (Drag a staff or a staff handle in Scroll View -when Special Part Extraction is selected in the Edit Menu), Adjust the staff's position in every staff system in Page View and the position of the staff in Scroll View. When the top staff is adjusted, Finale adjusts the distance between staves, as well as staff systems (Drag a staff or a staff handle in Page View -when Special Part Extraction is not selected in the Edit Menu. Note: If two handles appear on a staff, drag the top handle), Adjust the staff's position in every staff system in Page View; leave the position of the staff unchanged in Scroll View. Finale adjusts the distance between staves, as well as staff systems (Drag a staff or a staff handle in Page View -when Special Part Extraction is selected in the Edit Menu. Note: If two handles appear on a staff, drag the top handle), Adjust the staff's position only in the current staff system -drag the top handle to adjust the position of the staff in all staff systems in Page View (Drag the staff's lower handle in Page View. Note: If a staff system has been optimized using the Page Layout Tool, two handles will appear on each staff in the optimized staff system), Select a group or groups (Click a group handle, or drag-enclose group handles), Add the group to the selection. If a group is already selected, remove the group from the selection (Shift-click a group handle), Edit a full or abbreviated group name using the Edit Text window. (Ctrl-click a group handle, or right-click the handle and select Edit Full Group Name or Edit Abbreviated Group Name from the contextual menu.), Position a group name using the Position Full Group Name or Position Abbreviated Group Name dialog box. (Ctrl-shift-click a group handle, or right-click the handle and select Position Full Group Name or Position Abbreviated Group Name from the contextual menu.), Revert the position of the group names to their default position. (Press backspace for selected groups), Remove the selected group definitions. (Press delete for selected groups, or right-click the handle and select Delete Group from the contextual menu.), Adjust the position of a group name. (Drag a group handle), Select a staff name or names. (Click a staff name handle, or drag-enclose staff name handles), Add the staff name to the selection. If a staff name is already selected, remove the staff name from the selection. (Shift-click a full or abbreviated staff name handle), Edit a full or abbreviated staff name using the Edit Text window. (Ctrl-click a full or abbreviated staff name handle, or right-click the handle and select Edit Full Staff Name or Edit Abbreviated Staff Name from the contextual menu), Position the selected staff name using the Position Full Staff Name or Position Abbreviated Staff Name dialog box. (Ctrl-shift-click a full or abbreviated staff name handle, or right-click the handle and select Position Full Staff Name or Position Abbreviated Staff Name from the contextual menu.), Revert the position of the full or abbreviated staff name to its default position. (Press backspace for a selected staff name handle), Adjust the position of the selected staff name. (Drag a full or abbreviated staff name handle), Select a bracket or brackets (Click a bracket handle, or drag-enclose several bracket handles), Add the bracket to the selection. If a bracket is already selected, remove the bracket from the selection. (Shift-click a bracket handle), Remove the selected brackets. (Press delete for selected

brackets, or right-click the handle and select Delete from the contextual menu.), Revert the selected brackets to their default length. (Press backspace for selected brackets), Make a bracket taller or shorter. (Drag a bracket handle vertically), Move a bracket closer to or away from bracketed staves.(Drag a bracket handle horizontally) Select a clef for the staff. (Right-click the staff handle and select Select Clef from the contextual menu.), Remove Staff Styles from selected region. (Backspace);

- **Text Tool:** Left Justify text in a text block (Ctrl- [ left square bracket), Right Justify text in a text block (Ctrl- ] right square bracket), Center Justify text in a text block (Ctrl- ' apostrophe), Full Justify text in a text block (Ctrl- ; semicolon), Forced Full Justify text in a text block (Ctrl-Shift- ; semicolon), Bold (Ctrl-Shift- B), Italic (Ctrl-Shift- I), Underline (Ctrl-Shift- U), Increase Point Size by one (Ctrl-Shift- . period), Decrease Point Size by one (Ctrl-Shift- , comma), Page Number Text Insert (Ctrl-Shift- P), Sharp sign Text Insert (Ctrl-Shift- S), Flat sign Text Insert (Ctrl-Shift- F), Natural sign Text Insert (Ctrl-Shift- N), Display Character Settings dialog box (Ctrl-T Display), Line Spacing dialog box (Ctrl-Shift-L), Align Text block to the Left (Ctrl-Shift- [ left square bracket), Center Text block Horizontally (Ctrl-Shift- ' apostrophe), Align Text block to the Right (Ctrl-Shift- ] right square bracket), Align Text block to the Top (Ctrl- - minus), Center Text block Vertically (Ctrl-Shift- = equals), Align Text block to the Bottom (Ctrl-Shift- - minus), Display the Standard Frame dialog box (Ctrl- M), Display the Custom Frame dialog box (Ctrl-Shift- M), Display the Frame Attributes dialog box (Ctrl-Shift- T or shift-double-click a text block handle, or right-click the handle and select Edit Frame Attributes from the contextual menu.), Display the Text Menu (Click the Text Tool), Display handles on text blocks (/Click the Text Tool), Select a text block or text blocks (Click a text block handle or drag-enclose text block handles, shiftclick a text block handle), Create an unbounded frame that expands as you enter text (Double-click in the score), Create a bounded, fixed-size frame for text (Double-click and drag in the score), Edit the text block (Double-click a text block handle, or right-click the handle and select Edit Text from the contextual menu.), Delete the selected text blocks (Press delete for one or more selected text blocks, or right-click the handle and select Delete from the contextual menu.), Adjust the text block's position in the score (Drag a selected text block handle);

- **Tuplet Tool:** Display positioning handles (Click the first note of a tuplet), Position tuplet (Drag a positioning handle), Position tuplet without dynamic drawing (Ctrl-drag a positioning handle), Delete tuplet (Press delete for selected tuplet, or right-click the handle and select Delete from the contextual menu.), Display the Tuplet Definition dialog box (Double-click a positioning handle or the first note in a group that you want to define as tuplets, or right-click the handle and select Edit Tuplet Definition from the contextual menu.), Display the Default Tuplet Visual Definition dialog box (Ctrl-click the Tuplet Tool, or right-click the Tuplet Tool and select Edit Default Tuplet Visual Definition from the drop-down list);

- **Zoom Tool:** Zoom in - enlarge 2x, if tool is selected (Click the score), Zoom out - reduce by 1/2, if tool is selected (Ctrl-click the score), Temporary switch to Zoom Tool: enlarge (Shift-click the right-button), Temporary switch to Zoom Tool: reduce (Ctrl-Shift-click the right-button), Fill the screen with the selected area (Drag-enclose an area);

- **Playback:** Begin/Pause playing - Playback Controls open (Alt-D-P or Alt-D-O), Begin playing from the measure clicked (Spacebar-click in staff), Begin playing from the clicked measure in the clicked staff only (Shift-spacebar-click in staff), Begin playing from the clicked measure in all staves (Spacebar-click in between staves), Begin playing from measure one in all staves (Spacebar-click to the left of a staff system), Begin playing from measure 1 for the clicked staff (Spacebar-shift-click to the left of staff), "Scrub" onscreen music - all staves (Ctrl-spacebar -and drag across music), "Scrub" onscreen music - clicked staff only (Ctrl-Shift-spacebar -and drag across music).

## Funcțiile programului

### SIBELIUS

#### *Versiunea 2*

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[www.sibelius.com](http://www.sibelius.com)

- **File:** *New* (Type of manuscript paper, Instruments, Play using the device), *Open* [All Music Files (sib, mid, opt, mus, etf, tmp, pag, pge, s7), Sibelius (sib), MIDI (mid), Photo Score (opt), Finale/Allegro/PrintMusic (mus), Finale ENIGMA (etf), SCORE File (tmp)/Page (mus, pag, pge), Sibelius 6/7 (s7)], *Append Score* (sib), *Close*, *Close All*, *Save*, *Save As* [Sibelius (sib), Scorch Web Page (htm), MIDI (mid)], *Save As Graphics* (EPS, BMP, EMF), *Save As Manuscript Paper*, *Save All* [Sibelius (sib), Scorch Web Page (htm), MIDI (mid)], *Print*, *Extract Parts*, *Publish on SibeliusMusic.com*, *Score Info*, *Plug-ins* [*Batch Processing* (Apply House Style to Folder of Files, Convert: Folder of Acorn Sibelius Files/Folder of Files to Graphics/Folder of Finale Files/Folder of MIDI Files; Print Folder of Scores), *Composing Tools* (Double Notes Values, Finf Motif, Find Range, Halve Notes Values, Invert, Pitch Mapping, Retrograde), *Notation* (Add: Brass Fingering/Cautionary Accidentals,/Chord Symbols/Ficta Above Note/Note Names/String Fingering/Tonic Sol-Fa; Make Layout Uniform/Pitches Constant, Number Beats, Remove Dangling Ties/Rests, Respell Flats as Sharps/Sharps as Flats, Split Dotted Quarter Rests), *Playback* (Copy Dynamics, Cresc./Dim. Playback, Quarter-tone Playback), *Proof-reading* (Check: Clefs/for Parallel 5ths-8ves/Harp Pedaling/Pizzicatos/Repeat Barlines; Proof-read), *Edit Plug-ins*, *Show Plug-in Trace Window*], *Preferences* (General, Keyboard Shortcuts, Word Menus), *Register/Transfer* (Register Sibelius, Transfer SavingOut/In), *Exit*.
- **Edit:** *Undo*, *Redo*, *Undo/Redo History*, *Cut*, *Copy*, *Paste*, *Repeat*, *Delete*, *Flip*, *Voice* (1-4; All; Swap 1-2/1-3/1-4/2-3/2-4/3-4), *Hide or Show* (Hide, Show, Show in Score/in Parts), *Select* (All/More/System Passage/None), *Filter* [Advanced Filter, Chord Symbols, Dynamics, Expression Tool, Guitar Frames, Hairpins, Lyrics, Notes and Chords, Slurs, Tuplets, Voice 1-4, Voice 1-4 Only, Top/2<sup>nd</sup>/3<sup>rd</sup>/Bottom Note, Top Note/2<sup>nd</sup> Note/3<sup>rd</sup> Note/bottom Note or Single Notes, Player 1-2 (for Delation)], *Find*, *Find Next*, *Go to Bar/Page*;
- **View:** *Attachment*, *Breacks and Locks*, *Hidden Objects*, *Highlights*, *Note Colors* (Note out of Range, Pitch Spectrum, Voice Colors, None), *Page Margins*, *Textures*, *Selection/Object/Staff Rulers*, *Full Screen*, *Scroll Bars*, *Toolbar*, *Zoom* (Zoom, Zoom In/Out);
- **Create:** *Bar*, *Barline*, *Clef*, *Graphic*, *Guitar Frame*, *Highlight*, *Instruments*, *Key Signature*, *Line*, *Rehearsal Mark*, *Symbol*, *Text* [Expression, Technique, Lyrics, Lyrics verse 3-5, Chord symbol, Other Staff Text (Plain text, Lyrics verse 3-5, Figured bass, Fingering, Boxer text, Small text, Lyrics above staff, Nashville chord numbers, Footnote, Technique 2, Note flags 2, Small Text 2), Title, Subtitle, Composer, Lyricist, Dedication, Tempo, Metronome mark, Other System Text (Copyright, Header, Header – after first page, Footer – outside edge/inside edge, Rit./accel., Title 2, Header 2, Footer 3, Footer, Footer 2), Special Text (Bar numbers, Guitar frame fret, Instrument name at top left, Instrument names, Multirests, Page numbers, Rehearsal marks, Time signatures-huge/large, Tablature letters/numbers, Tuplets)], *Bar Numbers Change*, *Bracket or Brace* (Bracket, Sub-bracket, Brace), *Extra Slur Arc*, *Extra Staff* (Above, Below, Ossia Above/Below), *Staff Type Change* [Pitched (1-5 lines, No lines, etc.), *Tab* (Standard guitar, Bass guitar, etc.), Percussion (1-5 lines)], *Transposition Change*;
- **Play:** *Play or Pause*, *Stop*, *All Notes Off*, *Mixer*, *Performance*, *Dictiunary*, *Devices*, *Substitute Devices*, *Playback Options*;
- **Notes:** *Flexi time*, *Flexi-time Options*, *Arrange*, *Edit Arrange Styles*, *Transpose*, *Transposing Score*, *Add Interval* (2-9 Above/Below, Unison), *Add Interval* (A-B-C-D-E-F-G + Shift), *Cross-Staff Notes* (Move Up/Down a Staff), *Respell Accidental*, *Reset Beam Groups/Stems and Beam Angles*;
- **Layout:** *Document Setup*, *Break* (System/Page Break, Split System/Multirest), *Format* (Make Into System/Page, Lock/Unlock Format), *Align: in a Row/in a Column/Staves*; *Hide/Show Empty Staves*; *Reset: Portion/Design/Note Spacing/Space Above Staff/Space*



Below Staff:

- House Style: Engraving Rules, Note Spacing Rule, System Object Positions, Default Positions, Timecode, Edit: Lines/Noteheads/Staff Types/Symbols/Text Styles; Use: Multirests/“Show in Part“; Import/Export House Style;
- Window: New Window, Title Horizontal/Verticaly, Cascade, Mixer, Navigator, Properties, Keypade (separate);
- Help: Sibelius Help, Tip of the Day, Help Center, Sibelius.com, Sibelius.com Education Area, SibeliusMusic.com Internet Publishing, Sibelius Magazine, PhotoScore Professional, Sibelius Teaching Tools, About Sibelius.
- Comenzile operative (ce apar suprapuse partituri in lucru): General, Text, Lines, Bars, Staves, Notes, Keypad;
- Comenzi rapide uzuale: A/B/C/D/E/F/G (LA/SI/DO/RE/MI/FA/SOL), 1-6 pe keypad (TREZECIDOIME-NOTA INTREAGA), 7-9 pe keypad (BECAR,DIEZ,BEMOL), Ctrl + 3 (TRIOLET), Ctrl + 2-9 (ALTE DIVIZIUNI EXCEPTIONALE), P (PLAY), Esc (STOP), Ctrl + F/M/P (f/m/p – ca expresie), Ctrl + Shift + C/D (CRESC./DIM.).

Funcțiile programuluiNoteWorthy Composer v. 1.75

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- File: New, Open (NWC Files, MIDI Files, Song Files) Save, Save As (Standard NWC File, Type 1 Midi File, Type 0 Midi Files, Uncompressed NWC File), Revert, Close, Info [Title, Author, Copyright Notice 2 (All Rights Reserved), Comments], Page Setup, Printer Setup, Print Preview, Print, History, Exit;
- Edit: Undo Page Setup, Redo, Cut, Copy, Copy Special, Paste, Clear, Select All, Remove Chord Note, Beam, Triplet, Find, Find Next, Go to, Lyrics, Properties;
- View: Zoom In/Out, Zoom, Refresh Score, Status Bar, Toolbars;
- Staff: New Staff, Import Recording, Delete Staff, Move Staff, Move Staff Up/Down, Mute Staff, Staff Properties;
- Insert: Note, Rest, Chord Member, Bar Line, Bar Line (Decorated), Clef, Dynamic, Dynamic Variance, Flow Direction, Key Signature, Performance Style, Special Ending, Sustain Pedal, Tempo, Tempo Variance, Text, Time Signature, Instrument Patch, Multi-point Controller;
- Notes: Whole, Half, Quarter, Eight, Sixteenth, Thirty-second, Sixty-fourth; Natural, Flat, Sharp, Double Sharp, Double Flat; Accent, Dotted, Double-Dotted, Grace, Slur, Staccato, Tenuto, Tied, Stem Up/Down;
- Tools: Record, Staff Play, Play, Stop; Score Review, Mute List, MIDI Input Active, Persistent Note Tools; Automatic Beam, Transpose Staff, Force Accidentals; Audit Bar Lines/Accidents/Enharmonic Spelling/Note Stems; Options;
- Window: Cascade, Title, Arrange Icons, Close All;
- Help: Contents, Search for Help on, Did you know, Getting Started, Command Reference, Keyboard Reference, Benefits of Registering, How to Order, Support, Go to NoteWorthy Software.com, Check for Web Updates, About.

Funcțiile programuluiLIME 8.00

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[www.cerlsoundgroup.org](http://www.cerlsoundgroup.org)

[lime](mailto:lime), 1906 Augusta, Champaign, IL-61821, USA

- File: New, Open, Import NIFF, Import MIDI, Close, Save, Save As (Lime Fle – lim),

- Export NIFF, Export MIDI, Revert, Layout, Print Setup, Print, Print Multiple, About Lime, Exit;
- **Edit:** Undo, Redo, Cut, Copy, Copy Music, Paste, Clear (Note, Text, Annotation, At Each System, On Each Page, In Every Context, Staff/Chord/Accident Drag, Invisible Notes), Copy Measures, Align Annotations, Duplicate, Extend Line to Here, Allow Any Alt-click, Enable Duration Edits, Shortcut Keys, Options;
- **Context:** Previous Notation Context, Next Notation Context, Part Extraction, Score;
- **Page:** Previous/Next Page, Go to Page/Bar, Split Page/System, Add to Next Page/System, Systems, Insert/Delete Measures, Correct Measure;
- **Voice:** Previous/Next Part or Voice, Record, Note Entry, Parts and Voices, Voice to Staff Above/Below, Staff Drag, Highlight Voice, Voice on Channel;
- **Note:** Previous/Next Note, Show Accidental, Default/Special Accidentals, Transpose, Notehead Color, Tablature String/Thumb, Hide Tuplet/Rest, Don't Combine Rest, Chord Drag, Internal Fields;
- **Stem:** Stem Up/Down, No Stem, Slashed Stem, Stem Between Staves, Continue/End Beam, Continue/End Subbeam, Default Beaming, Beaming Rule, Tremolo Beam, Swing Eight Beam, Modify Slur/Tie;
- **Hear:** Hear, Tuning, Dynamic Levels, Default Playback, Modify Playback (Softer, Louder, Level, Lower, Higher, Pitch, Shorter, Longer, Earlier, Later), Recompute Playback, Play Octave Higher/Lower, Keyboard Shift (3-1 Octaves Up, Normal, 1-3 Octaves Down), MIDI Input/Output;
- **Symbol:** Clef, Key/Time Signature, Bar Line, Align Bars, System Bracket, Parameters, Hidden Test;
- **Annotation:** Preview/Next Annotation, Text Category, Font, Size, Style, Text Assistant, Line, Curve, Line and Curve Style, Horizontal/Vertical Lock, All Notation Context, Only In Score, Not In Score, This Notation Context Only;
- **Window:** Previous/Next Window, Arrange Icons, Close All.

*Funcțiile programului*

**ENCORE - The Musician's Choice for Composing & Publishing**

**Version 4.5.5**

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[www.gvox.com](http://www.gvox.com)

**PO Box 2755, NJ 07091, USA**

- **File:** New (Page Layout: Staves per system, Systems per page, Measures per system, Staff Format), Open [Scores (enc, mus, mto, rhp), MIDI (mid, miff), MT Pro (mts)], Close, Save, Save As [Encore Files (enc), MIDI Files (mid), MT Pro Files (mts)], Revert to Saved, Extract Part, Score Settings/Page Setup (Score Window Title; Enlarge or Reduce Score; Margin Setting), Print, Export to ESP, Exit;
- **Edit:** Undo Guess Durations, Cut, Copy, Paste, Clear, Select All, Nudge Left/Right/Up/Down;
- **Notes:** Attributes (Notes, Beams, Rests), Voice (Set to Voice 1-8), Accidentals to (Enharmonics, Sharps, Flats), Stems (Up, Down, Normalize), Marks (Add, Remove), Tie Notes, Slur Notes, Beam Notes (Beam Group, Beam on Beat, Sub Group, Flatten Beams), Change - Pitch, Duration, Velocity; Make-Chord, Tab, Grace/Cue; Revert to Raw, Guess Durations;
- **Measures:** Add/Delete Measure, Tempo, Time/Key Signature, Barline Types, Endings, Coda Phrases, Measure Numbers, Compressed Rests, Align/Swing Playback, Align Spacing;
- **Score:** Text Elements, Add/Delete Page, Add/Delete Staff, Split this Staff, Tablature Staff, Percussion Staff, Connect/Center Staves, Center Systems, Measure per System, Systems per Page;
- **View:** Show/Hide Score Colors, Guitar Frets, Show/Hide Staves, Refresh Score, Linear View, Hide Floating Windows;
- **Windows:** Palette (Notes, Clefs, Graphics, Tools, Dynamics, Marks 1, Marks 2, Symbols,

- Guitar, Expressions, Color), Keyboard, Tempo, Toolbar, Staff Sheet, Tile, Cascade, Arrange Icons, Close All;
- **Setup:** MIDI Setup, Record Setup, Transcription Setup, Spacing Defaults, Click Setup, Toolbar Setup, Click On, Follow Playback, Auto Guess/Beam, Auto Space, Save Preferences;
- **Help:** Topics, Current Topic, Help on Help, Link to Web Site, About Encore.

### Prezentarea generala a programului

#### SCORE

#### Computer Music Typography System

#### Written by Leland SMITH

#### Programers: Leland SMITH, Perry DEVINE

#### © 1977-1992 by Leland SMITH

#### © 1986-1992 by Passport Designs, Inc.

#### © 1995-2004 by San Antonio Press, PO Boc 60247, Palo Alto, CA-94306, USA

[www.scoremus.com](http://www.scoremus.com)

<http://ace.acadiau.ca/score>

[lcs@ccrma.stanford.edu](mailto:lcs@ccrma.stanford.edu)

- Complex de programe [SCORE Version 4.01, Midiscor (SCORE to MIDI), MIDISCORWRITE (MIDI to SCORE), FINALSCORE (Finale to SCORE)] realizate la Center for Computer Research in Music and Acoustics (CCRMA) - Department of Music, Stanford University (USA) de Prof. Leland SMITH - toate operand pe MS-DOS (drive: floppy -cf."Appendix 1") si avand urmatoarele coordonate: 1100 items, 11000 parameters, 29000 graphic vectors.

### - b.) PROGRAME WAV DE EDITARE MUZICALA

#### Funcțiile programului

#### SOUND FORGE 4.5

<http://www.sonicfoundry.com>

#### GENERALE

- **File:** New, Open (All Types), Work space (open), Exit;
- **Edit:** Paste to New;
- **View:** Full Screen, Toolbars, Clipboard (Contents, Play), Region List, Playlist/Cutlist, Keyboard, Mixer, Time Display, Video Preview, Play Meters, Undo/Redo History;
- **Special:** Record;
- **Tools:** Batch Convertor, Preset Manager;
- **Options:** MIDI Input Sync/Trigger, MIDI Output Sync, MIDI Triggers, Preferences;
- **Window:** New Window;
- **Help:** Contents, Search for Help, Keyboard Shortcuts, Troubleshooting, Tip of Day, Sonic Foundry on Web (Product News, Frequently Asked Questions, Online Support, Sound Forge Home Page, Send Feedback, Sonic Foundry Home Page), About Sound Forge.

#### SPECIALE

- **File:** New, Open (All Types), Close, Workspace, Save, Save As (asf, smp, svx, iff, v8, voc, vox, pat, ivc, aif, snd, sds, au, snd, rm, ra, smp, sfr, dig, sd, snd, avi, wav, wma), Save All, Properties, Send, Exit;
- **Edit:** Can't Undo, Can't Redo, Can't Reper, Cut, Copy, Copy Object Link, Paste, Paste Special (Crossfade, Mix, Overwrite, Replicate, Paste to New), Trim/Crop, Delete (Clear), Select All, Preview Cut/Cursor, Pre-roll Cursor, Tool (Edit, Magnify, Pencil), Go To, Selection (Snap to Time, Snap Edge to Time, Snap to Yero, Snap Edge to Yero, Set), Undo All, Disable Undo/Redo;
- **View:** Maximize Width, Full Screen, Clipboard (Contents, Play), Zoom Level (Out Full,

- Window, Selection), Zoom Time (In Full, Normal, Out Full, Selection), Focus to Data Window, Region List, Playlist/Cutlist, Keyboard, Mixer, Time Display, Video Preview, Play Meters, Undo/Redo History, Loop Tuner;
- *Special*: Transport (Record, Play All, Play, Pause, Stop, Go to Start, Rewind, Forward, Go to End, Play Normal Mode, Play Looped Mode, Play as Sample/Cutlist Mode), Region list (Add, Delete, Edit, Replicate, Split, Update, Clear, Markers to Regions, Open, Save As, Copy onto Clipboard), Playlist/Cutlist (Add, Delete, Edit, Replicate, Clear, Stop Point, Pre-roll Playback, Open, Save As, Copy onto Clipboard, Convert to New, Treat as Cutlist, Delete Cut Regions), ASF Markers/Commands (Save As, Import, Add Command), ACID Looping Tools (Halve Selection, Double Selection, Shift Selection Left, Shift Selection Right, Rotate Audio), Edit ACID Properties, Edit Sample, Edit Frame Rate, Edit Tempo, Center Cursor, Drop Marker, Create Region, Create Sample Loop, Mark In, Mark Out, Toggle Selection, Undo/Redo History (Clear, Clear All), Rebuild Peak Data;
  - *Process*: Audio Trim/Crop, Channel Converter, Convert to 8-Bit, DC Offset, EQ (Graphic, Paragraphic, Parametric), Fade (Graphic, In, Out), Insert Silence, Invert/Flip, Mute, Normalize, Pan/Expand, Resample, Reverse, Smooth/Enhance, Time Compress/Expand, Volume;
  - *Effects*: Amplitude Modulation, Chorus, Delay/Echo (Multi-Tap, Simple), Distorsion, Dynamics (Graphic, Multi-Band), Envelope, Flange/Wah-Wah, Gapper/Snipper, Noise Gate, Pitch (Bend, Shift), Reverb, Vibrato;
  - *Tools*: Auto Region, Batch Converter, Crossfade Loop, Extract Regions, Find, Preset Manager, Run Batch Script, Sampler, Spectrum Analysis, Statistics, Synthesis (DTMF/MF Tones, FM, Simple);
  - *DirectX* : Audio Plug-In Chainer, CW, SF, etc.;
  - *Options*: Status Format (Samples, Time, Seconds, Time& Frames, Absolute Frames, Measures & Beats, SMPTE - Non-Drop, Drop, EBU, Film Sync), Annotations (Marker - Names, Lines; Region - Names, Lines; Loop - Region, Lines), Play Meters (Reset Clip, etc.), Time Display (Position, Sync/Trigger Status, Playlist Position, Passive Update), Video (Passive Update, etc.), Scroll Playback, Scroll Smoothy, Drag and Drop Snapping, Lock Loop/Region Length, Past Events, Selection Grid Lines, Auto Snap - to Time, to Yero, MIDI - Input Sync/Trigger, Output Sync, Pre-Queue for SMPTE/MTE, MIDI Triggers, Preferences;
  - *Window*: New Window, Cascade, Title - Horizontally, Vertically, Arrange Icons, Minimize All, Restore All, Close All;
  - *Help*: Contents, Search for Help, Keyboard Shortcuts, Troubleshooting, Tip of Day, Sonic Foundry on Web (Product News, Frequently Asked Questions, Online Support, Sound Forge Home Page, Send Feedback, Sonic Foundry Home Page), About Sound Forge.

### Funcțiile programului

#### Audacity 1.2.0-pre2

<http://audacity.sourceforge.net>

- *File* : New , Open (Audacity Projects-aup, WAV-wav, AIFF-aif, AU-au, MP3, OggVorbis-ogg, List of Files-lof), Close, Save Project (aup), Save Project As (aup) Export As WAV, Export Selection As WAV, Export As MP3, Export Selection As MP3 (NB-funcția mp3 este viabilă doar prin adăugarea « lame\_enc.dll », ce poate fi obținut la [mitiok.free.fr](http://mitiok.free.fr) sau la [www.jthz.com/~lame/](http://www.jthz.com/~lame/) ), Export As OggVorbis, Export Selection As OggVorbis, Export Labels, Preferences, Exit ;
- *Edit* : Undo, Redo, Cut, Copy, Paste, Trim, Delete, Silence, Split, Duplicate, Select (All, Start, to Cursor, Cursor to End) , Find O Crossing, Selection Save, Move Cursor (to Track Start, to Track End, to Selection Start, to Selection End), Snap-To (On, Off) ;
- *View* : Zoom In, Zoom Normal, Zoom Out, Fit in Window, Fit Vertically, Zoom to Selection, Set Selection Format (min :sec, sec, ho :min :sec, film , PAL, NTSC, cdda, samples, etc.), History, Plot Spectrum, Float Control Toolbar, Float Edit Toolbar, Float Mixer Toolbar ;
- *Project* : Import Audio, Import Labels, Import MIDI (NB-doar vizualizat), Import Raw Data, Edit ID3 Tags, Quick Mix, New Audio Track, New Stereo Track, New Label Track, New Time Track, Remove Tracks, Align Tracks (with Zero, with Cursor, with Selection, Together), Align and move

*cursor (with Zero, with Cursor, with Selection), Add Label Art Selection ;*

- *Generate : Silence, Tone, White Noise ;*

- *Effect : Amplify, BassBoost, Change Pitch, Change Speed, Change Tempo, Compress, Echo, Equalization, Fade In, Fade Out, FFT Filter, Invert, Noise Removal, Normalize, Nyquist Prompt, Phaser, Repeat, Reverse, Wahwah ;*

- *Analyse ;*

- *Help : About Audacity, Online Help.*

*NB – Acest performant program\_este utilizat si in experimentele efectuate la CCRMA – Stanford University.*

### *Funcțiile programului*

**PRO TOOLS Free**

**version 5.0.1.471**

**© 1991-2000 digidesign – A divios of Avid**

<http://www.digidesign.com>

- **File:** New Session, Open Session, Close Session, Save Session, Save Session As, Save Session Copy In, Revert to Saved, Bounce to Disk, New Track, Rename Selected Tracks, Group Selected Tracks, Delete Selected Tracks, Import Audio/Track, Import MIDI/Track, Import MIDI, Get Info, Exit;
- **Edit:** Can´t Undo, Cut, Copy, Paste, Merge Paste, Clear, Duplicate, Repeat, Shift, Select All, Trim, Capture Region, Separate Region, Heal Separation, Quantize Regions, Mute/Unmute Region, Lock/Unlock Region, Consolidate Selection, Identify Sync Point, Identify Beat, Identify Silence, Strip Silence, Insert Silence, Fades (Create/Delete Fades, Fade To Start/End), Thin Automation;
- **AudioSuite:** DeEsser, Compressor, Limiter, Expander-Gate, Gate, 1-Band EQ II, 4-Band EQ II, Invert, Duplicate, short delay, slap delay, medium delay, long delay, Normalize, Gain, Reverse, DC Offset Removal, Time Compression Expansion, Pitch Shift;
- **MIDI:** Change Tempo, Change Meter, Quantize, Change Velocity, Change Duration, Transpose, Select Notes, Split Notes, Input Quantize, Click, Click Options, MIDI Beat Clock, Input Filter, MIDI Thru, All Notes Off;
- **Operations:** Destructive Record, Loop Record, QuickPunch, Auto Input Monitor, Input Only Monitor, Online, Pre/Post-Roll Playback, Loop Playback, Scroll Options,(No Auto-Scrolling, Scroll After Playback, Page Scroll During Playback), Link Edit and Timeline Selection, Play Edit Selection, Active In Background, Pre-Fader Metering;
- **Display:** Show Edit Window, Narrow Mix Window, Mix Window Shows (Comment View, 1/0 View, Insert View, Sends View, All, None), Edit Window Shows (Comment View, 1/0 View, Insert View, Sends View, All, None), Transport Window Shows (Counters, MIDI Controls, Expanded), Sends View Shows (Bars:Beats, Minutes:Seconds, Samples, Markers, Tempo, Meter, All, None), DSP Usage Window Shows, Disk Space Window Shows, Display Time In Regions (None, Current Time, Original Time Stamp, User Time Stamp), Display Name In Regions, Display Auto-Created Regions, Bars:Beats, Minutes:Seconds, Samples;
- **Windows:** Show/Hide Mix; Show Edit, MIDI Operations, Tempo/Meter; 1-9 on numeric keypad only – show: Transport, Session Setup, Big Counter, Automation Enable, Memory Locations, Disk Space;
- **Help:** Pro Tools Reference Guide, DigiRack Plug-Ins Guide, MIDI Controllers Guide, Keyboard Shortcuts, About Pro Tools.

- c.) **CONVERTERE**

- **WAV-MP3-WMA -**

**Funcțiile programului****MusicMatch Jukebox 6.00**<http://www.musicmatch.com>

- *File* : *Open* [All Song Files (cda, epcx, mp2, mp3, saf, wav, wma)], *Convert* [din wav in wma (5, 6, 8, 10, 12, 16, 20, 22, 32, 36, 40, 44, 48, 64, 80, 96, 128, 160 kbps), sau in mp3CBR (8, 16, 18, 20, 24, 32, 40, 48, 56, 64, 80, 96, 112, 128, 160, 192, 224, 256, 320 kbps), sau in mp3VBR (1-100%) ; din mp3 in wav, sau in wma (5-160 kbps), sau in mp3CBR (8-320 kbps), sau in mp3VBR (1-100%) ; din wma doar in wma (5-160 kbps)], *Add New Track(s) to Music Library*, *Open Music Library*, *Print*, *Export Play List Tracks*, *Create CD from Playlist*, *Exit* ;
- *Edit* : *Playlist Track Tag(s)*, *Select All in Playlist*, *Clear Playlist*, *Copy Art to Clipboard*, *Paste/Tag Art from Clipboard* ;
- *View* : *Small Player View*, *Full Player View*, *My Library*, *MusicMatch Radio*, *Music Guide*, *NowPlaying*, *Recorder*, *Media Window*, *Buy CD Site*, *Visualizations* (Select, Start, Configure), *Sound Enhancement* (Select, Enable, Show UI), *Auto Arrange Components*, *Always on Top* ;
- *Options* : *Player* [Play Control (Previous, Record, Play, Pause, Stop, Next, Seek backward/forward, Skip back songs/forward songs, Increase Volum, Decrease Volum, Mute), Play Cycle (Once, Repeat), Play Reording (Reorder by Album/Track, Shuffle), Equalizer, Settings], *Playlist* [Open Music, Auto DJ, Save Playlist, Clear Playlist], *Music Library* [New/Open/Save/Clear/Export/Import/Add New Track(s) to Music Library, Delete/Edit/Find Track(s), Search and Add Track(s) from All Drives, Music Library Settings], *Recorder* [Control (Start, Stop, Cancel, CDDb Refresh, Select All/None), Source (E:/CD, Line In, Mic In, System Mixer), Quality (MP3-160, 128, 96, 64 kbps ; WMA-128, 96, 64 kbps ; WAV ; Custom VBR-6% ; Custom CBR-48 kbps ; Custom WMA-5 kbps), Send Album Info to CDDb, Settings – NB-pentru auto-configurare : Settings/Recorder/Advanced/Autoconfig/medium], *Add New Features*, *Get Music Recommendations*, *Update Software*, *Change Skin*, *Download Skins*, *Change Text Size*, *Settings* ;
- *Help* : *MusicMatch Jukebox Help*, *Getting Started*, *Tip of Day*, *Additional Help Online*, *Purchase UpdateRegistration*, *Request Technical Support*, *Online Satisfaction Survey*, *About MusicMatch Jukebox*.

**Funcțiile programului****Shuffler Music Converter 4 r2**<http://www.ilustrate.org>

- *Convert (From)*: **MP3** File(s), **Wave** File(s), **WMA** File (s);
- *Next – Convert to Audio Format*: **Wave** (Quality 44.100 Hz, 16 Bit, Stereo), **MP3** (Quality 56, 64, 96, 128, 160, 192, 256, 320 Kbps, Stereo/Mono), **WMA** (Quality 32.000 Khz – 36, 48, 64, Kbps Stereo; 44.100 Khz – 48, 64, 96, 128, 160 Kbps Stereo); *Save Converted File(s)*: Same Folder as Original/This Folder-Browse;
- *Back/Convert*;
- *Exit*;
- *Help*;
- *About*.

**- WAV in MIDI -****Funcțiile programului****AmazingMIDI v1.70**

Copyright © 1998-2003 arakissoftware

<http://www.pluto.dti.ne.jp/~araki/amazingmidi/>

- *File* : Specify Tone File (piano0, piano1, pulse, sample, sine), Specify Input File (wav), Specify Output File (mid), Exit ;
- *Play* : Play Tone File, Play Input File, Play Output File ;

- *Transcribe* : Transcribe ;
- *View* : Zoom In Horizontally, Zoom Out Horizontally, Zoom In Vertically, Zoom Out Vertically ;
- *Help*: Contents, About AmazingMIDI.
- MIDI in WAV (sau MP3) –

#### **ACID Pro 4.0**

<http://sonicfoundry.com/acid>

- Prin activarea functiilor *File/Open/MIDI Files* si apoi *File/ Render As/Save as type WAV (sau MP3)* [NB - toate functiile acestui complex program de editare sunt prezentate mai jos].

#### **-IMAGINEA PARTITURII IN SUNET -**

##### ***Functiile programului***

**SharpEye Music Reader**

**version 1.15 (Mar 18 2000)**

**© 1999-2000 Graham Jones**

[www.visiv.co.uk](http://www.visiv.co.uk)

- **Image:** Display Image, Open (TIFF, BMP), Zoom (25%, 50%, 100%), Edit (Rotate Left/Right/By 180, Invert), Delete Zone, Read, Batch process, Exit ;
- **Music:** Save, Save As, Open ;
- **MIDI:** Save, Save As ;
- **NIFF:** Save, Save As ;
- **Options:** MIDI Options, Save window positions ;
- **Help:** Content, About SharpEye.

**NB** – Acest interesant program transforma imaginile partiturilor editate (dar nu si manuscritele) - scanate in prealabil (in formatele BMP si TIFF) - in fisiere audio (MIDI si NIFF/Notation Interchange File Format).

#### **- TEXT SCRIS IN SUNET (VOCE) -**

##### ***Functiile programului***

**River Past Talkative**

**Version 1.5.1.31216**

**© 2003 River Past Corporation**

[www.riverpast.com](http://www.riverpast.com)

- **File:** New, Open [Text File (txt), Rich Text Format (rtf)], Save As [Text File (txt), Rich Text Format (rtf)], Open Settings [River Past Talkative Settings 8sts], Save Settings [River Past Talkative Settings 8sts], Exit;
- **Edit:** Undo, Redo, Cut, Copy, Paste, Clear, Select All;
- **Speech:** Start, Pause, Stop, Record (WAV, PM3, WMA, AVI; Stereo/Mono; Resolution 8/16 bits, Sample Rates 8-48 khy, Bitrqte 352, 8 kb/sec.);
- **Download:** Latest DirectX, Windows Media Format runtime, Text-to-Speech Engine (SAPI 5.1);
- **Try:** Audio: Capture/CD Ripper/Converter; Screen Recorder, Video Cleqner, Video Perspective, Web Slides;
- **Help:** Contents, Buy Now, Register, Go to River Post Website, About River Past Talkative.

**NB** – Acest converter necesita si instalarea unor programe complementare (DirectX, SAPI 5.1 Text-to-Speech Engine, etc.), ce sunt descarcate automat de pe Internet prin activarea functiei

“Download”.

**- IMAGINEA FOTOGRAFICA IN SUNET -  
(pixels in MIDI)**

**Funcțiile programului**

**MIDIImage – The Loxound Musical Pixelator**

**Version 2.4.4.1**

**(conceput cu “Borland Delphi v.5”)**

**© 2003 Brute Force Programming, \_**

**© by Daniel J. Wojcik, Landstuhlerstr.2,Ramstein-Miesenbacg 66877 Germany**

**Imp@genjerdan.com**

**www.genjerdan.com**

- **File:** New Project [Project Files (Iprj), MIDI Files (mid), Configuration Files (Impc), WAVE Files (wav)], Open Project [Project Files (Iprj), Images (bmp, jpg, gif), MIDI Files (mid), Configuration Files (Impc), Patches (bank)], Save Project, Add Image to Project (jpg, jpeg, bmp, gif), Create Web Page, Save Settings As (mid, Iprj, Impc, wav), Load MIDI, Print Composition Settings, Exit;
- **Configure:** Pathes & Note Ranges, Select MIDI Device, Configure Scales, Bank Settings, Load Additional Patches (Banks);
- **Options:** Track 10 is Percussion, Boost Dynamics, Show Flyover Hints, Overwrite Image on Save, Strict Bank Control;
- **Tools:** Create Bank Patch List, Autoload SoundFonts, Go to Position, Track Editor;
- **Help:** Help, Program Info, Registration, Credits, MIDIImage Homepage.

**- d.) PROGRAME (WAV, MP3, MIDI) DE EDITARE MULTI-TRACKS**

**Funcțiile programului**

**ACID Pro 4.0**

**<http://sonicfoundry.com/acid>**

- **File:** *New, Open* [All Project and Media Files – incl. ACID Project Files (acd, acd-bak), MIDI Files (mid, smf, rmi), CD Audio, MP3 Audio (cda), Audio Interchange File Format (aif), OggVorbis (ogg), Quick Time (mov, qt, dv, gif), Sonic Foundry Audio (sfa), Sonic Foundry Perfect Clarity Audio (pca), Sonic Foundry Wave64 (w64), Wave Microsoft (wav), Windows Media Audio V8 (wma), Windows Media Video V8 (wmv)], *Save, Save As* [ACID Project File (acd), ACID Project File With Embedded Media (acd-zip), *Export Loops* [AIFF (aif), MP3 Audio (mp3), OggVorbis (ogg), Sonic Foundry Perfect Clarity Audio (pca), Wave Microsoft (wav)], *Render As* [AIFF (aif) Main Concept MPEG1 (mpg), Main Concept MPEG2 (mpg), MP3 Audio (mp3), OggVorbis (ogg), Quick Time (mov), Real Media (rm), Sonic Foundry Perfect Clarity Audio (pca), Sonic Foundry Wave64 (w64), Video for Windows (avi), Wave Microsoft (wav), Windows Media Audio V8 (wma), Windows Media Video V8 (wmv)], *Extract Audio from CD, Get Media from Web, Publish Setup, Publish, Properties* (Summary (Title, Artist, Engineer, Copyright, Comments), Audio (Master bus mode Stereo/5.a Round, Number of additional stereo busses, Sample rate-Hz., Bit depth-8/16/24)], Exit;
- **Edit:** *Undo Draw Event, Redo, Cut, Copy, Paste, Delete, Select All, Paste Repeat, Paste Insert, Trim, Split, Join, Fit to Time, Editing Tool* (Draw, Selection, Paint, Erase, Envelope, Time Selection, Next Tool, Previous Tool), *Undo All, Clear Undo History*;
- **View:** *Toolbar, Status Bar, Focus to Track View, Explorer, Chooper* (vizualizeaza in detaliu fisierul deschis), *Mixer, Video, Audio Plug-In* (introduce EQ), *Track Properties* (descrie fisierul deschis), *Surround Panner, Soft Synth Properties, Show Video Track, Show Bus Track, Zoom* (Normal, Edit, Overview), *Time Rules* [Show Time Ruler, Samples, Seconds, Time & Frames, Absolute Frames, Feet and Frames 16 mm (40 fpf) si 35 mm (16 fpf), SMPTE Film



- Sync (24 fps), SMPTE EBU (25 fps, Video), SMPTE Non-Drop (29.97 fps, Video), SMPTE Drop (29.97 fps, Video), SMPTE 30 (30 fps, Audio), Set Time at Cursor], *Show Envelopes (Volume, Pan), Minimize All Tracks;*
- *Insert: Marker, Region, Time Marker, Tempo/Key/Time Signature Cnage, Command MIDI Track, Assignable FX, Bus, Soft Synth (DLS Soft Synth, Sonic Foundry Inc.), Time, Envelopes (Volume, Pan);*
  - *Tools: Render to New Track, Burn Track-at-Once Audio CD, Start AC-3DVD Burner, Reset All MIDI Ports, Edit in Sound Forge;*
  - *Options: Snapping (Enable, Grid Only), Grid Spacing (Ruler Marks, Measures, Half Notes, Quarter Notes, Quarter Notes Triplets, 8<sup>th</sup> Notes, 8<sup>th</sup> Notes Triplets, 16<sup>th</sup> Notes, 16<sup>th</sup> Notes Triplets, , 32<sup>th</sup> Notes, 32<sup>th</sup> Notes Triplets, 64<sup>th</sup> Notes, 64<sup>th</sup> Notes Triplets), Ripple Edits, Lock Envelopes to Events, Loop Playback, Enables Real-Time MIDI, Timecode (Generate MIDI Timecode, Generate MIDI Clock, Trigger from MIDI Timecode), Customize Toolbar, Preferences;*
  - *Help: Contents and Index, What`s This ?, Keyboard Shorcuts, ACIDplanet.com, Sonic Foundry on the Web, About ACID Pro.*

*Comenzi Mouse-dreapta: Select in Chopper, Select All on Track, Select Events to End, Cut, Copy, Paste, Delete, Split at Cursor, Join, Pitch Shift (Up Semitone, Down Semitone, Reset), Insert/Remove Envelope (Volum, Pan, Bus A,B,C, FX Automation), FX Automation Envelopes (FX Automation), Quick Fade Edges, Properties, Zoom to Loop Region; Add Point: Cut, Copy, Paste, Delete, Linear Fade, Fast Fade, Slow Fade, Smooth Fade, Sharp Fade, Hold, Select All, Reset All;*

*Comenzi incluse in Track (de la stanga la dreapta): Minimize/Restore, Nume Track, Microsoft Sound Mapper, Track FX, Mute, Solo.*

#### **OPERATII CURENTE CU „SAMPLES“ SI „LOOPS“**

*Acest program bazat pe tehnica buclilor sonore („loops based music creation“) implica combinarea mai multor scurte fragmente muzicale pre-inregistrate („samples“), ce sunt ordonate intr-un folder special, reprezentand o banca de esantioane sonore (de obicei in formatele wav, mp3 sau midi). Prin comanda „File/Open“ acestea pot fi inserate in track-uri (linii temporale), prin trasarea lor cu „creionul“ digital activat prin comanda „Draw Tool button“. Esantioanele mai lungi de 30“ se pot sincroniza prin „Beatmapper Wizard“, ce determina precizarea unui tempo comun tuturor track-urilor (in BPM = bits per minute, primul timp din prima masura fiind considerat „Downbeat“). Tempourile si inaltimile acestor esantioane sonore („samples“) pot fi ulterior reformulate la diferite scari („rates“) de durate si frecvente, prin operatia „resample“. De asemenea, in cadrul track-urilor se pot efectua operatiile curente, (cut, copy, paste, delete, split, etc.), precum si cele referitoare la configurarea dinamicii si a micro- structurii sonore („envelope“). Compozitia rezultata prin suprapunerea mai multor track-uri poate fi salvata („Save“, „Save As“) in formatele specifice programului (acd, acd-zip), precum si in celelalte formate uzuale – ca bucla sonora („File/Export loops“ – aif, mp3, ogg, pca, wav) sau ca lucrare definitivata („File/Render As“ – aif, mp3, ogg, mov, rm, pca, wwav, wma, etc.). Acest program bazat pe bucle sonore („loops“) reprezinta o cale foarte eficienta de sinteza a structurilor muzicale de factura repetitiva.*

#### **- e.) PROGRAME COMPLEMENTARE**

##### *Funcțiile programului*

##### **KB PIANO Version 1.1**

© 2003 Gabriel Fernandez

<http://www.qfsoftwqre.com>

- *File: New, Open (KBPiano Files – kbp), Save, Save As (kbp), Export to MIDI File (mid), Properties (Title, Author, Comment), Exit;*
- *Channel: Delete Events, Remove Vol Messages, Remote Pan Messages, Clear channel;*
- *Options: Tuning, Show notes, Mem used, Midi devices, Restart Device;*
- *Metronome: Set up (Milliseconds, Sound number, Volume), Enabled;*

- *Help: Contents, KB Shortcuts, Quick Help, Support the author, About;*
- *Alte comenzi: Patch, QChord, Play, Rec (Rec Over, Solo), Stop, Undo, Pan, Octave (1-6), Channel [1-12, + (13-15), Name], Channel Volume, Master Volume.*
- *NB – Prin comanda “Rec”, programul transforma tastatura (keyboard-ul) computerului intr-o claviatura muzicala: prima linie de taste alfabetice in sistemul anglo-american (QWERTYUIOP[ ]) devine o claviatura cu un ambitus diatonic de o duodecima (C2-G3), cromatizabil prin adaugarea accidentilor (linia de taste numerice “2356790=” de deasupra) si extensibil la 6 octave (C2-G8), prin comanda “Octave 1-6” (sau F1 – F6); de asemenea, prin activarea liniei IV de taste alfabetice (ZXCVBNM) se pot obtine trisonuri diatonice pe ambitusul C2-G3, extensibil la 6 octave prin tastele F7 – F12 (configuratia acordurilor putand fi setata prin comanda QChord). Linile de taste alfabetice monodice (tastele diatonice “QWERTYUIOP[ ]” – la care se adauga tastele cromatice “2356790=”) si acordice (ZXCVBNM) se pot utiliza simultan; astfel, programul permite inregistrarea unor linii monodice (“Rec/Solo”), cat si omofonice, polifonice sau eterofonice (prin suprapuneri consecutive - “Rec/Rec Over”) pe toate cele 15 canale disponibile – canalul 9 fiind rezervat percutiei. Compozitia rezultata poate fi salvata (prin “Save” sau “Save As”) in formatul specific “KBPiano File” (kbp – ce nu este inasa recunoscut de alte programe) sau in formatul MIDI (prin “Export to MIDI File”) – format universal ce poate fi ulterior convertit intr-o partitura muzicala (de pilda, prin programul “MOZART 6” - comanda “File/Import MIDI”), sau integrat ca mostra (“sample”) sau bucla (“loop”) in programul “ACID Pro 4.0”.*

#### Funcțiile programului

#### PRAAT doing phonetics by computer

#### Version 4.1.12

© 1992-2003 by Paul Boersma and David Weenink

© 1992-1998 Summer Institute of Linguistics

#### - 1.) PRAAT objects

- *Control: Statistics, New Praat script, Open Praat script, Goodies (Calculator, Stop playing sound, Report floating point properties), Preferences (Buttons, Sound input prefs, Sound output prefs), Quit;*
- *New: Record mono sound, Record stereo sound, Sound (Create sound, Create sound from: tone complex, gamma tone, Shepard tone), Matrix (Create Matrix, Create simple Matrix), Tables [Create Table, Create TableOfReal, Create formant table (Pools & Van Nierop 1973), Create formant table (Peterson & Barney, 1952), Create TableOfReal (Pols 1973)], Tiers (Create: empty PointProcess, Poisson process, PitchTier, FormantTier, IntensityTier, DurationTier, AmplitudeTier), Create TextGrid, Create Strings as file list, Optimaly Theory (OT learning tutorial, Create: NoCoda grammar, place assimilation grammar, place assimilation distribution, tongue-root grammar, metrics grammar), Articulatory synthesis (AS tutorial, Create: Articulation, Speaker, Artword, Vocal Track from phone), Polynomial (Create: Polynomial, LegendreSeries, ChebyshevSeries, MSpline, Ispline), Multidimensional scaling (MDS tutorial, Create: letter R example, INDSCAL Carrol Wish example, Configuration; Draw splines and MDS class relations), Neural nets (FFNet tutorial, Create: Freedforward Net, Pattern with zeroes, empty Categories, iris example);*
- *Read: Read from file, Open long sound file, Read two Sounds from stereo file, Read from special sound file (raw Alaw file, 16-bit Little Endian file, 16-bit Big Endian file), Read Matrix from raw text file, Read Strings from raw text file, Read TableOfReal from headerless spreadsheet file, Read Table from table file, Read from special tier file (Text Tier from Xwaves, Interval Tier from Xwaves);*
- *Write;*
- *Help: Object window, Intro, FAQ, What’s new, Types of objects, Editors, Acknowledgments, Formulas tutorial, Scripting tutorial, Programming, Go to manual page, Search Praat manual, About Praat.*

#### - 2.) PRAAT picture

- *File: Read from praat picture file, Write to praat picture file, Write to Windows metafile, Copy to clipboard, PostScript setting, Write to EPS file, Write to fontless EPS file, Print;*
- *Edit: Undo, Erase all;*
- *Margins: Draw inner box; Text-left, right, top, bottom; Marks-left every, right every, bottom every, top every; One mark-left, right, bottom, top; Marks (left, right, bottom, top); Logarithmic marks (left, right, bottom, top), One logarithmic mark (left, right, bottom, top); Axes;*
- *World: Text; Text special; Draw-line, arrow, two-way arrow; Draw/Paint rectangle; Draw:Paint sounded rectangle; Draw arc; Draw/Paint ellipse; Draw/Paint circle; Draw/Paint circle (mm); Axes; Measure [Horizontal-mm to wc, wc to mm; Vertical-mm to wc, wc to mm; Text width (wc, mm), PostScript text width (wc, mm)];*
- *Select: Plain/Dotted/Dashed line; Line width, Black/White/Red/Green/Blue/Yellow/Cyan/Magenta/Maroon/Lime/Navy/Teal/Purple/Olive/Silver/Grey;*
- *Font: 10/12/14/18/24; Font size; Times/Helvetica/New Century Schoolbook/Palatino/Courier;*
- *Help: Picture window help, About special symbols, About text styles, Phonetic symbol chart, Search manual.*

**NB** – Acest foarte specializat program este dedicat analizei, sintezei si prelucrării sunetelor (cuvintelor), precum si generării unor imagini grafice complexe ale fenomenului sonor. Programul PRAAT este utilizat si in experimentele efectuate la CCRMA – Stanford University.

### Principalele functii ale programului

#### Fractal Tune Smithy v.2.21

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[www.tunesmithy.co.uk](http://www.tunesmithy.co.uk)

[support@tunesmithy.co.uk](mailto:support@tunesmithy.co.uk)

- **NB** – Programul genereaza melodii fractale in baza unor moduri prefigurate, dar sintetizeaza si noi moduri, precum si noi configuratii ale desenelor melodice fractale imaginat de utilizator. Structurile melodice rezultate pot fi salvate in mai multe formate audio - inclusiv in formatul MIDI, ce poate fi convertit ulterior in partituri, inclusiv prin programele de redactat mentionate mai sus: “Mozart” (functia “Import MIDI”), “Finale”, “Sibelius”, “NoteWorthy Composer”, “Lime”, “Encore”,etc.
- **Funcțiile de baza** : *Chose a View* (la lansarea programului – cu optiunile: Tune Smithying, Play Fractal Tunes, Scales Work, etc.), *File* (New, Open, Save, Save As, etc.), *Out* (Midi default, Play Control, etc.), *In* (Options, etc.), *Voices* (configurarea timbrelor MIDI), *Parts*, *Pitch*, *Bs*. (Play, Stop, Pause/Continue, Record, Arpeggio & Scale Playback, etc.), *View* (Tune Smithying, Play Fractal Tunes, Scales Work, etc.), *Help* (Help, About, etc.).
- **Cele mai importante arhetipuri modale incluse in program:**

1 n(1/7) ! 7 tone modes: 1 1 2 1 2 Thai mode 1; +1 2 1 2 1 Thai mode 2; 2 1 1 2 1 Thai mode 6.

Modes for default scales.lmd Alternate notes: 1 122 cents 271 cents 571 cents 677 cents 785 cents ! Typical 7 note Pelog scale; [2] 1 1 2 3 Slendro Alit; +[1] 1 2 2 2 Jegog; 1 3 1 1 1 Dangsoe; 1 1 1 3 1 Manyura; 1 1 2 1 2 Patet Lima, Patet Nem, Jawar, Selisir; [1] 1 2 1 1 2 Patet Barang; 1 2 1 1 2 Patet Lima, Nem with Pelog; [1] 1 1 2 1 2 Patet Barang with Pelog, Manangis, Slendro Gede, Pergenter 2; [2] 1 1 2 1 2 Liwung, Pergenter 1, Pengenter Alit; [3] 1 1 2 1 2 Tembung; [4] 1 1 2 1 2 Nyorog, Sunaren; [5] 1 1 2 1 2 Nyorog handap, Baro; 2 1 1 2 1 Pelog; 1 2 1 2 1 Bem, Pengenter; 2 1 2 1 1 Miring, Slendro 2; [4] 2 1 2 1 1 Slendro 1; [1] 2 1 2 1 1 Slendro 3; [3] 2 1 2 1 1 Slendro 4; 1 1 1 1 1 1 1 Lebeng.

Modes for default scales.lmd Alternate notes: 1 n(1/12) ! 12 tone modes; 10 2 Warao ditonic: South America; +5 7 Honchoshi: Japan; 7 5 Niagari: Japan; 6 1 5 Raga Ongkari; 3 7 2 Ute tritonic; 5 2 5 Raga Sarvasri, Warao tritonic: South America; 5 5 2 Sansagari: Japan; 3 4 5 Peruvian tritonic 2; 4 3 5 Raga Malasri, Peruvian tritonic 1; 1 5 1 5 Messiaen truncated mode 5; 5 1 5 1 Messiaen truncated mode 5 inverse; 2 1 7 2 Warao tetratonic: South America; 2 4 5 1 Raga Sumukam; 1 4 3 4 Raga Lavangi; 2 2 3 5 Eskimo tetratonic (Alaska: Bethel); 2 3 2 5 Genus primum; 5 2 3 2 Genus primum inverse; 2 4 2 4 Messiaen truncated mode 6; 4 2 4 2 Messiaen truncated mode 6 inverse; 2 3 4 3 Raga Bhavani; 4 3 3 2 Raga Mahathi; 3 4 3 2 Bi Yu: China; 1 6 1 3 1 Raga Deshgaur; 1 3 1 6 1 Raga Megharanji; 1 1 4 1 5 Raga Nabhomani; 1 5 1 1 4 Raga Saugandhini, Yashranjani; 5 2 1 3 1 Raga Devaranjani (Devaranji); 2 1 4 1 4 Hira-joshi, Kata-kumoi: Japan: =1 4 2 1 4 Hon-kumoi-joshi, Sakura, Akebono II: Japan, Olympos Enharmonic, Raga Salanganata, Saveri, Gunakri (Gunakali), Latantapriya; 1 4 1 4 2 Iwato: Japan: 4 2 1 4 1 Raga Amritavarshini, Malashri, Shilangi; 4 1 4 2 1 Raga Bhinna Shadja, Kaushikdhvani, Hindolita; 1 2 4 1 4 Balinese Pelog, Raga Bhupalam, Bhupala Todi, Bibhas; 4 1 2 4 1 Raga Gambhiranata, Ryukyu: Japan; 1 4 2 4 1 Raga

- Gauri;4 1 4 1 2 Raga Khamaji Durga;2 4 1 4 1 Raga Vaijayanti, Hamsanada;4 1 2 1 4 Raga Zilaf;4 1 3 3 1 Bacovia: Romania, Raga Girija;1 4 3 3 1 Raga Kshanika;1 3 1 3 4 Raga Megharanjani, Syrian pentatonic;3 3 1 4 1 Raga Multani;1 3 3 1 4 Raga Reva, Revagupti, Ramkali, Vibhas (bhairava);2 2 2 5 1 Raga Kumurdaki (Kumudki);5 2 2 1 2 Raga Kuntvarali;2 5 2 1 2 Raga Matha Kokila (Matkokil);2 2 5 2 1 Raga Neroshta;2 1 2 2 5 Raga Purnalalita, Chad Gadyo: Jewish, Ghana Pentatonic 1;5 2 2 2 1 Raga Puruhutika, Purvaholika;2 3 2 1 4 Han-kumoi: Japan, Raga Shobhavari;1 4 2 3 2 Kokin-joshi, Miyakobushi, Han-Iwato: Japan, Raga Vibhavari (Revati), Bairagi, Lasaki
- 1 4 2 2 3 Altered Pentatonic, Raga Manaranjani II:** 2 1 2 4 3 Raga Abhogi;2 1 2 3 4 Raga Audav Tukhari;2 2 3 1 4 Raga Bhupeshwari, Janasammadini;3 2 4 2 1 Raga Chandrakauns (modern), Marga Hindola, Rajeshwari;3 2 4 1 2 Raga Chandrakauns (kafi), Surya, Varamu;1 2 3 2 4 Raga Chhaya Todi;2 3 2 4 1 Raga Desh;4 2 1 2 3 Raga Dhavalashri;2 2 3 4 1 Raga Hamsadhvani (Hansadhvani);3 2 1 4 2 Raga Jayakauns;3 2 2 1 4 Raga Kokil Pancham;4 3 2 2 1 Raga Mamata;4 1 2 2 3 Raga Nagasvaravali, Raga Mand;3 2 2 4 1 Raga Nata, Udayaravicandrika, Madhuranjani;4 2 3 2 1 Raga Hindol (Sunada Vinodini), Sanjh ka Hindol;2 3 4 2 1 Raga Rasranjani;2 1 4 2 3 Raga Sivaranjini (Shivranjani), Akebono I: Japan, Dorian Pentatonic;3 4 1 2 2 Raga Shailaja;2 4 1 2 3 Raga Shri Kalyan;4 3 2 1 2 Raga Valaji;4 1 2 3 2 Mixolydian Pentatonic, Raga Savethri;2 3 3 1 Raga Chandrakauns (kiravani);1 3 3 3 2 Raga Manaranjani I;3 1 3 2 3 Raga Mohanangi;2 3 3 3 1 Raga Priyadharshini;1 3 3 2 3 Raga Rasika Ranjani, Vibhas (marva), Scriabin;3 3 1 3 2 Raga Samudhra Priya, Madhukauns (pentatonic);2 3 2 2 3 Ritusen, Ritsu (Gagaku): Japan, Zhi, Zheng: China, Raga Devakriya, Durga, Suddha Saveri, Arabhi, Scottish Pentatonic, Ujo: Korea, Major complement;2 2 3 2 3 Major Pentatonic, Ryosen: Japan, Man Jue, Gong: China, Raga Bhopali (Bhup), Mohanam, Deskar, Bilahari, Kokila, Jait Kalyan, Peruvian Pentatonic 1, Ghana pent.2;2 3 2 3 2 Yo: Japan, Suspended Pentatonic, Raga Madhyamavati, Madhmat Sarang;gyptian;Rui Bin, Jin Yu, Qing Yu: China;2 2 3 2 2 Chao: China;2 2 3 3 Kung: China;3 2 2 3 2 Minor Pentatonic, Raga Dhani (Suddha Dhanyasi), Abheri, Udhayaravi Chandrika, Qing Shang, Gu Xian, Jia Zhong, Yu: China, P'yongjo-kyemyonjo: Korea, Minyo: Japan, Peruvian Pentatonic 2, Blues Pentatonic;3 3 2 2 2 Raga Harikauns, Chin: China;3 2 3 2 2 Raga Malkauns (Malakosh), Raga Hindola, Man Gong, Quan Ming, Yi Ze, Jiao: China;2 2 3 3 2 Dominant Pentatonic, Shang: China;3 2 2 2 3 Minor added sixth Pentatonic, Kyemyonjo: Korea;1 1 4 1 4 1 Raga Vijayasri;1 1 4 1 1 4 Messiaen mode 5;4 1 1 4 1 1 Messiaen mode 5 inverse;2 2 1 1 5 Raga Dipak;2 1 3 1 4 1 Raga Amarasenapriya;1 1 4 1 2 3 Raga Chandrajyoti;1 3 2 1 1 4 Raga Dhavalangam;1 3 1 2 4 1 Raga Gaula;1 4 2 1 1 3 Raga Kalakanthi;2 4 1 3 1 1 Raga Malarani (Hamsanada);1 3 2 1 4 1 Raga Mandari, Gamakakriya, Hamsanarayani;1 4 2 1 3 1 Raga Padi;4 1 2 1 3 1 Raga Paraju, Ramamanohari, Simhavahini, Sindhu Ramakriya, Kamalamanohari;1 3 1 2 1 4 Raga Purna Pancama, Malahari, Geyahejjajji, Kannadabangala;3 1 2 1 4 1 Raga Rasamanjari;1 3 1 4 1 2 Raga Rudra Pancama;4 1 2 1 1 3 Raga Saravati (Sharavati);2 1 3 1 1 4 Raga Syamalam;4 1 2 3 1 1 Raga Tilang, Savitri, Brindabani Tilang;1 3 1 4 2 1 Raga Vasanta, Chayavati;4 2 1 3 1 1 Raga Vijayavasanta;1 3 3 1 3 1 Raga Bauli;3 3 1 3 1 1 Raga Jivantini, Gaurikriya;1 3 3 1 1 3 Raga Kalagada;1 3 1 3 3 1 Raga Lalita, Sohini, Hamsanandi, Lalit Bhairav;1 1 3 3 1 3 Raga Suddha Mukhari;1 3 1 3 1 3 Messiaen truncated mode 3, Prometheus (Liszt);3 1 3 1 3 1 Messiaen truncated mode 3 inverse, Major Augmented, Genus tertium.
- 2 1 4 2 2 1 Hawaiian:** 2 1 2 4 1 2 Raga Bagesri, Sriranjani, Kapijingla;2 2 2 1 4 1 Raga Caturangini;2 2 1 4 2 1 Raga Hamsa Vinodini;4 1 2 2 2 1 Raga Hari Nata, Genus secundum;2 4 1 1 2 2 Raga Jaganmohanam;1 4 2 2 2 1 Raga Jivantika;4 2 1 1 2 2 Raga Jyoti;4 1 2 1 2 2 Raga Kamalamanohari;4 1 2 2 1 2 Raga Khamas, Baduhari;2 1 4 2 1 2 Raga Manavi;2 2 1 2 4 1 Raga Nalinakanti, Kedaram;1 4 2 1 2 2 Raga Phenadyuti, Insen, Honchoshi, Niagari: Japan;1 2 2 1 4 2 Honchoshi plagal form: Japan;2 2 1 4 1 2 Raga Rageshri (Rageshwari), Nattaikurinji;1 4 2 2 1 2 Raga Rasavali;1 2 4 2 1 2 Raga Salagavarali;2 4 1 2 1 2 Raga Sarasvati;2 1 2 2 4 1 Raga Sindhura Kafi;1 2 2 2 1 4 Raga Suddha Simantini;2 1 4 1 2 2 Raga Trimurti;4 2 1 2 1 2 Raga Vutari;1 3 2 3 1 2 Prometheus Neapolitan;3 2 1 1 3 2 Blues scale I;2 1 2 1 3 3 Pyramid Hexatonic;1 2 2 1 3 3 Double-Phrygian Hexatonic;3 1 1 2 3 2 Raga Bhanumanjari, Jog;2 3 2 1 3 1 Raga Bhinna Pancama;2 1 2 3 3 1 Raga Ghantana, Kaushiranjani (Kaishikiranjani).
- 1 2 3 2 3 1 Raga Gurjari Todi:** 1 3 2 3 2 1 Raga Hamsanandi, Marva, Pancama, Puriya;1 3 2 2 1 3 Raga Hejjajji;1 3 1 2 2 3 Raga Kalavati, Ragamalini;2 2 3 1 3 1 Raga Latika;3 3 1 2 1 2 Raga Madhukauns (hexatonic);1 3 3 2 1 2 Raga Malayamarutam;2 1 3 3 2 1 Raga Ranjani, Rangini;2 3 2 3 1 1 Raga Brindabani Sarang, Megh (Megh Malhar);2 2 1 3 3 1 Raga Sarasanana;2 1 3 1 3 2 Raga Simharava (Sinharavava);3 2 2 1 3 1 Raga Takka;1 3 1 3 2 2 Raga Vasantabhairavi;2 1 3 1 2 3 Raga Vijayanagari;1 2 2 3 3 1 Raga Vijogavarali;1 2 3 1 2 3 Messiaen truncated mode 2;1 3 2 1 3 2 Messiaen truncated mode 2;3 2 2 1 2 P'yongjo: Korea, Yosen: Japan, Raga Darbar, Narayani, Suposhini, Andolika, Gorakh Kalyan, Mixolydian Hexatonic;2 2 2 3 1 2 Prometheus, Raga Barbara;1 2 2 3 2 2 Ritsu: Japan, Raga Suddha Todi;2 2 1 2 2 3 Arezzo Major Diatonic Hexachord, Raga Kambhoji, Devarangini, Scottish Hexatonic;2 1 2 2 3 2 Minor Hexatonic, Raga Palasi, Manirangu, Nayaki, Yo: Japan, Eskimo Hexatonic 1 (Alaska: King Island);2 2 2 2 3 1 Eskimo Hexatonic 2 (Alaska: Point Hope);1 2 3 2 2 2 Raga Bhavani;1 2 2 2 3 2 Raga Gandharavam;3 2 2 1 2 2 Raga Gopikavasantam, Desya Todi, Phrygian Hexatonic;2 2 3 2 2 1 Raga Kumud, Sankara (Shankara), Lydian Hexatonic;3 2 2 2 1 2 Raga Manohari;2 2 2 3 2 1 Raga Mruganandana;2 3 2 2 2 1 Raga Nagagandhari;2 3 2 1 2 2 Raga Navamanohari;2 2 1 2 3 2 Raga Siva Kambhoji, Vivardhini;2 1 2 2 2 3 Raga Suddha Bangala, Gauri Velavali;2 2 2 1 2 3 Raga Yamuna Kalyani, Kalyani Keseri, Ancient Chinese;2 2 2 2 2 2 Whole-tone, Messiaen mode 1, Raga Gopriya, Anhemitonic Hexatonic.
- 1 1 4 1 1 1 3 Mela Salaga:** 1 1 4 1 1 3 1 Mela Jhalavarali, Raga Varali, Jinavali;1 1 4 1 3 1 1 Mela Raghupriya, Raga Ravikriya, Ghandarva;1 1 4 1 1 2 2 Mela Jalarnava;1 1 4 1 2 1 2 Mela Navanitam, Raga Nabhomani;1 1 4 1 2 2 1 Mela Pavani, Raga Kumbhini;2 2 1 4 1 1 1 Raga Ragesri;4 1 2 2 1 1 1 Raga Madhuri;1 1 3 1 1 3 2 Chromatic Mixolydian;1 3 1 1 3 2 1 Chromatic Lydian, Raga Lalit, Bhankar;3 1 1 3 2 1 1 Chromatic Phrygian;1 1 3 2 1 1 3 Chromatic Dorian, Mela Kanakangi, Raga Kanakambari;1 3 2 1 1 3 1 Chromatic Hypolydian, Purvi That, Mela Kamavardhani, Raga Shri, Pantuvarali, Basant, Kasiramakriya, Suddharamakriya, Puriya Dhanashri, Dhipaka;3 2 1 1 3 1 1 Chromatic Hypophrygian, Blues scale III;2 1 1 3 1 1 3 Chromatic Hypodorian, Raga Dvigandharabushini;2 3 1 1 3 1 1 Chromatic Mixolydian inverse;1 1 2 3 1 1 3 Chromatic Phrygian inverse;1 1 3 1 1 2 3 Chromatic Hypophrygian inverse;3 1 3 1 1 2 Chromatic Hypodorian inverse;1 1 3 2 1 3 1 Mela Ganamurti, Raga Ganasamavarali;1 1 3 2 3 1 1 Mela Tanarupi, Raga Tanukirti;1 3 1 1 2 3 1 Raga Lalita, Chromatic Hypolydian inverse, Raga Suddha Pancama;1 3 1 2 1 1 3 Mela Gayakapriya, Raga Kalakanti, Gipsy Hexatonic;1 3

- 1 2 1 3 1 Major Gipsy, Persian, Double Harmonic Major, Bhairav That, Mela Mayamalavagaula, Raga Paraj, Kalingada, Second Byzantine mode, Hitzaskiar: Greece, Maqam Zengule, Hijaz Kar, Suzidil; 1 3 1 2 3 1 1 Mela Hatakambari, Raga Jeyasuddhamalavi; 3 1 1 2 1 1 3 Mela Yagapriya, Raga Kalahamsa; 3 1 1 2 1 3 1 Mela Gangeyabhusani, Raga Gangatarangini, Sengah: Greece; 3 1 1 2 3 1 1 Mela Calanata, Raga None, Chromatic Dorian inverse; 1 2 3 1 1 1 3 Mela Gavambodhi, Raga Girvani; 1 2 3 1 1 3 1 Todi That, Mela Shubhapantuvarali, Raga Multani, Gamakasamantam, Chromatic Lydian inverse.
- 1 2 3 1 3 1 1 Mela Divyamani; 1 3 2 1 1 1 3 Mela Dhavalambari, Foulds' Mantra of Will scale; 1 3 2 1 3 1 1 Mela Visvambhari, Raga Vamsavathi; 1 3 1 3 2 1 1 Verdi's Enigmatic descending; 2 1 3 1 1 1 3 Mela Syamalangi, Raga Shyamalam; 2 1 3 1 1 3 1 Minor Gipsy, Mela ;imhendramadhyama, Raga Madhava Manohari, Maqam Nawa Athar, Hisar, Double Harmonic Minor, Hungarian Minor, Niavent: Greece; 2 1 3 1 3 1 1 Mela Nitimati, Raga Nisada, Kaikavasi; 3 1 2 1 1 1 3 Mela Sucaritra, Raga Santanamanjari; 3 1 2 1 1 3 1 Mela Dhatuvardhani, Raga Dhauta Pancama, Devarashtra; 3 1 2 1 3 1 1 Mela Rasikapriya, Raga Rasamanjari, Hamsagiri; 1 3 1 1 3 1 2 Oriental, Raga Ahira-Lalita, Minor Gipsy inverse; 2 1 2 2 1 3 1 Harmonic Minor, Spanish gipsy, Mischung 4, Pilu That, Mela Kiravani, Raga Kiranavali, Kirvani, Kalyana Vasantha, Deshi(3), Maqam Bayat-e-Esfahan, Zhalibny Minor; 1 3 1 2 2 1 2 Harmonic Minor inverse, Mela Cakravaka, Raga Ahir Bhairav, Bindumalini, Vegavahini, Makam Hicaz, Zanjaran; 2 2 1 2 1 3 1 Harmonic Major, Mela Sarasangi, Raga Haripriya, Mischung 2, Ethiopian; 1 2 1 3 1 2 2 Makam Huzzam, Phrygian flat 4; 2 2 1 3 1 2 1 Ionian sharp 5; 1 2 2 1 3 1 2 Locrian natural 6, Maqam Tarznaun; 2 1 2 1 3 1 2 Locrian no.2; 1 2 1 2 2 1 3 Ultra Locrian, Mixolydian sharp 1; 1 2 2 1 2 1 3 Locrian double-flat 7; 2 3 1 2 1 2 1 Nohkan Flute scale: Japan; 2 1 1 3 1 2 2 Sambah (Sabach): Greece; 2 1 2 1 3 1 2 Makam Karcigar, Dorian flat 5, Kiourdi ascending: Greece; 2 1 2 1 3 2 1 Jeths' mode; 1 1 3 2 1 2 2 Mela Ratnangi, Raga Phenadyuti; 1 1 3 2 2 1 2 Mela Vanaspati, Raga Bhanumati; 1 1 3 2 2 2 1 Mela Manavati, Raga Manoranjani; 1 2 2 2 1 1 3 Mela Senavati, Raga Senagrani, Malini; 1 2 2 2 1 3 1 Neapolitan Minor, Mela Dhenuka, Raga Dhunibinnashadjam, Maqam Shahnaz Kurdi.
- 1 2 2 2 3 1 1 Mela Rupavati; 1 3 1 2 1 2 2 Mela Vakulabharanam, Alhijaz: Arabic, Raga Jogiya, Vativasantabhairavi, Ahava Rabba: Jewish, Maqam Humayun, Hitzaz: Greece, Dorico Flamenco: Spain, Harmonic Major inverse, Phrygian Dominant; 1 3 1 2 2 2 1 Mela Suryakanta, Bhairubahar That, Raga Supradhipam, Sowrashtram.
- 2 1 2 1 1 3 2 Modified Blues; 2 1 2 2 1 1 3 Mela Jhankaradhvani, Raga Jhankara Bhrumavi; 2 1 2 2 3 1 1 Mela Varunapriya, Viravasantham; 2 2 1 2 1 1 3 Mela Mararanjani, Raga Keseri; 2 2 1 2 3 1 1 Mela Naganandini, Raga Nagabharanam, Samanta; 3 1 1 2 1 2 2 Mela Ragavardhani, Raga Cudamani; 3 1 1 2 2 1 2 Mela Vagadhisvari, Raga Bhogachayanata, Nandkauns, Ganavaridhi, Bluesy R&R; 3 1 1 2 2 2 1 Mela Sulini, Raga Sailadesakshi, Raga Trishuli, Houzam: Greece; 1 2 3 1 1 2 2 Mela Bhavapriya, Raga Bhavani, Kalamurti; 1 2 3 1 2 1 2 Mela Sadvidhamargini, Raga Sthavarajam, Tivravahini; 1 2 3 1 2 2 1 Mela Suvarnangi, Raga Sauviram; 1 3 2 1 1 2 2 Mela Namanarayani, Raga Narmada, Pratapa; 1 3 2 1 2 1 2 Mela Ramapriya, Raga Ramamanohari, Romanian Major, Petrushka chord; 1 3 2 1 2 2 1 Marva That, Mela Gamanasrama, Raga Partiravam, Puriya, Puriya Kalyan, Sohani, Peiraiotikos: Greece.
- 1 3 2 2 2 1 1 Verdi's Enigmatic ascending; 2 1 3 1 1 2 2 Mela Sanmukhapriya, Raga Camara, Chinthamani; 2 1 3 1 2 1 2 Mela Hemavati, Raga Desisimharavam, Maqam Nakriz, Tunisian, Hedjaz, Misheberekh: Jewish, Souzinak (Peiraiotiko Minore): Greece, Dorian sharp 4, Kaffa; 2 1 3 1 2 2 1 Lydian Diminished, Mela Dharmavati, Raga Arunajualita, Dumyaraga, Madhuvanti, Ambika.
- 2 2 2 1 1 1 3 Mela Kantamani, Raga Kuntala, Srutiranjani; 2 2 2 1 1 3 1 Mela Latangi, Raga Gitapriya, Hamsalata; 2 2 2 1 3 1 1 Mela Citrambari, Raga Chaturangini; 2 3 2 2 1 1 1 Raga Sorati, Sur Malhar; 3 1 2 1 1 2 2 Mela Jyotisvarupini, Raga Jotismatti; 3 1 2 1 2 1 2 Hungarian Major, Mela Nasikabhusani, Raga Nasamani; 3 1 2 1 2 2 1 Mela Kosalam, Raga Kusumakaram, Lydian sharp 2; 3 1 2 2 1 2 1 Aeolian flat 1; 1 2 2 1 2 2 2 Gr.Mixolydian, Gr.Hyperdorian, Med.Hypophrygian, Med.Locrian, Pien chih: China, Makam Lami, Yishtabach: Jewish; 2 2 1 2 2 2 1 Gr.Lydian, Med.Ionian, Med.Hypolydian, Major, Bilaval That, Mela Shankarabharanam, Ghana Heptatonic, Peruvian major, 4<sup>th</sup> plagal Byzantine, Ararai: Ethiopian, Makam Cargah, Ajam Ashiran, Dastgah Mahur, Dastgah Rast Panjgah; 2 1 2 2 2 1 2 Gr.Phyrgian, Med.Dorian, Med.Hypomixolydian, Kafi That, Mela; araharapriya, Raga Bageshri, Sriraga, Bhimpalasi, Mischung 5, Dorian nr.8, Eskimo Heptatonic, Yu: China, Hyojo, Oshikicho, Banshikicho: Japan; 1 2 2 2 1 2 2 Gr.Dorian, Med.Phyrgian, Gr.Med.Hypoaolian, Bhairavi That, Mela Hanumatodi, Raga Asavari (Asaveri), Raga Bilashkhani Todi, In: Japan, Makam Kurd, Gregorian nr.3, Ousak: Greece, Major inverse; 2 2 2 1 2 2 1 Gr.Hypolydian, Med.Lydian, Kalyan That (Yaman), Mela Mecakalyani, Raga Shuddh Kalyan, Ping, Kung: China; 2 2 1 2 2 2 1 Gr.Hypophrygian, Gr.Ionian (Iastian), Med.Mixolydian, Gr.Med.Hypoionian, Khamaj That, Mela Harikambhoji, Raga Harini, Janjhuti, Surati, Mischung 3, Ching, Shang: China, Gregorian nr.7; 2 1 2 2 1 2 2 Gr.Med.Hypodorian, Gr.Med.Aeolian, Gr.Hyperphrygian, Natural Minor, Asavari That, Mela Natabhairavi, Raga Jaunpuri, Raga Adana, Se, Chiao: China, Gregorian nr.2, Makam Buselik, Nahawand, Peruvian minor, Geez, Ezel: Ethiopian, Kiourdi descending: Greece; 2 1 2 2 2 2 1 Melodic Minor ascending, Jazz Minor, Minor-Major, Mela Gaurimanohari, Raga Patdip, Velavali, Deshi(2), Mischung 1, Hawaiian.
- 2 2 2 2 1 2 1 Lydian Augmented, Lydian sharp 5; 2 2 1 1 2 2 2 Major Locrian; 2 1 2 1 2 2 2 Minor Locrian, Half Diminished, Locrian sharp 2, Minor flat 5; 1 2 1 2 2 2 2 Super Locrian, Altered, Diminished Whole-tone, Locrian flat 4, Pomeroy, Ravel; 1 2 2 2 2 2 1 Neapolitan Major, Phrygian Major, Mela Kokilapriya, Raga Kokilaravam; 1 2 2 2 2 1 2 Mela Natakapriya, Jazz Minor inverse, Phrygian-Mixolydian, Raga Natabharanam, Ahiri Todi; 2 2 1 2 1 2 2 Mischung 6, Mixolydian flat 6, Major-Minor, Mela Carukesi, Raga Charukeshi, Tarangini
- 2 2 2 1 1 2 2 Lydian Minor, Mela Risabhapriya, Raga Ratipriya; 2 2 2 1 2 1 2 Lydian Dominant, Mela Vacaspati, Raga Bhusavati, Overtone, Lydian-Mixolydian, Bartok; 2 2 2 2 1 1 Leading Whole-tone; 1 3 1 1 1 1 3 1 Raga Ramkali (Ramakri)
- 1 1 1 3 1 1 1 3 Messiaen mode 4; 3 1 1 1 3 1 1 1 Messiaen mode 4 inverse; 1 3 1 1 1 2 2 1 Raga Bhatiyar; 2 1 3 1 1 1 1 2 Raga Cintamani; 1 3 1 2 1 1 2 1 Raga Saurashtra; 1 2 2 1 1 1 3 1 Half-diminished Bebop; 1 3 1 1 2 2 1 1 Verdi's Scala enigmatica; 1 1 1 2 2 1 3 1 Harmonic and Neapolitan Minor mixed; 1 3 1 2 1 2 1 1 Maqam Hijaz; 1 2 1 1 1 3 1 2 Maqam Shadd'araban; 2 1 2 2 1 1 1 Raga Mian Ki Malhar, Bahar, Sindhura; 2 1 2 2 1 1 1 2 Raga Mukhari, Anandabhairavi, Deshi, Gregorian nr.1, Dorian/Aeolian mixed; 2 1 1 1 2 2 1 2 Minor Bebop, Raga Zilla, Mixolydian/Dorian mixed; 2 2 1 2 2 1 1 1 Genus diatonicum Dominant Bebop, Raga Khamaj, Desh Malhar, Alhaiya



Uttaramandra, Shuddha Swara Saptaka;[20] 2 4 3 2 4 4 3 Murchhana Rajani;[17] 3 2 4 3 2 4 4 Murchhana Uttarayata;4 3 2 4 3 2 4 Murchhana Suddhasadja, Raga Harikambhoji, Palaiyazh;4 4 3 2 4 3 2 Murchhana Asvkranta;3 2 4 4 3 2 4 Murchhana Abhirudgata, Kafi That, Raga Bageshri;4 3 2 4 3 4 2 Madhyama Grama, Bilaval That, Murchhana Suddhamadhy;[20] 2 4 3 2 4 3 4 Murchhana Margavi;3 4 2 4 3 2 4 Murchhana Hrishyaka;4 3 4 2 4 3 2 Murchhana Sauviri, Kalyan That;2 4 3 4 2 4 3 Murchhana Harinasva, Bhairavi That;[4] 3 2 4 3 4 2 4 Murchhana Kalopanata;3 2 4 3 2 4 4 Gandhaara Grama (Sarngadeva der. ma-grama);4 2 4 3 2 4 3 Gandhaara Grama (Narada der. ma-grama), Murchhana Pauravi;4 2 3 4 2 4 3 Gandhaara Grama (Damodara), Raga Darbari, Darbari Kanada;2 4 4 3 2 4 3 Gandhaara Grama (Popley), Murchhana Matsarikrita;4 2 3 4 2 3 4 Asavari That;3 4 2 4 3 4 2 Raga Jogiya;2 3 4 4 2 3 4 Raga Kanakangi;4 2 3 4 4 2 3 Raga Kharaharapriya, Bhimpalasi;3 2 4 3 3 3 4 Gandhaara Grama (Sarngadeva der. sa-grama);4 2 4 3 3 3 3 Gandhaara Grama (Narada der. sa-grama);2 4 3 3 3 4 3 Gandhaara Grama (Somanatha);1 6 2 1 3 1 6 2 Raga Ramkali;1 6 2 4 1 2 4 2 Raga Saurashtra;4 3 2 3 1 3 5 1 Raga Yaman Kalyan;4 3 2 3 1 4 4 1 Raga Bihag;2 5 2 3 1 3 4 2 Raga Bhatiyar;4 2 3 4 4 2 2 1 Raga Mian Ki Malhar;3 2 4 4 2 1 2 4 Raga Mukhari;4 3 2 3 1 4 3 2 Raga Gaud Sarang;4 3 2 4 3 2 3 1 Raga Khamaj;4 2 3 4 2 2 2 3 Raga Anandabhairavi;4 3 2 2 2 3 4 2 Raga Suddha Kalyan;4 2 2 1 4 4 2 2 1 Raga Ramdasi Malhar;4 3 2 3 1 3 2 3 1 Raga Chayanat;3 2 1 1 2 3 1 3 2 1 1 2 Old Indian gamut;2 2 2 1 2 2 2 2 2 1 2 Modern Indian gamut.

Modes for default scales.lmd Alternate notes - 1 n(1/27) ! 27 tone equal modes:

+1 1 2 1 1 1 1 2 1 1 1 1 2 1 1 15-Tone MOS;1 n(1/31) ! 31 tone equal modes:10 10 10 1 Genus quartum;+5 8 5 13 Genus primum;13 6 6 6 Genus decimum;6 6 7 6 6 Quasi-equal Pentatonic;5 7 6 7 5 1 Genus quintum;6 6 1 6 6 Genus octavum;8 2 8 3 7 3 Genus tertium;4 6 9 6 4 2 Genus nonum;10 3 5 5 5 3 Genus secundum;4 6 5 6 4 6 Genus septimum;1 2 10 1 2 10 5 Enharmonic Mixolydian;2 10 1 2 10 5 1 Enharmonic Lydian;10 1 2 10 5 1 2 Enharmonic Phrygian;1 2 10 5 1 2 10 Enharmonic Dorian;2 10 5 1 2 10 1 Enharmonic Hypolydian;10 5 1 2 10 1 2 Enharmonic Hypophrygian;5 1 2 10 1 2 10 Enharmonic Hypodorian;5 2 2 9 2 2 2 2 Hemiolic Chromatic Hypodorian;2 2 9 2 2 9 5 Hemiolic Chromatic Mixolydian;2 9 2 2 9 5 2 Hemiolic Chromatic Lydian;9 2 2 9 5 2 2 Hemiolic Chromatic Phrygian;2 9 5 2 2 9 Hemiolic Chromatic Dorian;2 9 5 2 2 9 2 Hemiolic Chromatic Hypolydian;9 5 2 2 9 2 2 Hemiolic Chromatic Hypophrygian;2 3 8 2 3 8 5 Ratio 2:3 Chromatic Mixolydian;3 8 2 3 8 5 2 Ratio 2:3 Chromatic Lydian;8 2 3 8 5 2 3 Ratio 2:3 Chromatic Phrygian;2 3 8 5 2 3 8 Ratio 2:3 Chromatic Dorian;3 8 5 2 3 8 2 Ratio 2:3 Chromatic Hypolydian;8 5 2 3 8 2 3 Ratio 2:3 Chromatic Hypophrygian;5 2 3 8 2 3 8 Ratio 2:3 Chromatic Hypodorian;2 5 6 2 5 6 5 Soft Diatonic Mixolydian;5 6 2 5 6 5 2 Soft Diatonic Lydian;6 2 5 6 5 2 5 Soft Diatonic Phrygian;2 5 6 5 2 5 6 Soft Diatonic Dorian;5 6 5 2 5 6 2 Soft Diatonic Hypolydian;6 5 2 5 6 2 5 Soft Diatonic Hypophrygian;5 2 5 6 2 5 6 Soft Diatonic Hypodorian;5 3 5 5 3 7 3 Thirty-one tone Harmonic Minor;5 3 5 5 3 7 3 Thirty-one tone Harmonic Major;5 5 3 5 5 5 3 Thirty-one tone Major, Intense Diatonic Lydian, M.Ionian;5 3 5 5 3 5 5 Thirty-one tone Natural Minor, Intense Diatonic Hypodorian, Aeolian;5 3 5 5 5 3 3 Thirty-one tone Melodic Minor;5 3 5 5 3 5 5 Thirty-one tone Major-Minor;3 5 5 3 5 5 5 Intense Diatonic Mixolydian, M.Locrian;5 3 5 5 3 5 5 Intense Diatonic Phrygian, M.Dorian;3 5 5 5 3 5 5 Intense Diatonic Dorian, M.Phyrgian;5 5 3 5 5 3 5 Intense Diatonic Hypolydian, M.Lydian;5 5 3 5 5 3 5 Intense Diatonic Hypophrygian, M.Mixolydian;4 4 5 4 4 5 5 Neutral Diatonic Mixolydian;4 5 4 4 5 5 4 Neutral Diatonic Lydian;5 4 4 5 5 4 4 Neutral Diatonic Phrygian;4 4 5 5 4 4 5 Neutral Diatonic Dorian;4 5 4 4 5 4 4 Neutral Diatonic Hypolydian;5 4 4 5 4 4 4 Neutral Diatonic ;Hypophrygian;5 4 4 5 4 4 5 Neutral Diatonic Hypodorian;4 5 4 4 5 4 5 Neutral Mixolydian;5 4 4 5 4 5 4 Neutral Lydian;4 4 5 4 5 4 5 Neutral Phrygian;4 5 4 5 4 5 4 Neutral Dorian;5 4 5 4 5 4 4 Neutral Hypolydian;4 5 4 5 4 4 5 Neutral Hypophrygian;5 4 5 4 4 5 4 Neutral Hypodorian;4 6 2 6 4 3 3 3 Genus sextum;5 3 5 5 3 2 3 Genus diatonicum;5 3 5 3 5 2 5 3 Modus conjunctus;3 5 2 5 3 5 3 5 Octatonic;5 2 6 5 2 5 6 “ Natural Minor;3 5 2 3 5 3 2 5 3 Genus chromaticum;5 3 3 3 3 5 3 3 3 Rothenberg Generalized Diatonic;3 3 4 3 5 3 4 3 3 Hahn symmetric pentachordal;3 4 3 3 5 3 4 3 3 Hahn pentachordal;4 3 4 3 4 3 4 3 3 Thirty-one tone Orwell;4 1 4 4 4 1 4 4 1 4 Breed 10-tone;4 2 4 2 4 2 4 3 3 3 Lumma Decatonic;5 1 5 1 5 1 5 1 5 1 1 de Vries 11-tone;5 2 1 2 5 3 2 1 4 1 2 3 Genus bichromaticum;3 4 3 2 1 4 1 4 1 2 3 Genus enharmonicum vocale;2 2 4 2 2 3 3 3 1 3 3 3 Genus enharmonicum instrumentale;2 3 3 2 3 2 3 2 3 3 Meantone Chromatic (53/220-comma);3 2 3 2 3 2 3 2 3 2 3 Genus diatonic-chromaticum;3 2 2 3 2 3 2 2 3 3 Fokker 12-tone.

Modes for default scales.lmd Alternate notes-1 100 cents !Equal Temperament (M)-12 Default 12 tone list...:

+10 2 Warao ditonic: South America;5 7 Honchoshi: Japan;7 5 Niagari: Japan;6 1 5 Raga Ongkari;3 7 2 Ute tritonic;5 2 5 Raga Sarvasri, Warao tritonic: South America;5 5 2 Sansagari: Japan;3 4 5 Peruvian tritonic;2 4 3 5 Raga Malasri, Peruvian tritonic 1;1 5 1 5 Messiaen truncated mode 5;5 1 5 1 Messiaen truncated mode 5 inverse;2 1 7 2 Warao tetratonic: South America;2 4 5 1 Raga Sumukam;1 4 3 4 Raga Lavangi;2 2 3 5 Eskimo tetratonic (Alaska: Bethel);2 3 2 5 Genus primum;5 2 3 2 Genus primum inverse;2 4 2 4 Messiaen truncated mode 6;4 2 4 2 Messiaen truncated mode 6 inverse;2 3 4 3 Raga Bhavani;4 3 3 2 Raga Mahathi;3 4 3 2 Bi Yu: China;1 6 1 3 1 Raga Deshgaur;1 3 1 6 1 Raga Megharanji;1 1 4 1 5 Raga Nabhomani;1 5 1 1 4 Raga Saugandhini, Yashranjani;5 2 1 3 1 Raga Devaranani (Devaranji);2 1 4 1 4 Hira-joshi, Kata-kumoi: Japan=1 4 2 1 4 Hon-kumoi-joshi, Sakura, Akebono II: Japan, Olympos Enharmonic, Raga Salanganata, Saveri, Gunakri (Gunakali), Latantapriya.  
1 4 1 4 2 Iwato: Japan;4 2 1 4 1 Raga Amritavarshini, Malashri, Shilangi;4 1 4 2 1 Raga Bhinna Shadja, Kaushikdhvani, Hindolita;1 2 4 1 4 Balinese Pelog, Raga Bhupalam, Bhupala Todi, Bibhas;4 1 2 4 1 Raga Gambhiranata, Ryukyu: Japan;1 4 2 4 1 Raga Gauri;4 1 4 1 2 Raga Khamaji Durga;2 4 1 4 1 Raga Vaijayanti, Hamsanada;4 1 2 1 4 Raga Zilaf;4 1 3 3 1 Bacovia: Romania, Raga Girija;1 4 3 3 1 Raga Kshanika;1 3 1 3 4 Raga Megharanani, Syrian pentatonic;3 3 1 4 1 Raga Multani;1 3 3 1 4 Raga Reva, Revagupti, Ramkali, Vibhas (bhairava);2 2 2 5 1 Raga Kumurdaki (Kumudki);5 2 2 1 2 Raga Kuntvarali;2 5 2 1 2 Raga Matha Kokila (Matkokil);2 2 5 2 1 Raga Neroshta;2 1 2 2 5 Raga Purnalalita, Chad Gadyo: Jewish, Ghana Pentatonic 1;5 2 2 2 1 Raga Puruhutika, Purvaholika;2 3 2 1 4 Han-kumoi: Japan, Raga Shobhavari;1 4 2 3 2 Kokin-joshi, Miyakobushi, Han-Iwato: Japan, Raga Vibhavari (Revati), Bairagi, Lasaki.

- Capitolul C -  
MUZICA DE CAMERA ASISTATA DE CALCULATOR

1.) Aspecte intonationale

- Acordajul, precum si intonatia – individuala si de ansamblu -, pot fi verificate si corectate prin programul « In-Tune Multi-Instrument Tuner ».

Funcțiile programului

In-Tune Multi-Instrument Tuner v. 1.8

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[www.MusicMasterWorks.com](http://www.MusicMasterWorks.com)

- Options : Auto-String Select, Tuning Options ;
- Source : Default Windows Input, Wave Out Mix, Yamaha Audio Microphone/CD Audio/Line in ;
- Help ; Unlock ;
- Configurari : Instrument Type, View (Graph ; Gauge), Pitch Range, Strings, Pitch Indicator, Pitch Graph, Frequency, Average Frequency, Target Frequency, View Microphone Input (Yellow=too low, Green=good, Red=too high) .

2.) Interpretarea comparata

- Se utilizeaza programul Acid Pro 4 , inserandu-se pe track-uri separate versiunile interpretative analizate, prin comenzile: File-Open-anularea functiei sincronizatoare Beatmapper Wizard (cu „No“ si „Finish“)-trasarea desenului sonor (Mouse-Stanga tinut apasat). Programul vizualizeaza toate configuratiile spatio-temporale specifice, iar versiunile inserate pot fi audiate separat prin comanda Solo (X). Prin aceasta metoda pot fi analizati toti parametrii sonori, iar imaginea grafica a operatiei (ce este edificatoare – inclusiv in realizarea unor studii teoretice) poate fi conservata prin comenzile: Save As-ACID Project File (acd)/sau ACID Project File With Embedded Media (acd-zip).

3.) Politempia structurala

- Elaborata de dirijorul, compozitorul si matematicianul roman Mihai BREDICEANU, teoria timpului polimodular (apud Mihai BREDICEANU, *Timpul polimodular si artele vizuale*, Bucuresti, Ed.Stiintifica si Enciclopedica, 1982, si *Music and Polymodular Time/Structural Polytempi Music. Lecture given at New York University, January 5, 1985* – curs universitar) analizeaza fenomenul politempiei (reliefa de pilda in lucrarile lui Mahler si Ives) si descrie evolutia unui numar finit de evenimente sonore desfasurate simultan in “ceasuri” (masuri de timp) diferite – sau, cu alte cuvinte, proiectarea simultana a mai multor SISTEME DE PULSATII REALE (SPR) reductibile fenomenologic la un SISTEM REFERENTIAL DE TIMP (SRT). Fiecare SPR are proprii MODULI TEMPORALI (M) ce se reflecta la nivelul SPR in tempouri specifice, induse interpretilor sau grupurilor de interpreti prin semnale vizuale sau sonore (“beeps”) – ultimele fiind receptionate prin casti. In acest sens, autorul a inventat un aparat special denumit “Polytimer” si brevetat inca din 1970 in Romania, USA si Franta.
- Computerul permite amplificarea acestor interesante experimente sonore, ce au reprezentat in primul rand o aplicare a teoriei einsteiniene a relativitatii (miscarea relativa a obiectelor si observatorului), dar si o confirmare a teoriei bergsoniene referitoare la perceptia subiectiva a timpului (in functie de varsta si stare emotionala) - asa cum remarca si eminentul muzicolog roman Prof.univ.Dr.Victor GIULEANU (*Tratat de Teoria Muzicii*, Bucuresti, Editura Muzicala, 1986, pag.745-752).
- Astfel modulii temporali pot fi realizati si multiplicati cu programul “MOZART” – ulterior ei fiind difuzati prin “computere paralele” corespunzatoare “muzicilor paralele” ce se



suprapun. In prealabil se analizeaza evolutia temporala a fiecarei muzici si se elaboreaza cate o partitura a “beeps”-urilor (cu variatiile de tempouri specifice fiecarei muzici). Aceste partituri de “beeps”-uri (configurate exclusiv pe timbre percutante – de pilda 2 Wood-Block-uri: cel grav pentru timpii principali iar cel acut pentru timpii secundari) sunt difuzate prin casti interpretilor, ce isi adapteaza executia tempourilor respective. “Computerele paralele” sunt eventual subordonate unui server avand functia de a controla (la nivelul “hiperpulsatiei”- ca factor comun al politempiei) evolutia intregului proces, ce poate fi amplificat si prin utilizarea Internetului - de pilda in sensul experimentelor efectuate prin proiectul “SoundWIRE” mentionat mai sus.

#### 4.) Efectul de intarziere in practica ansamblurilor – cu aplicatie la proiectul “Sound WIRE”

O analiza pertinenta a acestui aspect a fost realizata in studiul-pilot “*The Effects of Latency on Ensemble Performance*” elaborat in Mai 2002 de Nathan SCHIETT, sub coordonarea lui Chris CHAFE, directorul CCRMA din cadrul Universitatii Stanford (USA). Aceasta ampla cercetare sponsorizata de prestigioasa *National Science Foundation* a implicat efectuarea unor experimente bazate pe scenarii muzicale inedite desfasurate in real-time, ca de pilda cantatul in ansamblu prin transmisii pe Internet la distante continentale. Sub aspect teoretic, s-au luat in considerare urmatoarele elemente: intarzierea de < 7 msec nu este perceptibila; intarzierile tolerabile in convorbirile telefonice sunt de 100-300 msec; intarzierile tolerabile in concerte publice sunt de cca 40 msec pentru ansamblurile simfonice (situat pe scene ce depasesc 40 ft – distanta parcursa in aer de unda sonora in 40 msec) si de cca 5 msec pentru formatiile camerale (motiv pentru care distanta maxima intre muzicieni este de 2 m ! – cf. <http://ww2.mcgill.ca/icc/canarie/learnWare/milestone1/App1.htm> )

Prin masurarea diferitelor nivele ale coordonatei EPT (Ensemble Performance Threshold) s-au stabilit limitele (in msec) ale LDS (Latency Design Spec), sintetizandu-se totodata o serie de concluzii referitoare la: (1) relatia dintre intarziere (*delay, latency*) si tempo (daca intarzierea este mai mare de 30 msec, tempoul are tendinta sa scada; EPT-ul muzicii ritmice este de cca 20-30 msec); (2) aplicarea strategiei de tip “leader-subordonat” pentru mentinerea unui tempo uniform chiar si in conditiile unei intarzieri mari (de 50-70 msec) a determinat aparitia unor severe desincronizari; EPT-ul variaza in functie de specificul muzicii (viteza, stil, timpul de atact al instrumentelor, etc.); (3) nivelul optim al intarzierii este de 10-20 msec (si nu de 0 msec); (6) EPT-ul determinat prin intarziere electronica este cu mult mai scazut decat in cazul EPT-ului determinat in mediul acustic natural, ce include fenomene complementare de reverberatie si variatie de amplitudine.

- Acest important studiu poate fi obtinut pe site-ul [www-ccrma.stanford.edu](http://www-ccrma.stanford.edu) , sau la adresa [cc@ccrma.stanford.edu](mailto:cc@ccrma.stanford.edu)

#### 5.) Configurarea Toposului Acustic (de la spatiul arhitectonic la spatiul virtual)

*Precizare terminologica* : notiunea de « TOPOS » (>gr. *ὄψις* = loc) desemneaza in domeniul acusticii muzicale spatiul fizic in care evolueaza sursa sonora (sala de concert). Toposul Acustic impreuna cu Inaltime(Frecventa), Volumul(Amplitudinea) si Timbrul(Structura Spectrala) reprezinta parametrii Spatilui Sonor – proiectiile acestuia in Timp definind Sunetul [ce se clasifica in Sunet muzical (cu Frecventa regulata) si Zgomot (cu Frecventa neregulata)]. Asadar,

*Sunetul = Spatiu Sonor x Timp* –

in care :

*Spatiu Sonor = Frecventa x Amplitudine x Structura Spectrala x Topos Acustic.*

Edificatoare in acest sens sunt cercetarile complexe efectuate la celebrul **EXPERIMENTAL MUSIC STUDIOS** al Universitatii din Illinois-U.S.A. (<http://ems.music.uiuc.edu/ems/index.html> ) de catre Scott WYATT - in domeniul difuzarii/proiectiei sonore (« *Investigative Studies on Sound Diffusion/Projection at the University of Illinois : a report on an explorative collaboration* ») -, precum si cele initiate de Sever TIPEI (compozitor american de origine romana), impreuna cu matematicianul Hans G. KAPER - in directia proiectarii, intr-un mediu imersiv al realitatii virtuale, a compozitiilor multiple, a vizualizarii muzicii si a sonificarii stiintifice (« *Manifold Compositions, Music Visualization, and Scientific Sonification in an Immersive Virtual-Reality*

*Environment* »). Astfel, în introducerea pertinentului sau studiu compozitorul Scott WYATT afirma că primele investigații în planul spațializării sonore s-au concretizat, între altele, prin muzica concretă elaborată de Pierre SCHAEFFER, prin creațiile lui Edgard VARESE (*“Poème Electronique”*), John CAGE (ciclul *“Imaginary Landscape”*), Earle BROWN (*“Octet”*), Joji YUASA (*“Icon”*), Morton SUBOTNICK (*“Touch”*), John CHOWNING (*“Turenas”*), Salvatore MARTIRANO (*“Sal-Mar Construction”*), Ben JOHNSTON și Herbert BRUN (ultimii trei creatori activând în cadrul *“University of Illinois Experimental Music Studios”*), precum și prin experimentele făcute la G.M.E.B. (Bourges) cu *“Gmebaphone”*-ul și cu *“Acousmonium”*-ul utilizat de François BAYLE. În prezent, echipa de acusticieni a IRCAM-Paris ([www.ircam.fr](http://www.ircam.fr)) coordonată de Olivier WARUSFEL are ca domeniu de cercetare controlul propagării sunetului în spațiu – considerat în dimensiunea sa arhitectonică, sau mediatizat prin mijloace electro-acustice. Aceste investigații – ce au ca finalitate sintetizarea unor modele de integrare a spațializării sonore ca parametru constitutiv al unor noi creații componistice – sunt ordonate (în dimensiunile fundamentale, de natură obiectivă și perceptivă) prin următoarele proiecte: caracterizarea obiectivă a fenomenelor acustice ; modelarea fizică (« *physical modeling* ») și perceptivă a acestora ; simularea lor pe computer prin crearea unor interfețe de comandă a aplicațiilor acustice virtuale cu ajutorul *Spatializatorului digital*, ce operează - în sistem « MacIntosh » - cu un ansamblu de algoritmi bazati pe modele geometrice, oferind diferite ipoteze de propagare și reflexie sonoră: difracția, absorbția în incidență răsărită, reflexia speculară sau ideal difuză. Aceste experimente au dus și la elaborarea unei noi metode de determinare exactă a dimensiunii reverberației în sălile de concert. Spatializatorul este compus din module logice de prelucrare a semnalului și de comandă în timp real – generând sinteza locației surselor și cea a efectului de sală (*reverberația artificială*). Modulul de prelucrare poate fi configurat pentru sisteme individuale de reproducere tridimensională (la casca sau prin doi transductori), precum și pentru sisteme « multi-tracks » (cu reproduceri « stereo » și « stereo-3/2 »). În coordonată « scenei sonore virtuale », modulul de comandă permite controlul prelucrării audio-numerice a semnalelor într-o manieră accesibilă, adaptată – prin funcții « simbolice » - procesului de elaborare muzicală. În paralel, prin proiectul « *Design Sonore* », s-a experimentat și fenomenul legat de percepția și controlul iradiției surselor sonore instrumentale – în scopul realizării unor surse sonore artificiale capabile să reproducă caracteristicile celor naturale și totodată să inducă directivitatea sunetului, printr-un sistem de transductori (difuzoare) ce compun « imaginea de directivitate » a semnalelor prelucrate « prin sinteză aditivă » (în modul și în faza-filtrat), urmărindu-se efectele fizice și psiho-fizice ale fenomenului. S-au sintetizat astfel, cu puține surse sonore, « imagini de directivitate » fascinante prin noutatea și complexitatea lor. Așa cum subliniază și cercetătorii de la IRCAM, aplicațiile studiului sunt numeroase : « *dincolo de simularea caracteristicilor spațiale ale instrumentelor pentru sunete pre-inregistrate sau pentru sunetelor de sinteză, acest procedeu de reproducere permite optimizarea directivității ansamblurilor de difuzoare, corectia ecoului în sistemele de teleconferință, controlul în timp real a orientării direcției în fluxurile sonore, precum și multe alte efecte* ». Un alt program deosebit de important în domeniul interacțiunii timp-real/spațializare este « *Max/MSP - version 4.3.1* » (aplicabil atât pe « Mac » cât și pe « Windows XP » și disponibil la adresa <http://www.cycling74.com/products/download.html>), utilizat de asemenea la IRCAM în combinație cu programele « *AudioSculpt* », « *Modalys* » și « *Diphone* », ce sunt axate pe analiză/sinteză sonoră.

#### 6.) *Configurarea Acusticii Instrumentale*

Tot la IRCAM-Paris ([www.ircam.fr](http://www.ircam.fr)) – proiect coordonat de Rene CAUSSE – dar și la alte importante centre de cercetare acustică din U.S.A. , precum Bregman Electronic Music Studio/Dartmouth College (<http://eamusic.dartmouth.edu>) – proiect coordonat de Charlie SULLIVAN) - s-au efectuat și o serie de experimente dedicate studierii funcționalității instrumentelor tradiționale (în scopul perfecționării lor prin « grefe acustice »), precum și realizării unor noi instrumente reale sau virtuale. Caracterul eterogen al domeniului organologic a impus inițierea unor cercetări fundamentale multidisciplinare (acustică, botanică, mecanică vibrațiilor, mecanică fluidelor), în colaborare cu instituții de specialitate. Un proiect important se referă la modelare fizică (« *physical modeling* ») a instrumentelor și a vocii – în această direcție continuându-se experimentele ce au condus, încă de acum două decenii, la stabilirea « algoritmului Karplus-Strong » (K.KARPLUS and A.STRONG - Digital Synthesis of

**Plucked-String and Drum Timbres**, *Computer Music Journal*, 7(2), 1983. [bibtex-entry]

<http://www.cmi.univ-mrs.fr/HASSIP/hassipbib/Author/KARPLUS-K.html> )

pentru unele instrumente cu corzi ciupite (chitara, banjo, koto) si de percutie, prin analiza elementelor constitutive (sunet, vibratie, aer, coarda, etc.) si prin reconstituirea timbrelor originale cu ajutorul unor sisteme speciale (« building blocks »), bazate pe « delays », filtre, « feedbacks loops » si mai ales pe « buffers » (unitati de memorie cu acces aleatoriu – tip RAM, ce acumuleaza si totodata elibereaza permanent informatii, intr-un proces repetitiv generand – prin periodicitate - frecvente sonore). S-au elaborat astfel, prin multiple analize si simulari, si alte esantioane (« semnaturi acustice ») caracteristice instrumentelor cu ancie simpla (clarinet, saxofon), cu ancie dubla (oboi, fagot), cu jet de aer (Blockflöte, flaut transversal, tub de orga) si cu ancii libere (acordeon – in acest caz evidentiindu-se faptul ca o miscare sinusoidala a anciei poate genera un timbru foarte bogat, compus din peste 30 de armonice) ; in prezent la IRCAM sunt analizate sunetele pianului (studiindu-se diferentele observate in dubla-diminuare, intre diferitele partiale), precum si cele ale instrumentelor de coarde (in special in zona zgomotelor complementare produse prin contactul arcusului cu coarda). Rezultatele acestor atat de pertinente cercetari sunt ulterior implementate in programele originale (ruland pe sistemul de operare « MacIntosh ») « Resonans » si « Modalys-ER » (ex « Mosaïc ») – ultimul oferind o descriere uniforma a modelelor. Aplicatiile sunt multiple : de la cele mai traditionale (ca de pilda notarea calitatii trompetelor), pana la determinari ale raportului psiho-fizic in utilizarea unor instrumente traditionale modificate partial sau total, ca de pilda flautul cu sfert de ton si sisteme micro-intervalice, arcusul de vioara construit din materiale sintetice, Mundstück-ul cu volum variabil pentru clarinet (permitand schimbarea frecventei in timp real), noul dispozitiv electronic de acordaj al timpanului sau surdina wawa pentru corn. In acest context trebuie subliniata si contributia esentiala adusa de compozitorul american Rodney OAKES (profesor emerit la Los Angeles Harbor College si fondator al « *Journal SEAMUS* ») in impunerea midi-trombonului ca instrument de importanta majora pentru creatia muzicala live-electronica. In paralel, la Institutul International de Muzica Electroacustica de la Bourges – IMEB ([www.imeb.asso.fr](http://www.imeb.asso.fr) ) coordonat de Françoise BARRIERE si de Christian CLOZIER se utilizeaza in mod curent doua instrumente digitale originale (atat in coordonata « hard », cat si in cea « soft »), deosebit de utile in plan pedagogic (« *Cybersongosse 7* ») si interpretativ (« *Cybernéphone 7* »). Referitor la sinteza vocala, mentionam cercetarile efectuate la Princeton University din U.S.A. de Perry R. COOK, ce s-au finalizat si prin programul de modelare fizica « *SPASM singing voice software* » (<http://www.cs.princeton.edu/~prc/NewWork.html> ) , precum si inovatiile in domeniul emisiei vocale prelucrate audio-numeric reliefate in creatiile realizate la prestigiosul « *Brooklyn College Center for Computer Music* » de compozitorul Robert VOISEY, director al societatii « *Vox Novus* » din New York

### 7.) Alte domenii abordate la IRCAM

(apud [www.ircam.fr](http://www.ircam.fr) )

- Cercetarea psihoacustica (Asociatia PECA, Coordonator Stephen McADAMS) – proiectele „Perceptia si memorizarea timbrului muzical“ (analiza parametrilor acustico-auditivi; perceptia proprietatilor fizice ale obiectelor sonore; caracterizarea verbala a timbrului muzical si a relatiilor dintre timbre); „Procesul organizarii auditive“ (organizarea simultana si cea secventiala); „Perceptia structurilor muzicale contemporane“ (perceptia inarmonicitatii in agregatele de inaltimi si a progresiei in secvente de agregate – cu Tristan MURAIL; evolutia atentiei in structuri cu straturi multiple - cu Antoine BONNET; relatia perceptiva intre micro- si macro-structuri in sunetele si secventele sintetizate – cu Marco STROPPA); programe originale: „PsiExp“ si „FTS“;
- Compozitia asistata de ordinator – CAO (Echipa „Representations Musicales“, Coordonator Gerard ASSAYAG) – activitate curenta: aplicatii ale programelor originale „PatchWork“, „Sympatos“ si „OpenMusic“ in cadrul „Forumului utilizatorilor“, implicand colaborari sistematice cu compozitori si muzicologi interesati in elaborarea unor proiecte avansate de informatica muzicala;
- Analiza/sinteza sonora (Echipa coordonata de Xavier RODET) – proiecte: „Sinteza aditiva“ (aplicarea algoritmului de sinteza „FFT-1“ in studiul anvelopei spectrale); „Sinteza sursa-filtru“ (producerea unor variate sunete instrumentale si detectarea inaltimii si analizei

zgomotului complementar); „Sinteza SINOLA“ (bazata pe suprapunerea si juxtapunerea formelor elementare de unda, determinand modificarea inaltimei si a duratei sunetelor emise vocal – vorbit sau cantat); „Sinteza modelelor fizice“ (analizarea in timp real a modelelor matematice si informatice ale instrumentelor acustice din clasele clarinet, trompeta si voce; studiul oscilatiilor periodice si haotice); „Caracterizarea semnalelor sonore - diferite de cuvinte“ (extragerea parametrilor constitutivi, separarea de surse, segmentare, identificare si recunoastere, reprezentarile unor scene reale si ale sintezei intr-un limbaj hieratic legat in continut, prelucrari si transformari ale obiectelor sonore, codificarea selectiva a continutului); „Farinelli“ (fuziunea timbrelor – cu aplicatie la reconstituirea vocii celebrului cantaret castrat, pentru filmul realizat de Gerard CORBIAU); programe originale: „Super VP“, „AudioSculpt“, „Diphone Studio“, „Chant“ (sinteza granulara), „Xspect“.

8.) Procedee de sinteza si transformare digitala a sunetului  
utilizate si in aplicatii camerale live-electronice

**NB** – Se disting 2 categorii de muzici live-electronice : cea pentru interpreti in timp real si banda electronica preinregistrata – numita si «*tape and instruments music*», precum si cea in care banda este inlocuita cu sunete electronice produse ad-hoc sau cu sunetele interpretilor prelucrate chiar in momentul producerii lor (asadar in timp real) - aceasta a doua categorie formand genul «*electronics and instruments music*». In muzica electro-acustica analoga se utilizau sisteme complexe de prelucrare (incluzand mai multe magnetofone, mixere, filtre, ring-modulatoare, amplificatoare, difuzoare – procedeele fiind exemplar analizate de Allen STRANGE in tratatul *Electronic Music. Systems, Techniques, and Controls*. WM.C.Brown Company Publishers , 1972, ISBN 0-697-03612-X, p.126-137). Tehnica digitala a inlocuit inasa – cu rezultate acustice net superioare - aceste sisteme analoge prin programe si module specializate in sinteza si prelucrarea numerica a sunetului . Dat fiind faptul ca noile aplicatii sunt in plina evolutie, prezentarea de mai jos nu este (si nici nu ar putea fi !) exhaustiva, ea limitandu-se doar la unele dintre cele mai importante aspecte relevante pana la data elaborarii acestei lucrari – ce sunt expuse concentrat, dar cu trimiteri directe la principalele surse de informatie ce pot oferi celor interesati detalii suplimentare.

- a.) «*Phase Shifting*» - procesul sonor de tip « phasor » este dedus din « Teorema lui Fourier » (toate functiile periodice pot fi exprimate prin suma – pana la Infinit – a sinusoidelor componente) si se bazeaza pe baleierea (« sweep ») uniforma si continua (intr-un « perpetuum mobile » ascendent-descendent) a partialelor (armonicelor) unui sunet, implicand trecerea semnalului initial printr-o serie de filtre speciale (generand un « phase-lag » asemanator unui « time delay ») si suprapunerea semnalului astfel prelucrat cu semnalul originar ; vor rezulta o serie de intersectii (« notches ») in spectrul tonal, determinate de filtrarile combinate (« comb filter response »). Functiile principale de control in modulul «*MXR Phase 100* » sunt : (1) Speed (referitoare la viteza ratei « sweep » intre limitele 0.1 – 10 Hz) si (2) Intensity (actionand - in patru pozitii caracteristice - asupra celor doua coordonate fundamentale ale procesului « phase shifting » - amplitudinea dimensiunii « sweep » si profunzimea dimensiunii « notch »).

- b.) «*The Phase Vocoder*» – prin analizarea/resintetizarea sunetului [conform “reprezentarilor Fourier” - DFT (“Discrete Fourier Transform”), FFT (“Fast Fourier Transform” –reprezentarea cea mai frecvent utilizata) si IFFT (“Inverse Fast Fourier Transform”)] se poate schimba atat inaltimea unui sunet fara a-i modifica lungimea (“pitch shifting”), cat si lungimea unui sunet fara a-i altera inaltimea (“time stretching”). Ambele tipuri de transformari pot fi operate cu ajutorul programului “Audacity 1.2.0-pre2”: “pitch shifting” prin comenzile “Edit-Select-All” + „Effect-Change Pitch without Changing Tempo“, iar „time stretching“ prin comenzile “Edit-Select-All” + „Effect-Change Tempo without Changing Pitch“.

- c.) „*Convolution*“ – convolutia reprezinta un caz particular de utilizare a „phase vocoder“ prin realizarea unei „sinteze incrucisate“ („cross-synthesis“) implicand impunerea unei coordonate a unui sunet (numit „impulse response“) altui sunet. Reverberatia digitala ofera un exemplu concludent de convolutie: rezonanta caracteristica a unei sali este inregistrata (formand

un „impulse response“) si impusa unui alt sunet. Programul „Sound Forge“ ofera posibilitatea unui astfel de proces prin comanda „Effects-Reverb“ – specificandu-se tipul de „impulse record“ prin „Reverberation mode“: Rich hall, Wide open hall, Concert hall, Deep hall, Long hall, Warm ambience, Metal tank, etc. Prin convolutie pot fi insa generate si noi sunete, ca de pilda sinteza dintre zgomot si respiratie – realizata cu programul „Soundhack“ creat de Tom ERBE (apud BURK, Phil. POLANSKY, Larry. REPETTO, Douglas. ROBERTS, Mary. ROCKMORE, Dan. *Music and Computers – an interactive web-text.* (<http://eamusic.dartmouth.edu/~book/MATCpages/tableofcontents.html> ). Aceeasi autori semnaleaza un aspect deosebit de interesant: reverberatia simpla poate fi simulata si prin convolutia „zgomotului alb” („whitenoise”) cu orice alt sunet.

- d.) „Sampling“ – acest foarte popular procedeu (in special in genurile „rap“, „dance“ si „beat“) consta in selectarea unor mici esantioane sonore din muzici pre-existente, sau in crearea unor esantioane originale si in recontextualizarea lor prin mijloace digitale – cu eventuale modificari ale frecventelor si ale duratelor initiale. In acest sens au fost realizate - ca „hardware“ - instrumente digitale specifice („Samplers“ si „Drum Machines“) , iar in domeniul „software“ au aparut, in principalele sisteme de operare (Windows, Mac si Linux) noi programe de tip „Digital Audio Workstations“ -DAW (incluzand functiile: analog/digital-input/output, sound recording/editing/playback/multi-track mixer/amplifier, etc.) - ca de pilda „Pro Tools“, „Acid“, „Cakewalk“, „The Matk of the Unicorn-MOTU“ (cu „FireWire interface“), etc.

- e.) „Localizare/Spatializare“ – Localizarea sursei sonore prin auzul „cyclaural“ este determinata de mai multi factori: intensitatea sunetului (ce este mai puternica la urechea mai apropiata de sursa), diferentele de perceptie („Interaural Time Delay“-ITD – aspect determinat de distantele inegale dintre sursa si fiecare dintre urechi, marcate printr-o mica intarziere a perceptiei la urechea mai indepartata) si cele de frecventa (asa-numitele „Head Related Transfer Functions“-HRTF - generate de obstacolele fonice plasate pe traseul sonor, ce produc un efect de „low-pass filter“ specific fiecarei urechi). In consecinta, spatializarea sonora poate fi simulata - in doua dimensiuni - prin diferentierile de intensitate, ecou si filtraj dintre cele doua canale audio (de pilda, localizarea sursei in partea stanga impune cresterea intensitatii pe canalul „Left“ si totodata adaugarea unui mic ecou si filtrarea frecventelor inalte pe canalul „Right“). In acest sens s-au efectuat experimente relevante cu „Binaural Dummy Head Recording“ – o instalatie de inregistrare ce reconstituie cutia craniana, avand amplasate microfoanele in orificiile auditive. Solutiile descrise mai sus se pot aplica si intr-o proiectie audio „3-D“ (ce ia in considerare si coordonata verticala a perceptiei auditive). Multe dintre procedeele aplicate au fost utilizate si in „epoca analoga“, fiind pertinent descrise de Allan STRANGE in tratatul *Electronic Music. Systems, Techniques, and Controls.* WM.C.Brown Company Publishers , 1972, ISBN 0-697-03612-X, Cap. 9 „Location Modulation”, p.75-85).

- f.) „Prelucrari grafice“ – operatii ce determina convertirea imaginilor vizuale in imagini sonore, cu ajutorul unor instrumente si, respectiv, programe speciale: de la aparatul „Spectrogram“ (creat de High LeCaine in 1950) si de la „UPIC“ (sistem inventat de Iannis XENAKIS si utilizat la CEMAMu-Paris), pana la aplicatiile software „MetaSynth“, „Hyperupic“, „SoundHack/QT-coder“, „AudioSculpt“, „Squiggy“ (in „Mac“) si „MIDImage“ (in „Windows“). Dintre toate acestea, „Squiggy“ (creat Douglas REPETTO la renumitul „Darmouth College“ din S.U.A.) este cel mai performant program „graphics-to-sound“ avand ca finalitate interpretarile live-electronice.

- g.) „Sinteza aditiva“ - conform „Teoremei lui Fourier“ („toate functiile periodice pot fi exprimate prin suma – pana la Infinit – a sinusoidelor componente”), un sunet complex poate fi creat prin insumarea unor sunete simple – ca de pilda prin aditia de armonice, prin reconstruirea anvelopei ADSR (Attack-Decay-Sustain-Release), prin asa-numitul „Shepard Tone Effect” (bazat pe perceptia „chroma” referitoare la circularitatea frecventelor distantate la o octava – adica inmultite cu 2), sau prin sinteza formantilor (adica a acelor frecvente fixe, ireversibile ce definesc un anumit timbru vocal sau instrumental).

- h.) „Filtrari“ - tratarea sunetelor cu filtre fixe (formand „filter bank“) si variabile – aceasta ultima categorie incluzand filtrele: „High-pass“ (ce elimina frecventele joase), „Low-pass“

(ce elimina frecventele inalte), „*Band-pass*“ [ce selecteaza doar o anumita banda de frecvente, definita prin „*bandwidth*“ – adica prin diferenta dintre „*cutoff frequencies*“ (cea mai inalta si cea mai joasa frecventa la amplitudine maxima) – si prin „*center frequency*“ (frecventa medie)] si „*Band-reject*“ (ce elimina o anumita banda de frecvente). Prin „*EQ.Graphic Equalizers*“ (variind de obicei intre – 10 si + 12 dB) se pot realiza amplificari si/sau atenuari ale mai multor benzi de frecventa. De asemenea, anumite situatii sonore impun utilizarea filtrelor „*Finite Impulse Response*“-FIR (incluzand „*delays*“ ale unor fragmente sonore anterioare) si „*Infinite Impulse Response*“ –IIR (incluzand efectul „*feedback*“).

- j.) „*Waveshaping*” - operatie constand in transformarea sunetelor simple in sunete complexe printr-o „functie de transfer” [ $y = f(x)$ ] – ca de pilda in cazul transformarii formei sinusoidale a unui sunet intr-una triunghiulara. Functia de transfer poate avea si configuratia unui „Polynomial Chebyshev” – asa cum demonstreaza si autorii admirabilului tratat „*Music and Computers – an interactive web-text*” (<http://eamusic.dartmouth.edu/~book/MATCpages/tableofcontents.html>).

- j.) „*Modulatia de Amplitudine*” – „*Amplitude Modulation*” (AM) este un proces de prelucrare timbrala (analog unui efect de *tremolo*, implicand varieri periodice ale volumului sonor), ce consta in modificarea amplitudinii semnalului sonor initial (numit „*carrier signal*”) printr-un semnal de modulatie (numit „*modulating signal*”) inducand - prin coordonatele sale de amplitudine, frecventa si forma („*waveshape*”) – nivelul, viteza si, respectiv, configuratia („*pattern*”) modulatiei de amplitudine; amplitudinea sunetului initial va deveni amplitudinea medie a sunetului modulat. De pilda, dintr-un sunet initial („*carrier signal*” – pe care il numim „*x*”) de 700 Hz sinus modulat in amplitudine cu un sunet („*modulating signal*” – pe care il numim „*y*”) de 5 Hz sinus va rezulta un sunet sinus cu amplitudinea medie de 700 Hz si cu variatii de amplitudine intre 705 Hz ( $x + y$ ) si 695 Hz ( $x - y$ ), la o viteza de 5 cicluri/secunda. Daca sunetul de modulatie este de peste 20 Hz, viteza schimbarilor va fi imperceptibila in planul amplitudinii (volumului) – in aceasta situatie ea percepuandu-se ca doua noi frecvente (numite „*sidebands*”) reprezentand suma ( $x + y$ ) si diferenta

( $x - y$ ) dintre sunetul original si cel de modulatie, ce se suprapun peste sunetul original.

Astfel, daca  $x = 700$  Hz sinus si  $y = 20$  Hz sinus, vor rezulta 3 sunete cu frecventele de 700 Hz sinus ( $x$ ), 720 Hz sinus ( $x + y$ ) si 680 Hz sinus ( $x - y$ ). In programul „*Sound Forge*” AM se realizeaza prin functia „*Effects-Amplitude Modulation*”. [apud SCHRADER, Barry. *Introduction To Electro-Acoustic Music*. Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. – p. 88-90; STRANGE, Allen. *Electronic Music. Systems, Techniques, and Controls*. W.M.C.Brown Company Publishers, 1972, ISBN 0-697-03612-X, p.9-11].

- k.) „*Modulatia de Frecventa*” – „*Frequency Modulation*” (FM) este de asemenea un proces de prelucrare timbrala (dar analog unui efect de *vibrato*, implicand varieri periodice ale inaltimii sonore), ce consta in modificarea frecventei semnalului sonor initial (numit „*carrier signal*”) printr-un semnal de modulatie (numit „*modulating signal*”) inducand - prin coordonatele sale de amplitudine, frecventa si forma („*waveshape*”) – nivelul, viteza si, respectiv, configuratia („*pattern*”) modulatiei de frecventa; frecventa sunetului initial va deveni frecventa medie a sunetului modulat. Procesul FM este asemanator cu procesul AM – primul actionand in planul frecventei sonore (adica al inaltimii), iar cel de al doilea in planul amplitudinii sonore (adica al volumului). Ca si in AM, o modulatie de frecventa cu un sunet de modulatie de peste 20 Hz va produce doua noi frecvente („*sidebands*”) reprezentand suma ( $x + y$ ) si diferenta ( $x - y$ ) dintre sunetul original si cel de modulatie, ce se suprapun peste sunetul original. In plus, in FM, „*peak frequency deviation*” ilustreaza o functie a amplitudinii semnalului modulat in frecventa si indica diferenta dintre maxima/minima sunetului modulat si sunetul initial (de pilda, avand un „*carrier signal*” de 700 Hz, ce este modulat in sus la 900 Hz si in jos la 500 Hz, valoarea „*peak frequency deviation*” va fi de 200 Hz). In programul „*Sound Forge*” FM se realizeaza prin functia „*Tools-Synthesis-FM*”. Tot in acest domeniu, se remarca si faptul ca frecventele emise sub pragul auditiv uman inferior (de 20 Hz) sunt percepute ca durate – acest fenomen deschizand perspectivele unor interesante transformari ale coordonatelor „spatiu sonor” si „timp muzical”, cu aplicatii directe in practica componistica - asa cum am demonstrat in studiul meu „*Mistica lui Debussy si revelatia universului supratonal*” [Revista "Muzica" Nr.3/1999, Bucuresti (pag.61-72)]. In sfarsit, „*Ring Modulation*” reprezinta un caz particular de FM si consta in

realizarea sumei si a diferentiei dintre doua frecvente cu ajutorul unui aparat (initial analog) numit “Ring Modulator”; acest efect a fost insa transpus si in mediul digital (de pilda in programul “Csound” dezvoltat de Barry VERCOE la MIT). [apud SCHRADER, Barry. *Introduction To Electro-Acoustic Music*. Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. – p.50-51 si 90-92; CHOWNING, John M. *The Synthesis of the Complex Audio Spectra by Means of Frequency Modulation*. in *Journal of the Audio Engineering Society*, vol.21,no.7 (1973); STRANGE, Allen. *Electronic Music. Systems, Techniques, and Controls*. WM.C.Brown Company Publishers, 1972, ISBN 0-697-03612-X, p.12-20; BURK, Phil. POLANSKY, Larry. REPETTO, Douglas. ROBERTS, Mary. ROCKMORE, Dan. *Music and Computers – an interactive web-text*. (<http://eamusic.dartmouth.edu/~book/MATCpages/tableofcontents.html> )].

- l.) “*Morphing*” – preluat din artele vizuale (domeniu in care “anamorfoza” reprezinta o tehnica descoperita inca din antichitate), acest procedeu de transformare a unei imagini in alta - aparent total diferita de prima - a fost aplicat pentru prima data in arta sunetelor in 1976, in Cvartetul meu de Coarde “*Anamorphose*” [© 1977 by Edition Modern München – Germany], ce a fost distins cu Premiul I la Concursul International de Compozitie “GAUDEAMUS” din Olanda (1977). Ulterior, in studiul “*Anamorfoza Sonora*” (publicat in revista “*Muzica*”-Bucuresti, Nr.6/Iunie 1985, p.18-21) - pe care l-am prezentat de asemenea in conferintele sustinute la “Cursurile Internationale de Muzica Noua” de la Darmstadt-Germania (1980), precum si la Michigan University-USA (1982) – am aratat ca “*doua (sau mai multe) structuri muzicale aparent disjuncte pot coexista functional, fara a constitui un colaj, daca raspund conditiilor de a avea cel putin un element constitutiv comun. Astfel, intre multimile sonore A, A’ si B, avand proprietatile: A intersectat cu B = 0, si A intersectat cu A’ = diferit de 0, se poate exprima relatia de colaj prin  $A > A'$  si cea de anamorfoza prin  $A < B$ .*” Ulterior, in studiul “*Anamorfozele Timpului Muzical*” (publicat in revista “*Muzica*”-Bucuresti, Nr.3/1991, p.100-107), precum si in tratatul “*MUSICA CAELESTIS – Anamorfozele Sacralui in Arta Sunetelor*”(Editura UNMB,2000, ISBN 973-0-02102-3), am dezvoltat cercetarea muzicologica in acest domeniu aplicat, de altfel, in majoritatea creatiilor mele comunistice (de pilda, in opera “*Domnisoara Christina*” (1981), conceputa dupa un libret de Mircea ELIADE, in care am extins utilizarea tehnicii anamorfofice din domeniul sonor in cel multi-media. In prezent, posibilitatile practice nelimitate ale sistemelor digitale au determinat aparitia unor programe specializate in *anamorfoza muzicala /“music morphing”*, precum “*Diphone*” (promovat la IRCAM-Paris, [www.ircam.fr](http://www.ircam.fr)), “*Cendroid*” (creat, in baza programului “*SoundHack*”, de compozitorii Douglas I. REPETTO si Larry POLANSKY de la Dartmouth College - Bregman Electronic Music Studio <http://music.dartmouth.edu/~douglas/cendroid.sit.hqx> ) si de “*PROSONIQ morph VST PC – Realtime Audio Morphing Plugin*” (<http://products.soniq.com> ), “*Voicechanger Software*” ([www.voicechanger.biz](http://www.voicechanger.biz) ) si deja mentionatul “*crusherX*” ([www.crusher-x.de](http://www.crusher-x.de) – ce poate fi descarcat la adresa : [www.stelkens.de/bs/download](http://www.stelkens.de/bs/download) ). Practic, exista doua modalitati de realizare a efectului “*morphing*” in arta sunetelor: prin substitutie (sau “*replacement morph*”, adica prin inlocuirea treptata a fiecarui sunet din prima imagine cu un sunet din imaginea a doua) si prin interpolare (sau “*interpolation morph*”, adica prin compararea/definirea valorilor specifice celor doua imagini si prin intercalarea unei imagini intermediare, ce este bazata pe elementele comune ale imaginilor principale). Toate aceste aspecte expuse in Capitolul 5 6 “*Morphing*” din recentul tratat *Music and Computers – an interactive web-text* (2003 – <http://eamusic.dartmouth.edu/~book/> ) reprezinta de fapt o confirmare – formulata in baza cercetarilor efectuate cu mijloace tehnice de ultima ora - a teoriei anamorfozei sonore, definite si aplicate intuitiv de mine incepand din anul 1976.

- m.) “*Sinteza granulara*” – “*Granular Synthesis*” se refera la procedee specifice de generare a “*norilor de sunete*” (“*sound clouds*”), ca elemente de natura stochastica introduse in limbajul muzical contemporan inca din 1971 de catre marele compozitor grec Iannis XENAKIS (nascut in Romania si stabilit in Franta). Aceste complexe imagini sonore globale sunt alcatuite din multimi – sau “regiuni schimbatoare de energie sonora” (“*shifting regions of sound energy*”) - cuprinzand mii de sunete (de obicei sinusoidale, ce pot fi insa si “*sampled sounds*”) extrem de scurte (cu durate mai mici de 100 de milisecunde), ce isi metamorfozeaza permanent configuratiile de frecventa si amplitudine – comportandu-se (conform principiilor probabilistice) ca niste picaturi de ploaie, transformabile (in anumite conditii meteorologice) in fulgi de zapada... La randul lor, “*norii de sunete*” (proveniti, de pilda, atat de la un ansamblu cameral, cat si de la un computer)

se pot intersecta, generand noi fenomene sonore absolut inedite! Cercetarile lui Iannis XENAKIS au fost dezvoltate si de compozitorul canadian Barry TRUAX, ce a elaborat, in 1986, un sistem in real-time (PODX, realizat la Simon Fraser University). Actualmente sunt aplicate o serie de programe speciale, precum “Chant” (utilizat, in sistem “Mac”, la IRCAM-Paris, [www.ircam.fr](http://www.ircam.fr)), “KTGranulator” ([www.smartelectronix.com/~koen](http://www.smartelectronix.com/~koen)) si “crusherX” ([www.crusher-x.de](http://www.crusher-x.de)) – ultimul avand, pe langa functia de “vapor synthesis”, si pe aceea de “morphing system”.

#### - Cap. D

#### MUZICA FRACTALA (ALGORITMICA, GENERATIVA)

##### *Motto:*

„Les images algorithmiques conduisent à une nouvelle forme d’art“

(Benoit MANDELBROT – „Les fractales, l’art algorithmique et le test de Turing“, in „La science et la métamorphose des arts“-Textes réunis par R. Daudel, Paris, PUF, 1994, p.39-52)

- 01.) Definitia Fractalilor: figuri geometrice ce se genereaza prin auto-similaritate (ca forma de armonie interna) si auto-referentialitate, avand anumite dimensiuni fractionale specifice, numite si „fractale“ (termenul derivand din limba latina: „fractus“ = participiul trecut al verbului „frangere“, ce se traduce prin „a frange“). Auto-similaritatea asigura asadar o forma cantitativa fara a schimba structura arhetipala, ideea generatoare. Fractalii au fost descoperiti in natura si analizati in doua lucrari de referinta - : „Les objets fractals, forme, hasard et dimension” (1975) “The fractal geometry of nature” ( 1982) - de catre ilustrul matematician Benoit MANDELBROT (n.20 Nov. 1924 la Varsovia si stabilit din anul 1958 in U.S.A.; cercetator la IBM’s Watson Research Center si profesor la institutii de invatamant superior de inalt prestigiu, precum Yale University Harvard University si Einstein College of Medicine; laureat al “Barnard Medal for Meritorious Service to Science”, “Franklin Medal”, “Alexander von Humboldt Prize”, “Nevada Medal”, “Steinmetz Medal”). MANDELBROT a definit fractalul drept un obiect ale carui elemente constitutive reproduc macro-structura in micro-structura (apud “Les inattendus des fractales”, in “Pour la Science” No 234, Aprilie 1997, p. 10-12).

Astfel, aceste structuri geometrice se pot multiplica - prin dilatare (augmentare) sau prin reductie (diminuaire) - la scari simetrice, in cadrul unui proces recursiv (reiterativ) numit „haos ordonat“ (intermediar – din perspectiva euclidiană - intre „ordine“ si „haosul total“), ce genereaza noi forme si suprafete reductibile fenomenologic la structura initiala.

„Teoria Haosului“ (sintetizata in 1961 de meteorologul Edward LORENZ) este de factura determinista si defineste drept „haotice“ sistemele dinamice non-lineare si aperiodice (cu perioade infinite), ce sunt foarte sensibile la conditiile initiale. Aceste sisteme implica doua fenomene (cu configuratii distincte - „neteda“ si, respectiv, „franta“) ale caror interferente marcheaza o regiune bine definita in spatiul fazelor, numita „Lorenz Attractor“ (sau „Strange Attractor“), ce are si o dimensiune fractala proprie. In acest domeniu, este extrem de interesant si experimentul initiat de Prof. Diana S. DABBY (de la Massachusetts Institute of Technology), ce a aplicat cu ajutorul computerului o serie de coordonate ale “Atractorului Lorentz” la Preludiul I (in Do Major) din Caietul I al “Clavecinului Bine Temperat” de J.S.BACH, pentru a compune “Bach to Chaos: Chaotic Variations on a Classical Theme” (“Science News”, 24 Dec.1994). Mentionez de asemenea faptul ca, in studiul “Anamorfozele Timpului Muzical” (publicat in revista “Muzica”-Bucuresti, Nr.3/1991, p.100-107), precum si in tratatul “MUSICA CAELESTIS – Anamorfozele Sacrului in Arta Sunetelor”(Editura UNMB,2000, ISBN 973-0-02102-3), am analizat o serie de transformari de tip fractal operate in sfera imagisticii muzicale anamorfofice.

De altfel, aplicabilitatea teoriei fractalilor este cu-adevarat universala, existand numeroase programe specifice in domeniile matematicii, fizicii, biologiei, medicinei, genetiicii, chimiei, psihologiei, sociologiei, stiintelor strategice, ecologiei, economiei, tehnologiei, educatiei, lingvisticii, si, nu in ultimul rand, in cel artistic in general si muzical in special (cf. <http://www.calresco.org/applicat.htm>).

Fractalii se „traduc“ matematic prin algoritmi (formule aplicate in informatica, reprezentand seturi de instructiuni/operatii/comenzi, ce - pornind de la un set de valori din domeniul de definitie - produc in timp finit un alt set de valori) – expresia „fractalului Mandelbroit“ („The



Mandelbrot Set“) fiind  $(Z \Rightarrow Z^2 + C) / \text{sau } \langle z, z + c \rangle$ , cea a „fractalului Julia“ („The Julia Set“ – dupa numele matematicianului francez Gaston JULIA) fiind identica, dar procesata diferit, iar cea a „fractalului Feigenbaum“ fiind reprezentata prin ecuatie:  $x(n+1) = rx(n) (1 - x(n))$ . Dintre principalele formule proto-fractale, mentionam: multimea lui Cantor, curbele lui Peano si Hilbert, Curba lui Koch, Triunghiul lui Sierpinski si „Buretele“ lui Menger (apud „Música Fractal: El Sonido del Caos“ de Juan Antonio Pérez Ortiz, Departamento de Lenguajes y Sistemas Informáticos, Universidad de Alicante, Mayo 2000, [japerez@dlsi.ua.es](mailto:japerez@dlsi.ua.es))

#### - 02) Alti algoritmi aplicati in geometria fractala (formule ale Teoriei Haosului):

(apud: - xxx , *Winfract (Fractint for Windows)* , Copyright (C) 1990-93 The Stone Soup Group;

- Gustavo Diaz Jerez, *FractMus*, [gusdiaz@ibm.net](mailto:gusdiaz@ibm.net) , [gusdiaz@attglobal.net](mailto:gusdiaz@attglobal.net) , FractMus 2000 Webpage at: <http://www.geocities.com/SiliconValley/Haven/4386>;

- Arnold Reinders, *a Musical Generator 3.0 (Beta 7)*, Copyright © 1997-2002 Arnold Reinders, Copyright © 1997-2002 MuSoft Builders , <http://www.musoft-builders.com/> . Email: [sales@kagi.com](mailto:sales@kagi.com) ,FAX: +1 510 652 6589, Kagi,1442-A Walnut Street #392-Q97A,Berkeley, California, 94709-1405,USA.):

##### barnsleyj1

$z(0) = \text{pixel};$   
 $z(n+1) = (z-1)*c$  if  $\text{real}(z) \geq 0$ , else  
 $z(n+1) = (z+1)*\text{modulus}(c)/c$

Two parameters: real and imaginary parts of c

##### barnsleyj2

$z(0) = \text{pixel};$   
 if  $\text{real}(z(n)) * \text{imag}(c) + \text{real}(c) * \text{imag}(z(n)) \geq 0$   
 $z(n+1) = (z(n)-1)*c$   
 else  
 $z(n+1) = (z(n)+1)*c$

Two parameters: real and imaginary parts of c

##### barnsleyj3

$z(0) = \text{pixel};$   
 if  $\text{real}(z(n)) > 0$  then  $z(n+1) = (\text{real}(z(n))^2 - \text{imag}(z(n))^2 - 1) + i * (2*\text{real}(z(n)) * \text{imag}(z(n)))$  else  
 $z(n+1) = (\text{real}(z(n))^2 - \text{imag}(z(n))^2 - 1 + \text{real}(c) * \text{real}(z(n)) + i * (2*\text{real}(z(n)) * \text{imag}(z(n)) + \text{imag}(c) * \text{real}(z(n)))$

Two parameters: real and imaginary parts of c.

##### barnsleyj1

$z(0) = c = \text{pixel};$   
 if  $\text{real}(z) \geq 0$  then  
 $z(n+1) = (z-1)*c$   
 else  
 $z(n+1) = (z+1)*\text{modulus}(c)/c$ .

Parameters are perturbations of z(0)

##### barnsleyj2

$z(0) = c = \text{pixel};$   
 if  $\text{real}(z)*\text{imag}(c) + \text{real}(c)*\text{imag}(z) \geq 0$   
 $z(n+1) = (z-1)*c$   
 else  
 $z(n+1) = (z+1)*c$

Parameters are perturbations of z(0)

##### barnsleyj3

$z(0) = c = \text{pixel};$   
 if  $\text{real}(z(n)) > 0$  then  $z(n+1) = (\text{real}(z(n))^2 - \text{imag}(z(n))^2 - 1) + i * (2*\text{real}(z(n)) * \text{imag}(z(n)))$  else  
 $z(n+1) = (\text{real}(z(n))^2 - \text{imag}(z(n))^2 - 1 + \text{real}(c) * \text{real}(z(n)) + i * (2*\text{real}(z(n)) * \text{imag}(z(n)) + \text{imag}(c) * \text{real}(z(n)))$

Parameters are perturbations of z(0)

##### bifurcation

Pictorial representation of a population growth model.

Let P = new population, p = oldpopulation, r = growth rate

The model is:  $P = p + r*p*(1-p)$ .

Two parameters: Filter Cycles and Seed Population.

**bif+sinpi**

Bifurcation variation: model is:  $P = p + r \cdot \sin(\pi \cdot p)$ .  
Two parameters: Filter Cycles and Seed Population.

**bif=sinpi**

Bifurcation variation: model is:  $P = r \cdot \sin(\pi \cdot p)$ .  
Two parameters: Filter Cycles and Seed Population.

**biflambda**

Bifurcation variation: model is:  $P = r \cdot p \cdot (1-p)$ .  
Two parameters: Filter Cycles and Seed Population.

**bifstewart**

Bifurcation variation: model is:  $P = (r \cdot p^2) - 1$ .  
Two parameters: Filter Cycles and Seed Population.

**circle**

Circle pattern by John Connett  
 $x + iy = \text{pixel}$   
 $z = a \cdot (x^2 + y^2)$   
 $c = \text{integer part of } z$   
 $\text{color} = c \text{ modulo}(\text{number of colors})$

**cmplxmarksjul**

A generalization of the marksjulia fractal.  
 $z(0) = \text{pixel};$   
 $z(n+1) = (c \cdot \exp) \cdot z(n) + c.$   
Four parameters: real and imaginary parts of  $c$  and  $\exp$ .

**cmplxmarksmand**

A generalization of the marksmandel fractal.  
 $z(0) = c = \text{pixel};$   
 $z(n+1) = (c \cdot \exp) \cdot z(n) + c.$   
Four parameters: real and imaginary parts of perturbation of  $z(0)$  and  $\exp$ .

**complexnewton, complexbasin**

Newton fractal types extended to complex degrees. Complexnewton colors pixels according to the number of iterations required to escape to a root. Complexbasin colors pixels according to which root captures the orbit. The equation is based on the newton formula for solving the equation  $z^p = r$   
 $z(0) = \text{pixel};$   
 $z(n+1) = ((p - 1) \cdot z(n)^p + r) / (p \cdot z(n)^{p-1}).$   
Four parameters: real & imaginary parts of degree  $p$  and root  $r$

**diffusion**

Diffusion Limited Aggregation. Randomly moving points accumulate. One parameter: border width (default 10)

**fn+fn(pix)**

$c = z(0) = \text{pixel};$   
 $z(n+1) = \text{fn1}(z) + p \cdot \text{fn2}(c)$

Six parameters: real and imaginary parts of the perturbation of  $z(0)$  and factor  $p$ , and the functions  $\text{fn1}$ , and  $\text{fn2}$ .

**fn(z\*z)**

$z(0) = \text{pixel};$   
 $z(n+1) = \text{fn}(z(n) \cdot z(n))$   
One parameter: the function  $\text{fn}$ .

**fn\*fn**

$z(0) = \text{pixel}; z(n+1) = \text{fn1}(n) \cdot \text{fn2}(n)$   
Two parameters: the functions  $\text{fn1}$  and  $\text{fn2}$ .

**fn\*z+z**

$z(0) = \text{pixel}; z(n+1) = p1 \cdot \text{fn}(z(n)) \cdot z(n) + p2 \cdot z(n)$   
Six parameters: the real and imaginary components of  $p1$  and  $p2$ , and the functions  $\text{fn1}$  and  $\text{fn2}$ .

**fn+fn**

$$z(0) = \text{pixel};$$

$$z(n+1) = p1*fn1(z(n))+p2*fn2(z(n))$$

Six parameters: The real and imaginary components of p1 and p2, and the functions fn1 and fn2.

**formula**

Formula interpreter - write your own formulas as text files!

**gingerbread**

Orbit in two dimensions defined by:

$$x(n+1) = 1 - y(n) + |x(n)|$$

$$y(n+1) = x(n)$$

Two parameters: initial values of x(0) and y(0).

**henon**

Orbit in two dimensions defined by:

$$x(n+1) = 1 + y(n) - a*x(n)*x(n)$$

$$y(n+1) = b*x(n)$$

Two parameters: a and b

**Hopalong**

Hopalong attractor by Barry Martin - orbit in two dimensions.

$$z(0) = y(0) = 0;$$

$$x(n+1) = y(n) - \text{sign}(x(n))*\text{sqrt}(\text{abs}(b*x(n)-c))$$

$$y(n+1) = a - x(n)$$

Parameters are a, b, and c.

**IFS**

Barnsley IFS fractals.

**julfn+exp**

A generalized Clifford Pickover fractal.

$$z(0) = \text{pixel};$$

$$z(n+1) = \text{fn}(z(n)) + e^{z(n)} + c.$$

Three parameters: real & imaginary parts of c, and fn

**julfn+zsqr**

$$z(0) = \text{pixel};$$

$$z(n+1) = \text{fn}(z(n)) + z(n)^2 + c$$

Three parameters: real & imaginary parts of c, and fn

**julia**

Classic Julia set fractal.

$$z(0) = \text{pixel}; z(n+1) = z(n)^2 + c.$$

Two parameters: real and imaginary parts of c.

**julia4**

Fourth-power Julia set fractals, a special case of julzpower kept for speed.

$$z(0) = \text{pixel};$$

$$z(n+1) = z(n)^4 + c.$$

Two parameters: real and imaginary parts of c.

**julibrot**

'Julibrot' 4-dimensional fractals.

**julzpower**

$$z(0) = \text{pixel};$$

$$z(n+1) = z(n)^m + c.$$

Three parameters: real & imaginary parts of c, exponent m

**julzpw**

$$z(0) = \text{pixel};$$

$$z(n+1) = z(n)^{z(n)} + z(n)^m + c.$$

Three parameters: real & imaginary parts of c, exponent m

**kamtorus, kamtorus3d**

Series of orbits superimposed.

3d version has 'orbit' the z dimension.

$x(0) = y(0) = \text{orbit}/3;$   
 $x(n+1) = x(n)*\cos(a) + (x(n)*x(n)-y(n))*\sin(a)$

$y(n+1) = x(n)*\sin(a) - (x(n)*x(n)-y(n))*\cos(a)$   
 After each orbit, 'orbit' is incremented by a step size.  
 Parameters: a, step size, stop value for 'orbit', and points per orbit.

#### lambda

Classic Lambda fractal. 'Julia' variant of Mandellambda.  
 $z(0) = \text{pixel};$   
 $z(n+1) = \text{lambda}*z(n)*(1 - z(n)^2).$   
 Two parameters: real and imaginary parts of lambda.

#### lambdafn

$z(0) = \text{pixel};$   
 $z(n+1) = \text{lambda} * \text{fn}(z(n)).$   
 Three parameters: real, imag portions of lambda, and fn

#### lorenz, lorenz3d

Lorenz two lobe attractor - orbit in three dimensions.  
 In 2d the x and y components are projected to form the image.  
 $z(0) = y(0) = z(0) = 1;$   
 $x(n+1) = x(n) + (-a*x(n)*dt) + (a*y(n)*dt)$   
 $y(n+1) = y(n) + (b*x(n)*dt) - (y(n)*dt) - (z(n)*x(n)*dt)$   
 $z(n+1) = z(n) + (-c*z(n)*dt) + (x(n)*y(n)*dt)$   
 Parameters are dt, a, b, and c.

#### lorenz3d1

Lorenz one lobe attractor - orbit in three dimensions.  
 The original formulas were developed by Rick Miranda and Emily Stone.  
 $z(0) = y(0) = z(0) = 1; \text{norm} = \text{sqrt}(x(n)^2 + y(n)^2)$   
 $x(n+1) = x(n) + (-a*dt-dt)*x(n) + (a*dt-b*dt)*y(n)$   
 $+ (dt-a*dt)*\text{norm} + y(n)*dt*z(n)$   
 $y(n+1) = y(n) + (b*dt-a*dt)*x(n) - (a*dt+dt)*y(n)$   
 $+ (b*dt+a*dt)*\text{norm} - x(n)*dt*z(n) - \text{norm}*z(n)*dt$   
 $z(n+1) = z(n) + (y(n)*dt/2) - c*dt*z(n)$   
 Parameters are dt, a, b, and c.

#### lorenz3d3

Lorenz three lobe attractor - orbit in three dimensions.  
 The original formulas were developed by Rick Miranda and Emily Stone.  
 $z(0) = y(0) = z(0) = 1; \text{norm} = \text{sqrt}(x(n)^2 + y(n)^2)$   
 $x(n+1) = x(n) + (-a*dt+dt)*x(n) + (a*dt-b*dt+z(n)*dt)*y(n)/3$   
 $+ ((dt-a*dt)*(x(n)^2-y(n)^2)$   
 $+ 2*(b*dt+a*dt-z(n)*dt)*x(n)*y(n))/(3*\text{norm})$   
 $y(n+1) = y(n) + ((b*dt-a*dt-z(n)*dt)*x(n) - (a*dt+dt)*y(n))/3$   
 $+ (2*(a*dt-dt)*x(n)*y(n)$   
 $+ (b*dt+a*dt-z(n)*dt)*(x(n)^2-y(n)^2))/(3*\text{norm})$   
 $z(n+1) = z(n) + (3*x(n)*dt*x(n)*y(n)-y(n)*dt*y(n)^2)/2 - c*dt*z(n)$   
 Parameters are dt, a, b, and c.

#### lorenz3d4

Lorenz four lobe attractor - orbit in three dimensions.  
 The original formulas were developed by Rick Miranda and Emily Stone.  
 $z(0) = y(0) = z(0) = 1;$   
 $x(n+1) = x(n) + (-a*dt*x(n)^3$   
 $+ (2*a*dt+b*dt-z(n)*dt)*x(n)^2*y(n) + (a*dt-2*dt)*x(n)*y(n)^2$   
 $+ (z(n)*dt-b*dt)*y(n)^3) / (2 * (x(n)^2+y(n)^2))$   
 $y(n+1) = y(n) + ((b*dt-z(n)*dt)*x(n)^3 + (a*dt-2*dt)*x(n)^2*y(n)$   
 $+ (-2*a*dt-b*dt+z(n)*dt)*x(n)*y(n)^2$   
 $- a*dt*y(n)^3) / (2 * (x(n)^2+y(n)^2))$   
 $z(n+1) = z(n) + (2*x(n)*dt*x(n)^2*y(n) - 2*x(n)*dt*y(n)^3 - c*dt*z(n))$   
 Parameters are dt, a, b, and c.

#### lssystem

Using a turtle-graphics control language and starting with an initial axiom string, carries out string substitutions the specified number of times (the order), and plots the resulting.

**lyapunov**

Derived from the Bifurcation fractal, the Lyapunov plots the Lyapunov Exponent for a population model where the Growth parameter varies between two values in a periodic manner.

**magnet1j**

$z(0) = \text{pixel};$

$$z(n+1) = \left| \frac{z(n)^2 + (c-1)}{2z(n) + (c-2)} \right|^2$$

Parameters: the real and imaginary parts of c

**magnet1m**

$z(0) = 0; c = \text{pixel};$

$$z(n+1) = \left| \frac{z(n)^2 + (c-1)}{2z(n) + (c-2)} \right|^2$$

Parameters: the real & imaginary parts of perturbation of z(0)

**magnet2j**

$z(0) = \text{pixel};$

$$z(n+1) = \left| \frac{z(n)^3 + 3(C-1)z(n) + (C-1)(C-2)}{3z(n)^2 + 3(C-2)z(n) + (C-1)(C-2) - 1} \right|^2$$

Parameters: the real and imaginary parts of c

**magnet2m**

$z(0) = 0; c = \text{pixel};$

$$z(n+1) = \left| \frac{z(n)^3 + 3(C-1)z(n) + (C-1)(C-2)}{3z(n)^2 + 3(C-2)z(n) + (C-1)(C-2) - 1} \right|^2$$

Parameters: the real and imaginary parts of perturbation of z(0)

**mandel**

Classic Mandelbrot set fractal.

$z(0) = c = \text{pixel};$

$$z(n+1) = z(n)^2 + c.$$

Two parameters: real & imaginary perturbations of z(0)

**mandel4**

Special case of mandelzpower kept for speed.

$z(0) = c = \text{pixel};$

$$z(n+1) = z(n)^4 + c.$$

Parameters: real & imaginary perturbations of z(0)

**mandelfn**

$z(0) = c = \text{pixel};$

$$z(n+1) = c^{fn} z(n).$$

Parameters: real & imaginary perturbations of z(0), and fn

**Martin**

Attractor fractal by Barry Martin - orbit in two dimensions.

$$z(0) = y(0) = 0;$$

$$x(n+1) = y(n) - \sin(x(n))$$

$$y(n+1) = a - x(n)$$

Parameter is a (try a value near pi)

**mandellambda**

$z(0) = .5; \text{lambda} = \text{pixel};$

$$z(n+1) = \text{lambda} * z(n) * (1 - z(n)^2).$$

Parameters: real & imaginary perturbations of z(0)

**manfn+exp**

'Mandelbrot-Equivalent' for the julfn+exp fractal.

$z(0) = c = \text{pixel};$

$$z(n+1) = \text{fn}(z(n)) + e^{z(n)} + C.$$

Parameters: real & imaginary perturbations of z(0), and fn

**manfn+zsqr**

'Mandelbrot-Equivalent' for the Julfn+zsqr fractal.

$$z(0) = c = \text{pixel};$$

$$z(n+1) = \text{fn}(z(n)) + z(n)^2 + c.$$

Parameters: real & imaginary perturbations of  $z(0)$ , and fn

**manowar**

$$c = z1(0) = z(0) = \text{pixel};$$

$$z(n+1) = z(n)^2 + z1(n) + c;$$

$$z1(n+1) = z(n);$$

Parameters: real & imaginary perturbations of  $z(0)$

**manowarj**

$$z1(0) = z(0) = \text{pixel};$$

$$z(n+1) = z(n)^2 + z1(n) + c;$$

$$z1(n+1) = z(n);$$

Parameters: real & imaginary perturbations of  $z(0)$

**manzpower**

'Mandelbrot-Equivalent' for julzpower.

$$z(0) = c = \text{pixel};$$

$$z(n+1) = z(n)^{\text{exp}} + c; \text{ try exp} = e = 2.71828\dots$$

Parameters: real & imaginary perturbations of  $z(0)$ , real & imaginary parts of exponent exp.

**manzppwr**

'Mandelbrot-Equivalent' for the julzppwr fractal.

$$z(0) = c = \text{pixel}$$

$$z(n+1) = z(n)^{z(n)} + z(n)^{\text{exp}} + C.$$

Parameters: real & imaginary perturbations of  $z(0)$ , and exponent

**marksjulia**

A variant of the julia-lambda fractal.

$$z(0) = \text{pixel};$$

$$z(n+1) = (c^{\text{exp}})^{z(n)} + c.$$

Parameters: real & imaginary parts of c, and exponent

**marksmandel**

A variant of the mandel-lambda fractal.

$$z(0) = c = \text{pixel};$$

$$z(n+1) = (c^{\text{exp}})^{z(n)} + c.$$

Parameters: real & imaginary perturbations of  $z(0)$ , and exponent

**marksmandelpwr**

The marksmandelpwr formula type generalized (it previously had fn=sqr hard coded).

$$z(0) = \text{pixel}, c = z(0) ^ (z(0) - 1);$$

$$z(n+1) = c * \text{fn}(z(n)) + \text{pixel},$$

Parameters: real and imaginary perturbations of  $z(0)$ , and fn

**newtbasin**

Based on the Newton formula for finding the roots of  $z^p - 1$ .

Pixels are colored according to which root captures the orbit.

$$z(0) = \text{pixel};$$

$$z(n+1) = ((p-1)*z(n)^p + 1)/(p*z(n)^{(p-1)}).$$

Two parameters: the polynomial degree p, and a flag to turn on color stripes to show alternate iterations.

**newton**

Based on the Newton formula for finding the roots of  $z^p - 1$ .

Pixels are colored according to the iteration when the orbit is captured by a root.

$$z(0) = \text{pixel};$$

$$z(n+1) = ((p-1)*z(n)^p + 1)/(p*z(n)^{(p-1)}).$$

One parameter: the polynomial degree p.

**pickover**

Orbit in three dimensions defined by:

$$x(n+1) = \sin(a*y(n)) - z(n)*\cos(b*x(n))$$

$$y(n+1) = z(n)*\sin(c*x(n)) - \cos(d*y(n))$$

$z(n+1) = \sin(x(n))$   
 Parameters: a, b, c, and d.

#### plasma

Random, cloud-like formations. Requires 4 or more colors.  
 A recursive algorithm repeatedly subdivides the screen and

colors pixels according to an average of surrounding pixels  
 and a random color, less random as the grid size decreases.  
 Three parameters: 'graininess' (.5 to 50, default = 2), old/new  
 algorithm, seed value used.

#### popcorn

The orbits in two dimensions defined by:  
 $x(0) = \text{apixel}$ ,  $y(0) = \text{ypixel}$ ;  
 $x(n+1) = x(n) - h * \sin(y(n) + \tan(3 * y(n)))$   
 $y(n+1) = y(n) - h * \sin(x(n) + \tan(3 * x(n)))$   
 are plotted for each screen pixel and superimposed.  
 One parameter: step size h.

#### popcornjul

Conventional Julia using the popcorn formula:  
 $x(0) = \text{apixel}$ ,  $y(0) = \text{ypixel}$ ;  
 $x(n+1) = x(n) - h * \sin(y(n) + \tan(3 * y(n)))$   
 $y(n+1) = y(n) - h * \sin(x(n) + \tan(3 * x(n)))$   
 One parameter: step size h.

#### rossler3D

Orbit in three dimensions defined by:  
 $x(0) = y(0) = z(0) = 1$ ;  
 $x(n+1) = x(n) - y(n) * dt - z(n) * dt$   
 $y(n+1) = y(n) + x(n) * dt + a * y(n) * dt$   
 $z(n+1) = z(n) + b * dt + x(n) * z(n) * dt - c * z(n) * dt$   
 Parameters are dt, a, b, and c.

#### sierpinski

Sierpinski gasket - Julia set producing a 'Swiss cheese triangle'  
 $z(n+1) = (2 * x, 2 * y - 1)$  if  $y > .5$ ;  
           else  $(2 * x - 1, 2 * y)$  if  $x > .5$ ;  
           else  $(2 * x, 2 * y)$   
 No parameters.

#### spider

$c(0) = z(0) = \text{pixel}$ ;  
 $z(n+1) = z(n)^2 + c(n)$ ;  
 $c(n+1) = c(n)/2 + z(n+1)$   
 Parameters: real & imaginary perturbation of  $z(0)$

#### sqr(1/fn)

$z(0) = \text{pixel}$ ;  
 $z(n+1) = (1/\text{fn}(z(n)))^2$   
 One parameter: the function fn.

#### sqr(fn)

$z(0) = \text{pixel}$ ;  
 $z(n+1) = \text{fn}(z(n))^2$   
 One parameter: the function fn.

#### test

'test' point letting us (and you!) easily add fractal types via  
 the c module testpt.c. Default set up is a mandelbrot fractal.  
 Four parameters: user hooks (not used by default testpt.c).

#### tetrate

$z(0) = c = \text{pixel}$ ;  
 $z(n+1) = c^z(n)$   
 Parameters: real & imaginary perturbation of  $z(0)$

#### tim's\_error

A serendipitous coding error in marksmandelpwr brings to life  
 an ancient pterodactyl! (Try setting fn to sqr.)

```

z(0) = pixel, c = z(0) ^ (z(0) - 1);
tmp = fn(z(n))
real(tmp) = real(tmp) * real(c) - imag(tmp) * imag(c);
imag(tmp) = real(tmp) * imag(c) - imag(tmp) * real(c);
z(n+1) = tmp + pixel;
Parameters: real & imaginary perturbations of z(0) and function fn

```

#### unity

```

z(0) = pixel;
x = real(z(n)), y = imag(z(n))
One = x^2 + y^2;
y = (2 - One) * x;
x = (2 - One) * y;
z(n+1) = x + i*y

```

No parameters.

(apud Winfract (Fractint for Windows), Copyright (C) 1990-93 The Stone Soup Group)

Morse-Thue Sequence The Morse-Thue sequence comes from number theory and has many interesting mathematical properties. It can be generated in many ways, one of the simpler ones is starting from 0 and adding its binary complement, as follows: 01 10 10 01 10 01 01 10 ...

One of the most interesting properties of the sequence is that if you remove every even number, you get back the same sequence !! This self-similarity gives the sequence fractal properties. How do you make music out of this sequence?. Very simply.

First you choose a Base in which to count (the original sequence is in base 2). Second, you choose a number by which the counters will be multiplied (Multiplier). Now, this is what happens: The number shown in the Start Counter is multiplied by the Multiplier, then the result is converted to the base you have chosen, for example:

base 3 mult 3 (counter 17) =  $3 \times 17 = 51 \rightarrow 3 = 1220$ .

The digits of this number are then added:

$1+2+2+0 = 5$

and made the modulo operation with the number of notes in the scale times the number of octaves. Assuming C major (7 notes) and 1 octave, this yields:

$5 \% (7 \times 1) = 5$ ,

which is then added to the starting note in MIDI values (middle C is No. 60). Since the mapping starts at 0, then the resulting note is an A above middle C.

Some base-multiplier combinations yield an amazing variety, while others are boringly static. The result depends in the right combination of base, multiplier and scale.

These are some interesting combinations:

base: n multiplier:  $n^p \pm 1$

base: nm (n,m integers) multiplier: mn, where both nm and mn are primes.

The best teacher is experimenting, your only limit is your imagination.

Earthworm Sequence "Earthworm" algebra was first discussed by Clifford A. Pickover in his book Computers and the imagination. While digging up in his garden Clifford accidentally severed an earthworm. It is known that both parts of a severed earthworm generally continue growing, so Mr. Pickover did not worry too much about the fate of the earthworm. However, he devised a method of multiply-and-sever which he called "Earthworm algebra". It works as follows: take any whole number A, a constant multiplier B and a number which will be the maximum number of digits allowed, C. Next, multiply A and B. Take the result and multiply it again by B. Repeat this process until the number of digits in the result get past C. Now, sever the result by truncating it to its rightmost C digits. Multiply again by B and sever again to C digits, and so forth. It turns out that all earthworms (mathematically speaking) eventually enter a cycle, an infinite loop of repeating values. A simple example: let's take 2 as our first number, 3 as the multiplier and 2 for the maximum number of digits. The sequence will go as follows: 6 18 54 62 (severed 162) 86 58 74 22 66 98 94 82 46 38 14 42 26 78 34 2 6 18... This particular combination gives a cycle of 20 different values. Some combinations generate "worms" that are thousands of values long. Initial value of X, Multiplier and Max. number of digits in the dialog box must be positive whole numbers greater than 1. Max. number of digits is 10. This simple procedure yields great complexity. The generated sequences seem to be almost random, but if you listen to them you'll notice hidden patterns. I believe that aural inspection of these algorithms reveals information that would otherwise go unnoticed.

Wolfram one-dimensional Cellular Automata The mathematician Stephen Wolfram created a one-dimensional variation of von Neumann's cellular automata which develops on a one-dimensional universe (a line). In this type of CA, each cell is surrounded by only two other cells, its two immediate neighbors on either side. Each succeeding generation is represented by a line underneath the preceding one. A cell in generation 2 determines its state (dead or alive) by looking at the state of the cell directly above it (that is, in generation 1) and at that cell's two neighbors. There are only eight possible combinations of the states of those 3 cells, ranging from "AAA" (all alive) to "DDD" (all dead).

Since there are only eight possible states for the ancestors of any given cell, and these states may result in one of two states for the new cell (dead or alive), there are 256 (2 to the 8th power) possible rule sets for this type of cellular automata. Wolfram classified all 256 rules in four different "classes":

· Class I are rules that generate boring configurations, such as all dead or all alive cells.

· Class II includes "frozen" configurations that eventually settle down to stable structures.



- Class III rules generate chaotic configurations, resembling noise patterns.
- Class IV rules display complex but not random behavior. The output is highly sensitive on initial conditions (cell configuration).

In the Rules group box you can select which rule you want to use. This can be done either by entering the rule number directly in the edit box or selecting the state of the cells by clicking on the check boxes. A checked box means the cell will live if the 3-cell configuration above it (the cell and its two neighbors) is met in the previous generation, an unchecked box means the cell will die. Initial configuration is a number between 1 and 1410065408, representing the initial state of cells in generation 1 (encoded as a 32-bit integer). Universe size is the length of the cellular automaton in cells. This universe is a one-dimensional torus, that is, the last cell connects with the first cell. Allowed values range from 128 to 512. It is remarkable how the aural representation resembles the graphical output of these CA. You can very clearly hear the differences between all four classes and how they match perfectly with their graphical counterpart.

**3n+1 numbers** Take any whole number greater than 1. If it is even, divide it by two, if odd, multiply by 3 and add 1; continue with this process until you reach the number 1. This is the procedure to generate 3n+1 number sequences, a.k.a. hailstone numbers. Take for example the number 7. It generates the following sequence: 7, 22, 11, 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1, 4, 2, 1, 4, 2, 1...It is conjectured that all numbers "fall" to 1 after a finite number of iterations. Some numbers generate extraordinarily long sequences before falling to 1. 27 is one of the smallest examples. Very little is known about these simple but mysterious sequences. Although seemingly chaotic, there is an hidden order in these sequences, and you can easily tell when you listen to the music they generate.

**Logistic Map** The Logistic Map is one of most studied non-linear equations in chaotic dynamics. It models very well the behavior of many natural phenomena, such as predator-prey ecosystems, food-population, etc. It is defined as follows:

$$X(n+1) = X(n) * \mu * (1 - X(n)),$$

where  $\mu$  is any real value in the interval  $[0, 4]$ . The iteration of this formula gives back values between  $[0, 1]$ . For  $\mu$  values less than 3.5 the iteration quickly stabilizes into one value. But at higher values of  $\mu$  the solutions bifurcate, stabilizing in 2 values then 4, 8, 16... until total chaos is reached.

This is call period doubling. Surprisingly, among this sections of total chaos there are others that have a stable number of values. For a  $\mu$  value of 4, the behavior is totally unpredictable, random. The logistic map is an example of deterministic chaos.

How the Logistic Map is transformed into notes is a very simple matter:

The Start Counter is used as an iteration control. The formula will be iterated until the number shown there. The result (between 0, and 1) is then multiplied by the number of notes in the scale and by the number of octaves. The result of adding this value to the starting note is the final note that will be played.

Since the sequence of values is deterministic, for a given value of  $\mu$  you always get the same sequence of values, thus the same melodies.

**1/f noise** 1/f noise ("one-over-f-noise", occasionally called "flicker noise" or "pink noise") is a type of noise whose power spectra  $P(f)$  as a function of the frequency  $f$  behaves like:  $P(f) = 1/f^a$ , where the exponent  $a$  is very close to 1 (hence the name "1/f noise"). 1/f noise appears in nature all over the places, including traffic flow, radioactive decay, chemical systems, granular flow, ecological systems, human speech...and music!! Extensive spectral analysis of "pleasing" pieces of music, such as Bach's Brandenburg Concerti, Vivaldi's four seasons, etc, etc, show the same spectrum as the 1/f noise. The music derived from the 1/f noise is the most pleasing to the human ear: it does not have the unpredictability and randomness of "white noise" (the power spectrum of the Logistic Map for a  $\mu$  value of 4) nor the predictability of "brown noise" (derived from brownian motion). The 1/f noise is simulated with the following non-linear equation (for more information see Fractals, Chaos, Power Laws):

$$X(n+1) = (X(n) * \beta) + (\text{sqr}(1 - \beta^2) * r),$$

where  $\beta$  is a real number between  $[0, 1]$  and  $r$  is any random value. The user has to specify only the  $\beta$  parameter.

Instead of using a truly random value for  $r$ , the program uses the Logistic Map algorithm with a  $\mu$  value of 4, which generates random but deterministic values. This is necessary so that your melodies are the same for the same set of parameters, otherwise you would never know what will come next. As with the Logistic Map, the Start Counter is used as an iteration control.

Try using values of  $\beta$  that are not too much to the extremes (0 and 1), for the music gets "brownish". Best values are between .4 and .9.

**Henon** The Henon attractor is a two-dimensional chaotic map defined by the following equations:

$$X(n+1) = 1 + Y(n) - a * X(n)^2$$

$$Y(n+1) = b * X(n)$$

This attractor is named after its discoverer, Michel Henon, an astronomer at the Nice Observatory in France. Although it is composed entirely of lines, orbits on this fractal do not flow continuously, but jump from one location to another in the attractor. This is a chaotic attractor: all seed values that converge do so in different ways. Single points that are initially separated (even by the most minuscule gap) eventually diverge. The Henon attractor also has an infinite amount of structure. Successive magnifications prove an ever increasing degree of detail. Any cross-section made through an arm of the Henon attractor forms a Cantor middle-thirds set. Two parameters: initial values of  $a$  and  $b$ . Range of both variables is  $[1, 2]$ . Classical attractor parameters are  $X(0)=1.4$ ,  $Y(0)=0.3$ .

**Hopalong** This two-dimensional chaotic map, proposed by Barry Martin, is defined by the following equations:

$$X(n+1) = Y(n) - \text{sign}(X(n)) * \text{sqr}(|\sin(a) * X(n) - \cos(a)|)$$

$$Y(n+1) = a - X(n)$$

One parameter: value of the angle  $a$  in radians. Range of  $a$  is from  $-2\pi$  to  $2\pi$ .

**Martin** This two-dimensional chaotic map was proposed by Barry Martin (see also Hopalong). It is defined by the

following equations:

$$\begin{aligned} X(n+1) &= Y(n) - \sin(X(n)) \\ Y(n+1) &= a - X(n) \end{aligned}$$

One parameter: value of the angle  $a$  in radians. Range of  $a$  is from  $-2\pi$  to  $2\pi$ .

**Gingerbread man** This two-dimensional chaotic map, although very easy to generate, is still very poorly understood. It was proposed by R. Devaney in 1988. It is defined by the following equations:

$$\begin{aligned} X(n+1) &= 1 - Y(n) + |X(n)| \\ Y(n+1) &= X(n) \end{aligned}$$

Two parameters: initial values of  $X$  and  $Y$ . Valid range for both variables is  $[-20, 20]$ .

For more information on this fractal refer to "The Science of Fractal Images" .

**Lorenz** This algorithm uses a chaotic equation proposed by Lorenz in 1976 as part of his research in climatology. The equation is defined as follows:  $X(n+1) = a(3X(n) - 4X(n)^3)$

One parameter: value of  $a$ . Valid range is  $[0, 1]$ . Range with best results is  $[0.65, 1]$ .

**Random** This algorithm uses a pseudo-random number generator to produce values between 0 and 1. The music generated with this algorithm is always unpredictable and does not show any discernible pattern. You can choose the range of the numbers generated. Minimum and Maximum must be in the range  $[0, 1]$ . Minimum must be less than Maximum.

These algorithms come from number theory, such as the Morse-Thue algorithm, noise simulation ( $1/f$  noise), chaotic dynamics (Logistic Map), fractals (Henon, etc.) and cellular automata (Wolfram). All algorithms' dialog boxes include a visualize button which shows a graphical representation of the data. For a more in-depth discussion of these algorithms refer to any of the great number of books written on the subject.

(apud Gustavo Diaz Jerez, [FractMus\\_gusdiaz@ibm.net](mailto:FractMus_gusdiaz@ibm.net) , [gusdiaz@attglobal.net](mailto:gusdiaz@attglobal.net) , FractMus 2000 Webpage at: <http://www.geocities.com/SiliconValley/Haven/4386>)

**Build your own fractals** The most exciting thing (in my opinion) is trying to build your own fractals, but you must have some idea of common mathematics. Fractals are based on self referencing. That means that expressions like:

$$\begin{aligned} x &= a - \sin(y) \\ y &= \sin(x) - \cos(y) \\ z &= x * y \end{aligned}$$

are quite common. The  $X$  before the equals sign denotes the newly to be computed  $X$ . Note that in this example the  $X$  and  $Y$  after the equals sign refer to the current  $X$  and  $Y$  values. So in the expression  $y = \sin(x) - \cos(y)$ , the current  $X$  is used, even when a new  $X$  was computed in the former equation.

**A Musical Generator** iterates the equations from 1 to  $N$ .  $N$  is a value you can provide. The iteration value is assigned to the variable  $T$ . So you have four variables:  $T$  (the iteration variable) and  $X, Y, Z$ : the variables for each dimension. The equation computed for  $Z$  is used for the color, you may omit this equation. An equation for  $Y$  must be supplied. If you

omit the equation for  $X$ , the value for  $T$  will be assumed. That means that if you provide only the equation:  $y = \sin(x)$ ,  $y$  will assume the value  $\sin(1), \sin(2) .. \sin(N)$ . \_

Apart from the variables you may provide up to five parameters: A .. E. These do not change during the computation of the formula, you can set these when you edit the formulas. \_

How to create your own fractal? Select the Dynamic Sytems tab and click the button Your own fractal The user editor comes up, and you can supply the formulas, starting values of the fractal and the values for the parameters.

(apud Arnold Reinders, a Musical Generator 3.0 (Beta 7) Copyright © 1997-2002 Arnold Reinders, Copyright © 1997-2002 MuSoft Builders , <http://www.musoft-builders.com/> . Email: [sales@kagi.com](mailto:sales@kagi.com) ,FAX: +1 510 652 6589, Kagi,1442-A Walnut Street #392-Q97A,Berkeley, California, 94709-1405,USA)

### **- 03.) Generarea fractalilor prin L-Systems:**

(apud Jason Stredwick, MSU 2004 - L-Systems, Lindenmayer Systems, [algorithmicbotany.org](http://algorithmicbotany.org))

L-System Overview

Goals (Plant modeling)

- Structural
- Developmental
- Chemical

Parallel replacement grammar

Representative of multicellular growth

Other types of parallel replacement systems

- Open polygon by Koch
- Cellular automata by Wolfram
- Game of Life by Conway

L-System grammar interpretations

- LOGO (graphical modeling of plants)
- Pure math
- Jordan Pollack's Golem project

D0L-System Notation

0 stands for context free

D stands for deterministic

V is the alphabet

V\* is the set of all words over V

V+ is V\* excluding the empty word

is the word in V+ that is the seed of the system, called the axiom

P is the set of production rules, explained later

0L-System is defined as  $G = \langle V, \alpha, P \rangle$

D0L-System Product Rules

Production rule is defined as  $P \subseteq V \times V^*$

Alternate notation ( , ) or

is called the predecessor

is called the successor

can only be a single character

can be any word, which includes letters

If no production rule is given for a predecessor, it is assumed to be

Determinism

A system is considered deterministic if and only if for each predecessor, there exists exactly one production rule, or more simply each letter in the alphabet can map to exactly one word in V\*.

Example: D0L-System

Alphabet: {a,b}

Words: {a,b,ab}

Production Rules:

a ab

b a

(seed): b

Recursion Depth 5

String Depth

b 0

a 1

ab 2

aba 3

abaab 4

abaababa 5

LOGO Language

Used to graphically model plants

F move forward while drawing a line

f move forward without drawing a line

+ rotate left

- rotate right

3-D instructions are also available, using Euler rotations

n = 4

= 90

= -F

P: F F+F-F-F+F

n = 2

= 90

= F-F-F-F

P: F F+FF-FF-F-F+F

n = 2

= 90

= F+F+F+F

P: F F+f-FF+F+FF+ff+FF-f+FF-F-FF-ff-FFF

f fffff

Context Sensitive L-System

Non-deterministic

Types: 1, 2, and I, written 2L-System

Uses neighbor information as a condition to use a production rule

> Right of predecessor

< Left of predecessor

Example:

1. > F Type 1

2. + <> F Type 2

++F <> F+F Type I

Context

Signal Propagation

: baaaa

p1: b < a b

p2: b a

baaaaa

abaaaa

aabaaa

Sensitive

Example

aaabaa

aaaaba

aaaaab

aaaaaa

**Non-deterministic**

Each predecessor,

Multiple production rules

Each rule has a probability of use

Probabilities must sum to one

**Example:**

F

FF

FFF

**Stochastic L-System**

0.1

0.2

0.7

**Bracketed L-System**

[ push current state onto a stack

] pop current state onto a stack

Used to create tree like structures

n = 5

= 25.7

= F

P: F F[+F]F

[-F]F

n = 5

= 20

= F

P: F F[+F]F

[-F][F]

n = 4

= 22.5

= F

P: F FF[-F+F]F+

[+F-F-F]

n = 7

= 20

= X

P: F FF

X F[+X]F[-X]+X

n = 7

= 25.7

= X

P: F FF

X F[+X][-X]FX

n = 5

= 22.5

= X

P: F FF

X F-[[X]+X]+F

[+FX]-X

**Parameterized L-System**

V is the alphabet

is the set of formal parameters, , real numbers

is the axiom, seed, (V x \*)+

E() represent math operations

C() represent logic operations, conditional

is the predecessor, (V x \*)

is the successor, (V x E())\*

P x C() x

G = <V, , , P> defines a parametric 0L-System

**Parameterized 0L-System Example**

: B(2)A(4,4)

p1: A(x,y) : y<=3 A(x\*2, x+y)

p2: A(x,y) : y>3 B(x)A(x/y, 0)

p3: B(x) : x<1 C

p4: B(x) : x>=1 B(x-1)

B(2)A(4,4)

B(1)B(4)A(1,0)

B(0)B(3)A(2,1)

CB(2)A(4,3)  
 CB(1)A(8,7)  
 CB(0)B(8)A(1,0)  
**Hornby/Pollack**  
**Multiple applications**  
 Considers there system generic by simply replacing the alphabet.  
 Uses Parameterized Bracketed D0L-System  
 Constrain conditions to compare with a constant  
 Additional feature: {...}(n) block repeat  
**Table Language**  
 Forward(n)  
 Backward(n)  
 Up(n)  
 Down(n)  
 Left(n)  
 Right(n)  
 Clockwise(n)  
 Counter-clockwise(n)  
 [ ]  
 { block }(n)  
 [{{forward(6)}left(1)}(4)]  
 up(1)forward(3)down(1)  
 [{{forward(4.5)}left(1)}(4)]  
**Neural Network Language**  
 decrease-weight(n)  
 duplicate(n)  
 increase-weight(n)  
 loop(n)  
 merge(n)  
 next(n)  
 output(n)  
 parent(n)  
 reverse(n)  
 set-function(n)  
**Mutation**  
**Original:**  

$$P0(n0, n1) : n0 > 5.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Mutate condition:**  

$$P0(n0, n1) : n0 > 7.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Mutate arguement:**  

$$P0(n0, n1) : n0 > 5.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 2.0, n0/2.0) ]$$
**Mutation**  
**Original:**  

$$P0(n0, n1) : n0 > 5.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Mutate symbol:**  

$$P0(n0, n1) : n0 > 7.0 \{ c(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Mutate random symbol (removed b(2.0)):**  

$$P0(n0, n1) : n0 > 5.0 \{ a(1.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 2.0, n0/2.0) ]$$
**Mutation**  
**Original:**  

$$P0(n0, n1) : n0 > 5.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Insert random symbol:**  

$$P0(n0, n1) : n0 > 7.0 \{ a(1.0)b(2.0) \}(n1)c(3.0)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$
**Encapsulate a block of characters:**  

$$P0(n0, n1) : n0 > 5.0 \{ P2(n0, n1) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 2.0, n0/2.0) ]$$

$$P2(n0, n1) : n0 > 5.0 a(1.0)b(2.0)$$

$$n0 > 2.0 a(1.0)b(2.0)$$
**Recombination**  
**Original:**  

$$P3(n0, n1) : n0 > 5.0 \{ a(1.0)b(2.0) \}(n1)$$

$$n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$$

$$P3(n0, n1) : n0 > 3.0 b(3.0)a(2.0)$$

$$n0 > 1.0 P1(n1 - 1.0, n0 - 2.0)$$

Replace condition-successor pair

$P3(n0, n1) : n1 > 3.0 \text{ b}(3.0)\text{a}(2.0)$   
 $n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$

Original:

$P3(n0, n1) : n0 > 5.0 \{ a(1.0)\text{b}(2.0) \}(n1)$   
 $n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$

$P3(n0, n1) : n0 > 3.0 \text{ b}(3.0)\text{a}(2.0)$   
 $n0 > 1.0 P1(n1 - 1.0, n0 - 2.0)$

Replace successor

$P3(n0, n1) : n1 > 3.0 \text{ b}(3.0)\text{a}(2.0)$   
 $n0 > 2.0 P1(n1 - 1.0, n1 - 2.0)$

Original:

$P3(n0, n1) : n0 > 5.0 \{ a(1.0)\text{b}(2.0) \}(n1)$   
 $n0 > 2.0 [ P1(n1 - 1.0, n0 / 2.0) ]$

$P3(n0, n1) : n0 > 3.0 \text{ b}(3.0)\text{a}(2.0)$   
 $n0 > 1.0 P1(n1 - 1.0, n0 - 2.0)$

Replace one block with another

$P3(n0, n1) : n1 > 3.0 \text{ b}(3.0)\text{a}(2.0)$   
 $n0 > 2.0 [ \text{b}(3.0)\text{a}(2.0) ]$

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- **04) - PRINCIPALELE PROGRAME MUZICALE FRACTALE (ALGORITMICE, GENERATIVE)**

- **Universal Music Machine (UMM) v.0.5.7** , Free compositional software tool developed by Steve Ricks and Morgan Quigley <http://www.universalmusicmachine.com/> , [steve.ricks@byu.edu](mailto:steve.ricks@byu.edu) , [mlq3@email.byu.edu](mailto:mlq3@email.byu.edu) , [morganquigley@gmail.com](mailto:morganquigley@gmail.com) . Acest important program algoritmic este extrem de util in asistarea procesului componistic – de pilda in sintetizarea diferitelor tipuri de texturi in zona sonoritatilor globale. Utilizarea programului implica trei etape: 1.) se stabilesc pentru fiecare pista (“track”) setarile, adica coordonatele de baza (“Pitch”, “Rhythm”, “Dynamics”), tipul de algoritm (“Random”, “Sequential”, “Bottle” sau “Persistent Sequence”), “Track Size”, “Beat Offset”, “MIDI Patch”, “Tempo”; 2.) se actioneaza comanda “Generate Sequence”; 3.) produsul sonor – ce poate fi salvat atat in formatul MIDI (“Export MIDI file”), cat si in formatul specific programului (“ssn”/ “Session File”) prin succesiunea de comenzi “File-Save” - poate forma si un “Sample” utilizabil in viitoare aplicatii. Prin suprapunerea mai multor piste (“tracks”) se pot obtine texturi sonore deosebit de complexe, ce pot fi integrate in partituri, prin convertirea formatului MIDI in formatul programului utilizat pentru elaborarea partituri (de pilda prin comanda “Import MIDI” in programule “Mozart”, “Finale” sau “Sibelius”). UMM poate rula atat in sistemul de operare Windows (XP/2000/Me/98), cat si in Mac OS X v10.2 "Jaguar" si v10.3 “Panther”.

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- Oblivion - Chaotic Music Generator [cynique@postmark.net](mailto:cynique@postmark.net)

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### - Cap. E

#### LIVE COMPUTER MUSIC – O NOUA IPOSTAZA A ARTEI INTERACTIVE

Interactivitatea ilustreaza relatia individului cu mediul ambiant. Acest fenomen este cuantificabil, avand o configuratie spectrala (ce variaza de la pasiv la interactiv). El reprezinta totodata si o coordonata esentiala a artei sunetelor in general si a muzicii de camera in special. In acest context, domeniul « computer music » include si genul « live computer music » (cel mai simplu exemplu fiind ilustrat prin tehnica « karaoke »). « Live electronic music » s-a dezvoltat in a doua jumătate a secolului XX in zona avangardei americane, urmand directia cercetarii fascinantelor relatii interactive stabilite in timp real intre om (performer) si masina (ordinador) prin intermediul unei interfete speciale, conform schemei : performer(s) – controllers (sensors) – computer (cu programe specifice, precum « MidiLive », « pCM », « Kyma », « Max », « Sonar 3 », etc.) – generator/sintetizator (analog sau digital) – amplificator – difuzoare.

In aceasta ordine de idei, celebrul compozitor Rodney OAKES, ce este si un important pionier al genului , imi marturisea urmatoarele : « utilizez curent MX4, un program-sintetizator produs de MOTU, ce ruleaza in combinatie cu Digital Performer; eu comand computerul cu trombonul, prin intermediul unui Yamaha G50 pitch to MIDI controller si al unei pedale Yamaha MFC10 . Partea electro-acustica complementara este inregistrata pe CD. In ultimii doi ani am folosit programele *MetaSynth* , *Digital Performer* si, ocazional, *Reason . MetaSynth* mi-a oferit posibilitatea de a sintetiza imagini sonore din fotografii digitale, astfel incat in acesti ani am compus trei DVD-uri : *Homage to Chopin*, *Maise* si *The Blue Bridge* . Toate aceste lucrari au fost create prin transformarea unor fotografii realizate de mine. »

Mentionam de asemenea si experimentele initiate la Illinois University in perioada 1972-1975 de catre compozitorul Joseph PINZARRONE, ce a imaginat – impreuna cu inginerul Thomas NOGGLE si cu coregrafa Debra LOEWEN – un interesant sistem de transformare a miscarii in sunet (« Interactive Woman-Machine Improvisations ») bazat pe un proces de tip bio-feedback implicand conectarea a 64 de senzori instalati pe corpul dansatoarei la un sintetizator analog, prin intermediul unui program special instalat pe computer. (<http://www.atariarchives.org/bcc3/showpage.php?page=81> )

Tot in aceasta perspectiva reliefam si recentul « computerART project » - coordonat de compozitorul Leonello TARABELLA in cadrul « Computer Music Laboratory of CNUCE-CNR » din Pisa, Italia – ce consta in transformari ale miscarii mainilor in structuri sonore, prin intermediul unor senzori cu raze IR (“TwinTowers” si “PalmDriver”) ale caror semnale sunt transformate de computer (in baza programului “pureC MUSIC LANGUAGE”) in coduri acustice preluate in final de lantul “generator-amplificator-difuzor”. (<http://tarabella.isti.cnr.it> )

Un reprezentant de frunte al genului “live computer music” este si compozitorul american Carl STONE, ce foloseste curent tehnica “sampling” (ce consta in combinarea libera a unor mici fragmente sonore preinregistrate) in conjunctie cu imagini sonore sintetizate live. (<http://redcat.org> )

In acelasi spirit, compozitoarea si violoncelista Joan JEANRENAUD – autoare si a interesantului studiu “*Reinventing Chamber Music*” (publicat in « NewMusicBox » [lasso.euge.net/ar.nmbx](http://lasso.euge.net/ar.nmbx)) - isi propune ca prin intermediul acestui nou gen cultivat in lucrari

precum *Metamorphosis* pentru violoncel si computer, sa realizeze inedite structuri sincretice compuse “in real time” din variate elemente de factura audio-vizuala. (<http://www.jccello.org> )

O coordonata esentiala in anumite circumstante este ilustrata *prin capacitatea improvizatorica a interpretului* – aceasta calitate fiind determinata de o serie de factori strict individualizati (cunostintele muzicale, creativitatea, stilul personal, comunicativitatea, posibilitatile tehnice instrumentale, conexiunea cu ceilalti interpreti – ca element definitoriu al performantei camerale), in conjunctie cu feed-back-ul acustic (incluzand caracteristicile mediului ambiant) si cu modul de reactie a publicului. In acest context, o situatie des intalnita in muzica contemporana este reprezentata prin asa-numita “*improvizatie controlata*” (aspect analizat si la IRCAM - Paris – <http://smc04.ircam.fr/ProgWorkshop.html> ) , ce implica un amplu proces analitic/generativ desfasurat in mai multe faze: “ascultarea” fondului sonor, segmentarea, extragerea “pattern”-urilor, automatizarea compozitiei modulare, adaptarea la conditiile specifice ale elementului “interfata” si ale programelor audi/midi rulate pe computer (conform studiului “Composing & Performing Interactive Music” de Bruce PENNYCOOK, DMA, Dept. of Composition – School of Music, Dept. of Radio Television Film – College of Communication – University of Texas at Austin, McGill University at Montreal <http://www.music.mcgill.ca/~ko/610/BPSeminarSlides/sld001.htm>).

Gratie programelor de analiza si sinteza digitala - ce pot reduce fenomenologic orice domeniu la ordinea arhetipala a numerelor in sistem binar, recompunandu-l apoi algoritmic, intr-o noua perspectiva holistica -, in lumea virtuala a computerului nici o transformare nu este imposibila, nici o asociere nu este irealizabila ! De aceea, proiectarea lumii reale in “oglinza anamorfoica” a lumii virtuale create de computer poate oferi imagini tulburatoare, cu profunde si inedite valente artistice.

In fond, acesta este si sensul artei interactive, asa cum s-a demonstrat recent si cu prilejul festivalului “New Sound, New York” (30 Martie – 16 Mai 2004 - <http://www.timeoutny.com/nsny/>), ce a fost dedicat exclusiv relatiilor interactive dintre muzica, arhitectura si artele vizuale – impresionanta manifestare incluzand concerte experimentale in aer liber si instalatii multi-media subsumate urmatoarelor teme (NB – cu scurte prezentari originale): „*the interactive project - activated environments and hybrid instruments*” (presentations about responsive environments and new technologies), “*resonating frequencies - dialogues on architecture & music*” (prominent architects and composers are paired to reflect on architecture and music), „*architects design music*” (Michael J.Schumacher’s computer-based matrix)“, „*feedback*” (sound innovators explore the use of feedback to create sonic environments), “*anyware*” (a real-time concert in "networked" collaboration with colleagues worldwide: Ljubjana, Berlin, Munich, Barcelona, Montreal, London, Canary Islands, Vienna, Amsterdam, Prague), “*tune(in)) the kitchen*” (this sound installation/event is designed for a virtually silent environment in which listeners hear live performances through individual radio headsets), “*annon wolman & carl stone*” (a sound installation by Israeli composer Amnon Wolman and a new, erythroblastic remix of the Tokyo urban soundscape by pioneer of live computer music Carl Stone), “*The Morrow Sound Cube™*” (a multi-channel, playback environment providing an immersive, 3D audio experience), “*christopher janney: sonic forest '04*” (a free-standing, interactive sound/light installation composed of sixteen 4-foot aluminum "electronic trees," each set with audio speakers, lights and photo-electric sensors. As passersby walk between columns, the sensors are triggered to produce an ever-changing "score" of melodic tones, environmental sounds and spoken text, accompanied by varying light effects. If participants solve the "riddle," they may also activate pre-programmed patterns from a flock of birds to a swarm of fireflies at night), “*listening room*” (two compilation CD’s featuring highlights from the 1979 “New Music, New York” concerts – Philip Glass, Steve Reich, Meredith Monk, Pauline Oliveros, Tony Conrad -"One of the most important records ever of the history of minimal music."/Tom Johnson, *The Village Voice* ), “*rock's role (after ryoanji)*” (sound works by artists responding to John Cage's musical transliterations of the famed Japanese Zen rock garden, Ryoanji; the works are arranged spatially and temporally so that they can be heard both in isolation and simultaneously), “*o+a (bruce odland and sam auinger): blue moon*” (an installation that transforms the ambient soundscape of the Hudson River waterfront at the World Financial Center into a resonant environment; tuning tubes wired with microphones and suspended over the harbor harmonize the local acoustic happenstance, from waves to helicopters overhead; five cube loudspeakers play back this real-time data and serve as street furniture on which listeners can experience *Blue Moon* 's shifting sonic bricolage), “*shirazeh houshiary: breath (2004)*” (this

twenty-foot tall enameled brick tower emits a low sequence of vocal tracks from Buddhist, Christian, Jewish, and Islamic traditions. *Breath* is the fourth installment in “Art on the Plaza”), “*treble*” (exploring the practices that fall between "sound art" and "visual art," this group exhibition seeks to locate moments when sound inhabits and informs drawing, sculpture, and architecture).

Pe plan european, remarcam pretioasa contributie adusa de “Ars Electronica Center” din Linz/Austria ([www.aec.at](http://www.aec.at) , [info@aec.at](mailto:info@aec.at) ) in promovarea consecventa a artei interactive, in multiplele ei forme de manifestare.

#### Alte links-uri:

##### *Interactiv Art*

[www.teatron.org/forum/post.php?action=reply&fid=10&tid=202&repquote=3423](http://www.teatron.org/forum/post.php?action=reply&fid=10&tid=202&repquote=3423)  
[www.italiq-expos.com/actualites,95.html](http://www.italiq-expos.com/actualites,95.html)  
[lists.indymedia.org/pipermail/imc-cleveland/2004-January/002348.html](http://lists.indymedia.org/pipermail/imc-cleveland/2004-January/002348.html)  
[netzspannung.org/./archiventry.xsp?tab=personen&name=netzkollektor-42204&letter=t&lang=en](http://netzspannung.org/./archiventry.xsp?tab=personen&name=netzkollektor-42204&letter=t&lang=en)  
[netzspannung.org/version1/cast01/classic/index9.html](http://netzspannung.org/version1/cast01/classic/index9.html) Ein Alter Freund mit neuem Gameplay  
[www.domfree.de/ziba/features.htm](http://www.domfree.de/ziba/features.htm)  
[www2.arnes.si/~uljff4/reprezentacija.htm](http://www2.arnes.si/~uljff4/reprezentacija.htm)  
[www2.arnes.si/~uljff4/septemal/gledanjeupodabljanje.htm](http://www2.arnes.si/~uljff4/septemal/gledanjeupodabljanje.htm)  
[www.kulturkontakt.or.at/KulturKontakt.aspx?target=119110](http://www.kulturkontakt.or.at/KulturKontakt.aspx?target=119110)  
[www.minotaurusverlag.de/deu/autoren/aut\\_nicolai.htm](http://www.minotaurusverlag.de/deu/autoren/aut_nicolai.htm)  
[www.big.or.jp/~dj-roshi/garage/link.cgi](http://www.big.or.jp/~dj-roshi/garage/link.cgi)  
[www.big.or.jp/~dj-roshi/garage/link.cgi?task=num](http://www.big.or.jp/~dj-roshi/garage/link.cgi?task=num)  
[www.kulturrad.no/.../\\$FILE/Evaluering%20av%20nettverk%20for%20elektronisk%20kunst.pdf](http://www.kulturrad.no/.../$FILE/Evaluering%20av%20nettverk%20for%20elektronisk%20kunst.pdf)  
[www.glu-sg.si/saso/skatle.htm](http://www.glu-sg.si/saso/skatle.htm)  
[archives.lists.indymedia.org/imc-cincinnati/2004-January/000008.html](http://archives.lists.indymedia.org/imc-cincinnati/2004-January/000008.html)  
[www.anoca.org/http/org/interactive\\_art.html](http://www.anoca.org/http/org/interactive_art.html)

##### *Interactiv Music*

[www.interactive-music.be](http://www.interactive-music.be)  
[www.noodleheaven.net](http://www.noodleheaven.net)  
[www.arobance.com/dimc.html](http://www.arobance.com/dimc.html)  
[www.arobance.com/atelier.html](http://www.arobance.com/atelier.html)  
[www.kisinis.ch/arobance/edito.html](http://www.kisinis.ch/arobance/edito.html)  
[rd.grame.fr/~carat/inclassables.html](http://rd.grame.fr/~carat/inclassables.html)  
[www.kyushu-id.ac.jp/~snlab/j/DVD-collection.shtml](http://www.kyushu-id.ac.jp/~snlab/j/DVD-collection.shtml)  
[www1.keyboards.de/magazine/gv1998.htm](http://www1.keyboards.de/magazine/gv1998.htm)  
[www.diskob.com/etc/events/sarajevo/sarajevo.html](http://www.diskob.com/etc/events/sarajevo/sarajevo.html)  
[www.design.kyushu-u.ac.jp/~snlab/j/DVD-collection.shtml](http://www.design.kyushu-u.ac.jp/~snlab/j/DVD-collection.shtml)  
[www.comasweden.se/konserter/kons\\_info\\_e.asp?linkID=3&linksubID=1&page=sasong&id=96](http://www.comasweden.se/konserter/kons_info_e.asp?linkID=3&linksubID=1&page=sasong&id=96)  
[www.fitnessmusic.pl/modules.php?name=News&file=print&sid=4](http://www.fitnessmusic.pl/modules.php?name=News&file=print&sid=4)  
[hsfkf.ld.infoseek.co.jp/soft.htm](http://hsfkf.ld.infoseek.co.jp/soft.htm)  
[bodylife.com.pl/index.php?id=139](http://bodylife.com.pl/index.php?id=139)  
[members.chello.at/edgar.renate.peer/attenzione/attenzione.html](http://members.chello.at/edgar.renate.peer/attenzione/attenzione.html)  
[www.underground.pcdome.hu/magazin.php?pos=32](http://www.underground.pcdome.hu/magazin.php?pos=32)  
[www.kapaza.be/results/userid/27KZF4RBA6/](http://www.kapaza.be/results/userid/27KZF4RBA6/)  
[www.kapaza.be/subcat/index.cfm?id=584&](http://www.kapaza.be/subcat/index.cfm?id=584&)  
[www.all-forums.co.uk/forum/showthread.php?t=192787](http://www.all-forums.co.uk/forum/showthread.php?t=192787)  
[www.mixradio.ro/index.php?oldal=15&vsz=17](http://www.mixradio.ro/index.php?oldal=15&vsz=17)  
[www.element-music.com/fr/sister.php](http://www.element-music.com/fr/sister.php)  
[www.interactive-music.no/omoss.htm](http://www.interactive-music.no/omoss.htm)  
[thehacker.free.fr/afp/index.php3?m=independants&start=300&t=1](http://thehacker.free.fr/afp/index.php3?m=independants&start=300&t=1)  
[spark.cla.umn.edu/archive2005/SPro\\_sec3.pdf](http://spark.cla.umn.edu/archive2005/SPro_sec3.pdf)  
[www.design.kyushu-u.ac.jp/~sn/critic/shiftcontrol.html](http://www.design.kyushu-u.ac.jp/~sn/critic/shiftcontrol.html)  
[www.morph.dk/misc.html](http://www.morph.dk/misc.html)  
[archiv.transponder-news.de/sat-stefan-1999/160.html](http://archiv.transponder-news.de/sat-stefan-1999/160.html)  
[www.undergroundmagazin.hu/cikk.php?id=2174](http://www.undergroundmagazin.hu/cikk.php?id=2174)  
[www.meceeo.fr/search?kw=streaming%20music&stype=web&searchzone=local](http://www.meceeo.fr/search?kw=streaming%20music&stype=web&searchzone=local)  
[digital.tinusi.com/fr/search/page11/digital.html](http://digital.tinusi.com/fr/search/page11/digital.html)  
[finance.euroclips.com/music\\_15\\_1.html](http://finance.euroclips.com/music_15_1.html)  
[www.meceeo.fr/search?kw=streaming%20music&stype=web&searchzone=local](http://www.meceeo.fr/search?kw=streaming%20music&stype=web&searchzone=local)  
[digital.tinusi.com/fr/search/page11/digital.html](http://digital.tinusi.com/fr/search/page11/digital.html)

##### *Live Computer Music*

[www.atariarchives.org/bcc3/showpage.php?page=81](http://www.atariarchives.org/bcc3/showpage.php?page=81)  
[www.onds.com/hvega/music/events.php](http://www.onds.com/hvega/music/events.php)  
[artscilab.org/~david/scores/Pleroma1.pdf](http://artscilab.org/~david/scores/Pleroma1.pdf)  
[nagasm.suac.net/ASL/profile/](http://nagasm.suac.net/ASL/profile/)

nagasm.suac.net/ASL/kassel/  
 arcana.dartmouth.edu/~eric/Lyon\_resume.html  
 bibserv.isti.cnr.it/Dienst/UI/2.0/Describe/ cnr.isti/2003-A2-101?tiposearch=ercim&langver=  
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 www.artifact.com/catalog.php  
 www.berkowski.net/cv.php  
 www.music.columbia.edu/~alesi/pianorecitals.html  
 www1.pacific.edu/~rcoburn/music.htm  
 www.ercim.org/publication/ Ercim\_News/enw37/tarabella.html  
 www.o-art.org/history/80s&90s/ Mills/LPolansky/PolCVita-2.html  
 www.springeronline.com/sgw/cda/pageitems/ document/cda\_downloadaddocument/0,10900,0-0-45-110264-0,00.pdf  
 www.newmusicbox.org/article.nmbx?id=4187  
 www.japansociety.org/events/ event\_detail.cfm?id\_event=1702597446  
 cmr.soc.plymouth.ac.uk/publications/ CMW%20Music%20Leaflet.pdf  
 www.music.buffalo.edu/faculty/lippe/pdfs/liege.pdf  
 artscilab.org/~david/Index1.htm  
 cmr.soc.plymouth.ac.uk/event.htm  
 www.lovely.com/bios/bischoff.html  
 www.ultrasound.ws/showcase.html  
 www.spjc.edu/spg/music/emit98-99.html  
 arcana.dartmouth.edu/~eric/LyonMP3/  
 www.zakros.com/mica/iMesp01/iMesp01.html  
 www.informatik.uni-trier.de/~ley/db/conf/cmmr/cmmr2003.html  
 www.doctornerve.org/nerve/pages/schubertstatement.shtml  
 smc04.ircam.fr/scm04actes/P30.pdf  
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 www.symbolicsound.com/ cgi-bin/bin/view/Community/WebHome  
 music.calarts.edu/~hpark/links.html  
 mitpress2.mit.edu/e-journals/ Leonardo/lmj/lmj9intro.html  
 cec.concordia.ca/econtact/ Harvest\_Moon/electro/bios/lyon.html

*Integrarea computerului in arta muzicala interactiva este esentiala, aparatul oferind creatorilor o extraordinara libertate in transgresarea frontierelor dintre sunet si imagine, dintre concret si abstract, dintre “lumea reala” si “realitatea virtuala”. In consecinta, putem afirma ca “live computer music” este un gen in plina evolutie, conducand spre noi spatii ale cunoasterii artistice.*

Bucuresti, 25 August 2005

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## APPENDIX

### PRINCIPALELE COMENZI IN SISTEMUL DE OPERARE MS-DOS

[*apud* [http://www.butterwick0.freeseerve.co.uk/tutor/Answers\\_2.html](http://www.butterwick0.freeseerve.co.uk/tutor/Answers_2.html) ]

**Internal commands:** Internal commands are built into the operating system as part of a file called COMMAND.COM . They are loaded into memory whenever you switch on your computer. When you type an internal command, MS-DOS performs it immediately. The MS-DOS internal commands are listed below. The synonyms of some command names which you can use in place of their official names are shown in brackets.

BREAK, DEL (ERASE), PATH, SHIFT,  
 CALL, DIR, PAUSE, TIME,  
 CHCP, ECHO, PROMPT, TYPE,  
 CHDIR (CD), EXIT, REM, VER,  
 CLS, FOR, REN(RENAME), VERIFY,  
 COPY, GOTO, RMDIR (RD), VOL,  
 CTTY, IF, SET,  
 DATE, MKDIR(MD).

**External Commands:** Files with extension COM or EXE are external commands. Because these commands are files, they are not built into the operating system ( these are the commands that alter between versions of MS-DOS) . The MS-DOS external commands may contain SOME or all of the following,

APPEND, EDLIN, KEYB, RESTORE,  
 ASSIGN, EXE2BIN, KEYBXX, SETVER,  
 ATTRIB, FASTOPEN, LABEL, SHARE,  
 BACKUP, FC, MODE, SORT,  
 CHKDSK, FDISK, MORE, SUBST,  
 COMMAND, FIND, NLSFUNC, SYS,  
 COMP, FORMAT, PRINT, TREE,  
 DELTREE, GRAFTABL, RECOVER, XCOPY,  
 DISKCOMP, GRAPHICS, REPLACE,  
 DISKCOPY, JOIN.

When you type an external command, MS-DOS looks for the command in the current directory. If it is not there, you must guide MS-DOS to the relevant directory with the PATH command.

**Adding Parameters to a command:** A parameter is a letter typed after a command, that tells the command to carry out an extra task.

For instance, a command that you will find later in this section is the COPY command. This command copies files from one disk to another. The command with a parameter might look like this:

COPY A:MEMO.TXT C:\ /v

This part Tells MS-DOS to

COPY Make a copy ...  
 A:MEMO.TXT .. of the file MEMO.TXT on drive A: ...  
 C:\ ... and put it on drive C:  
 /v and at the same time verify that  
 the file is recorded correctly on C:

Most parameters are optional, however you will discover, over time, ones that you use frequently.

**Everyday MS-DOS Activities:** This section provides a brief introduction to the MS-DOS activities that you are likely to perform most often.

Activity	Command needed
Formatting a diskette	FORMAT

Copying a diskette	DISKCOPY
Comparing two diskettes	DISKCOMP
Checking the condition of a disk	CHKDSK
Copying a file	COPY
Displaying the contents of a file	TYPE
Renaming a file	REN (RENAME)
Printing a file	PRINT
Deleting a file	DEL (ERASE)
Listing the files in a directory	DIR
Making a new directory	MD
Changing from one directory to another	CD
Removing a directory	RD
Setting a command search path	PATH
Assign a name to a disk	LABEL

**Wildcards** are symbols that enable you to perform an MS-DOS operation on more than one file at a time. A file specification that contains wildcards can refer to more than one file because it gives MS-DOS a pattern to match.

MS-DOS searches for any file whose filename or extension matches the pattern. There are two wildcard characters:

- ? A question mark in a filename or extension means that up to a maximum of ONE character/letter/number can occupy that position.
- \* An asterisk in a filename or extension means that any number of characters/letters/numbers, (up to maximum of EIGHT before the dot, and up to a maximum of THREE after the dot) can occupy that position.

**NOTE:-** There can be LESS than the maximum number of characters/letters/numbers. For example suppose you had a directory containing the following files: A.DOC, AA.DOC, AAA.DOC, B.DOC, A.TXT, B.TXT. The following command and file patterns match some or all the above files:-

- DIR \*.DOC Is the equivalent to DIR ??????.DOC and matches the first four files (those with the DOC extension)
- DIR \*.\* Is the equivalent to DIR ??????.??? and matches ALL files. Use \*.\* with care e.g. DEL \*.\* deletes ALL files in the current directory, regardless of extension!!
- DIR ?.DOC Matches A.DOC and B.DOC
- DIR ?.\* Matches A.DOC, B.DOC, A.TXT and B.TXT
- DIR A?.DOC Matches A.DOC and AA.DOC
- DIR A\*.DOC Matches A.DOC, AA.DOC and AAA.DOC

**Formatting a Diskette:** It may be an advantage from this point if you have access to a computer. You use the FORMAT command to format a diskette. Formatting a diskette you have previously used erases any data on the diskette, so only reformat a diskette if you are very sure you don't need any of the data on it.

1. Type

FORMAT A: {ENTER}

Note: To put the MS-DOS operating system files onto the diskette you are formatting, add the /S switch to the command

FORMAT A: /S {ENTER}

Putting the operating system on the diskette enables you to BOOT-UP the computer from the diskette. This disk is now known as a SYSTEM DISK.

2. When this prompt appears on the screen.

Insert new diskette for drive A: and strike ENTER when ready

insert the diskette you want to format into drive A:

Press the {Carriage Return } or { ENTER } key.

3. When formatting is complete, and this prompt appears:

Format another (Y/N) ?

Type Y (for yes) to format another diskette, N (for no) to exit from the FORMAT command.

**Copying a Diskette:** You use the DISKCOPY command to make a copy of a diskette. Before you run DISKCOPY bear in mind:

- Diskcopy only works if both diskettes are EXACTLY the same type.
- The diskette you are copying FROM is the SOURCE diskette. The diskette you are copying TO is the TARGET diskette.
- You don't need to format the target diskette - DISKCOPY does it for you.
- DISKCOPY erases any information you already had on the target diskette.

If your computer has only one diskette drive ( this is normal! )

1. Type

DISKCOPY A: A: {ENTER}

2. When this message appears:

Insert SOURCE diskette in drive A:

Press any key when ready...

Insert the source diskette and press any key when ready!

3. When this message appears:

**Insert TARGET diskette in drive A:**

**Press any key when ready...**

**Remove the SOURCE diskette and insert the TARGET diskette into drive A:  
and press any key again.**

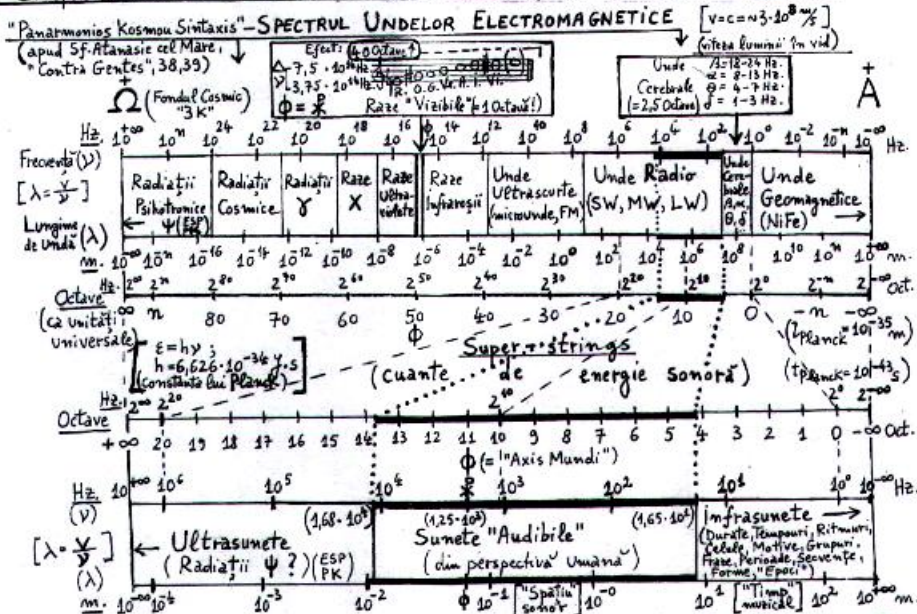
**4. When copying is complete this prompt appears:**

**Copy another diskette (Y/N) ?**

**Type Y (for yes) to copy another diskette, N (for no) to exit from the DISKCOPY  
command. NOTE:- Later versions of MS-DOS may ask if you wish to make another copy of the diskette, this makes  
another copy WITHOUT having to insert the SOURCE diskette again.**

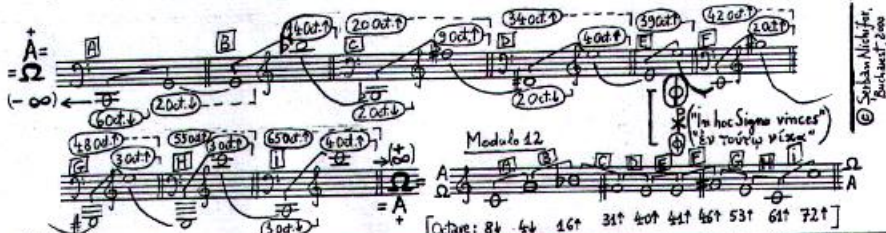


**Sinopsis: MUSICA CAELSTIS - model holonomic al Universului ondulatoriu -**



**PROIECȚII ALE SPECTRULUI ELECTROMAGNETIC ÎN SPAȚIUL SONOR**

- [NB: Unitatea = Octava ⇒ 2/1; Do<sub>1</sub> = 1,03125 Hz.]
- A = Unde Cerebrale (1-4,5 Oct.)
  - B = Unde Radio (4,5-24,8 Oct.)
  - C = Unde Ultrascurte (24,8-39,54 Oct.)
  - D = Raze infraroșii (39,54-48,4 Oct.)
  - E = Raze "Vizibile" (48,4-49,4 Oct.)
  - F = Raze Ultraviolete (49,4-54,7 Oct.)
  - G = Raze X (54,7-61,35 Oct.)
  - H = Radiații γ (61,35-69 Oct.)
  - I = Radiații Cosmice (69-80 Oct.)



**Valori metronomice (M.M.) ale undelor infrasonore (Hz.)**  
 (Conexiunea Timper-Spațiu sonor)

M.M.	4,25	5,62	64,92	82,5	123,76	159,72	185,6	247,52
Hz.	0,69	0,91	1,08	1,38	2,06	2,58	3,03	4,12
Spațiu (7 Octave)								

Tempo: Largo, Adagio, Andante, Moderato, Allegro, Vivace, Presto

Amplitudine (A) x Frecvență (v) x Timbru (Specif) = Spațiu sonor (3D)

Timbru sonor 4D

## Definirea Informatiei

**Bibliografie:**  
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- Ontologic : Componenta a triadei "informativ-energie-materie" (ca principiu universal)

[Ontologia = ramură a filosofiei care studiază ființele generale ale existentei.]

- Cibernetic : Informația este cantitatea de noapte, ce depinde de gradul de interes al receptorului  
 gradul de satisfacere a interesului receptorului

[Cibernetică = știință care are ca obiect studiul matematic al legăturilor, conexiunilor și controlului în sistemele tehnice și în organismele vii din punctul de vedere al analogiilor lor formale.]

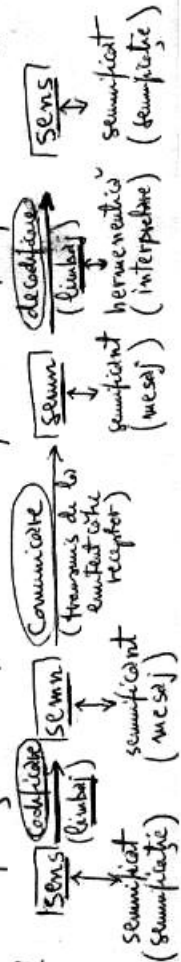
**NB** - informația repetabilă (sau redundanță) are gradul de noapte = 0

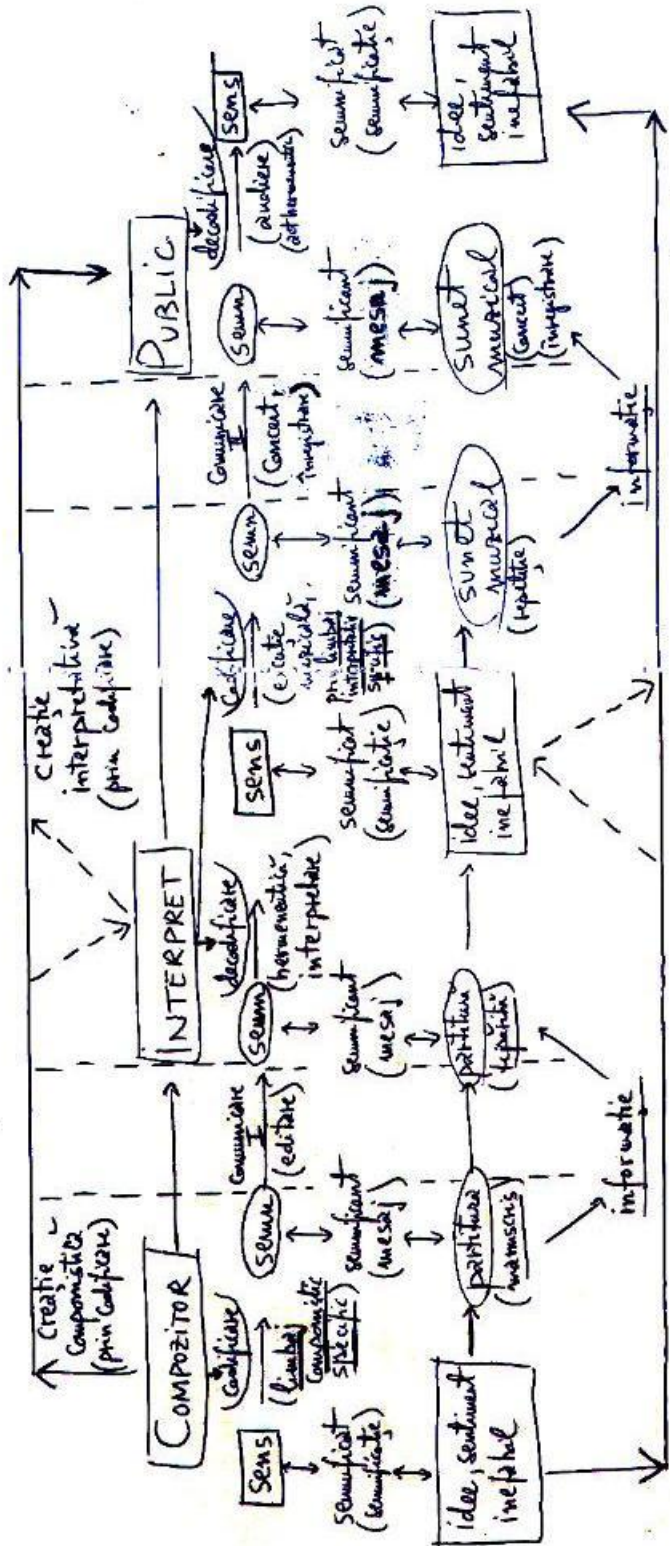
- epistemeologic : Informația este o componentă a dihotomie "realitate-informativ" în procesul diferențierii adevăr/creare (fals) și informația se manifestă prin fenomene, a căror formă (trăind sau actuale) este informativ => informația = formă fenomenal prin care s-a manifestat sau se manifestă realitatea => cunoașterea este direct proporțională cu cantitatea și calitatea informațiilor.

[epistemeologia = teoriei cunoașterii științifice.]

- Semiotic : Informația este un ansamblu logic de semne purtătoare de sensuri => Informația = Semn, în dihotomia Semn/Sens = semnificat/semnificabil/semnificativ

[Semiotică = ramură a logicii simbolice (matematică) care se ocupă cu studiul general al semnelor.]





**Acte specifice:**

- Compozitor → Codificare (= act creator) prin **partitura (harm.)**
- Interpret → decodificare (= act hermeneutic) prin **partitura (repetitiv)**
- Public → decodificare (= act hermeneutic)

**Comunicare:**

- Comunicare I: Edificabil
- Comunicare II: Concurs (hermeneutic) / Repetitiv (mesaj)

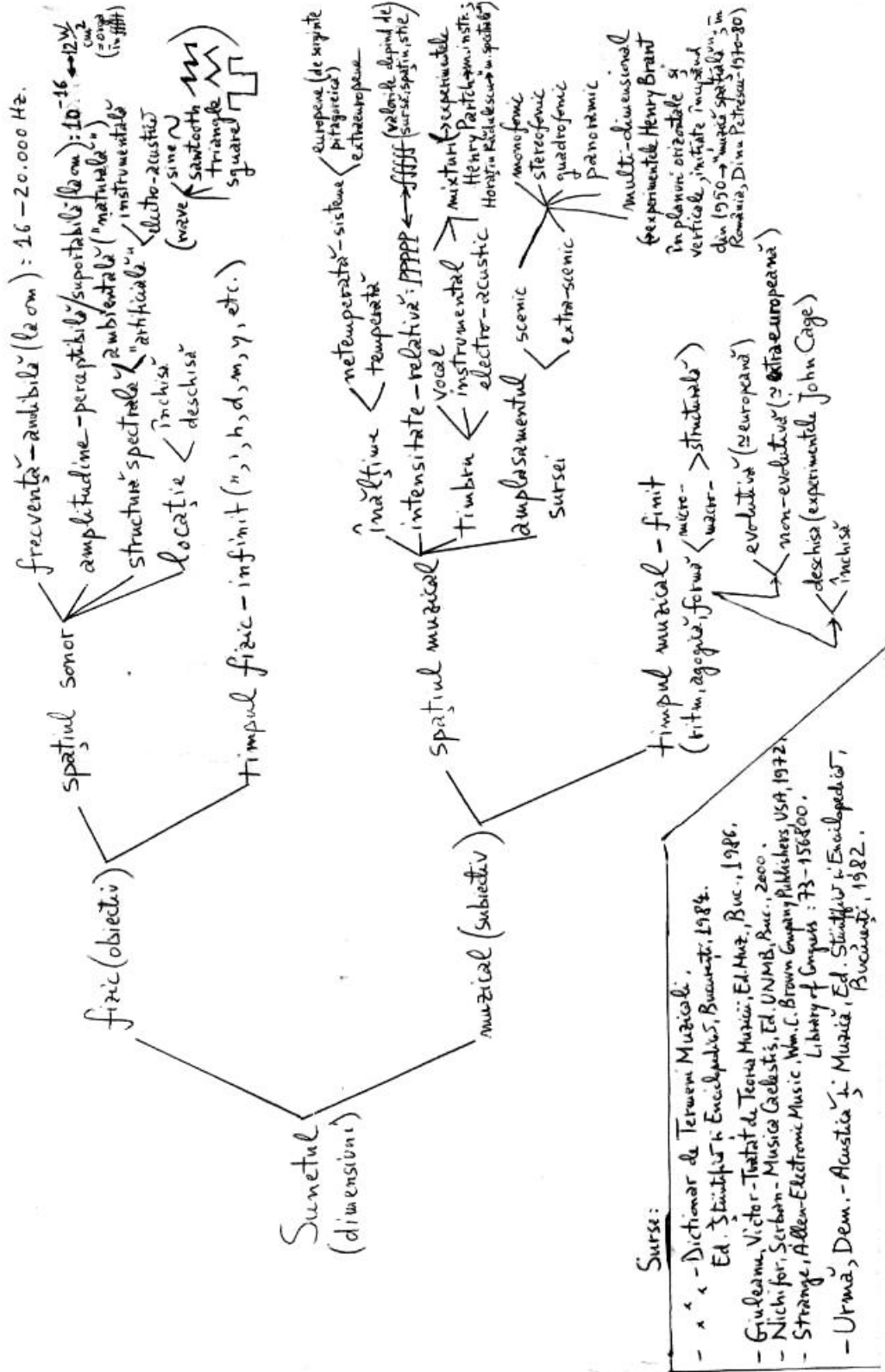
**Factori determinanti in Comunicare:**

- Factori rationali, cognoscibili (revelatia naturala) = Comunicare pozitiv (catalitic)
- Factori irationali, inconoscibili (Revelatia supra naturala) = Comunicare negativ (apofatic)

**Factori determinanti in Codificare / decodificare:**

- Codificare = act creator
- decodificare = act hermeneutic

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Anexa 7 a  
Tehnici aleatorii în muzică (1)  
 ("Chance operations", "Indeterminacy")

Muzică aleatorie (← lat. "alea" = zar) ilustrată un limbaj  
 sonor contemporan caracterizat prin aplecare — în spiritul doctrinei  
 "new age" — a hazardului (a indeterminării) în generarea structurilor  
 constituitive ale discursului muzical. Având antecedente  
 recunoscute în istoria muzicii (în sec. XVI coexistența genurilor  
 antagonice "sortisatio" = muzică întâmplătoare și "compositio" =  
 muzică fixată; în sec. XVIII W. A. Mozart a elaborat un  
 "Würfelspiel" [= joc de zaruri] muzical și fiind foarte  
 îndrăgite și improvizate, muzică aleatorie a apărut ca  
 atare în cea de a doua jumătate a sec. XX. Reprezentând  
 o reacție la determinismul exacerbât al serialismului  
 european, curentul numit "aleatorism" s-a născut în  
 spațiul american (John Cage) — determinând la  
 rândul său noi limbaje muzicale conexe: grafismul  
 (Earle Brown), minimalismul (La Monte Young,  
 Morton Feldman, Christian Wolff) și muzică  
 repetitivă (Terry Riley, Philip Glass, Steve Reich).

- Tipuri de aleatorism
  - liber (interpretul este și creator ad hoc)
  - controlat (compozitorul impune interpretului limitele improvizatiei)
- Situații specifice aleatorismului controlat
  - compozitorul elaborează structuri (sugestii) sonore în baza cărora interpretul improvizează
  - compozitorul precizează micro-structura, iar interpretul definește micro-structura



File: Würfelspiel S.I-III(36 bars)

# WÜRFELSPIEL

## Series I-III

### (bars 01-36)

W.A.MOZART  
arr.S.Nichifor

Allegro SERIES I

$\text{♩} = 120$

Harpischord

01 02 03 04 *tr* 05 06 07 08

09 10 11 12 13 SERIES II 14 15

16 17 18 19 20 21 22 23

24 25 SERIES III 26 27 28 29

Harpischord

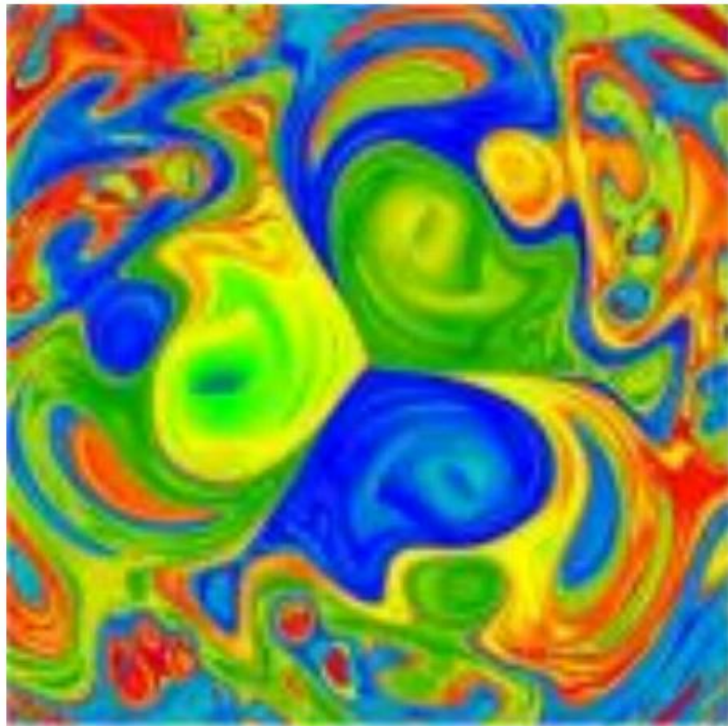
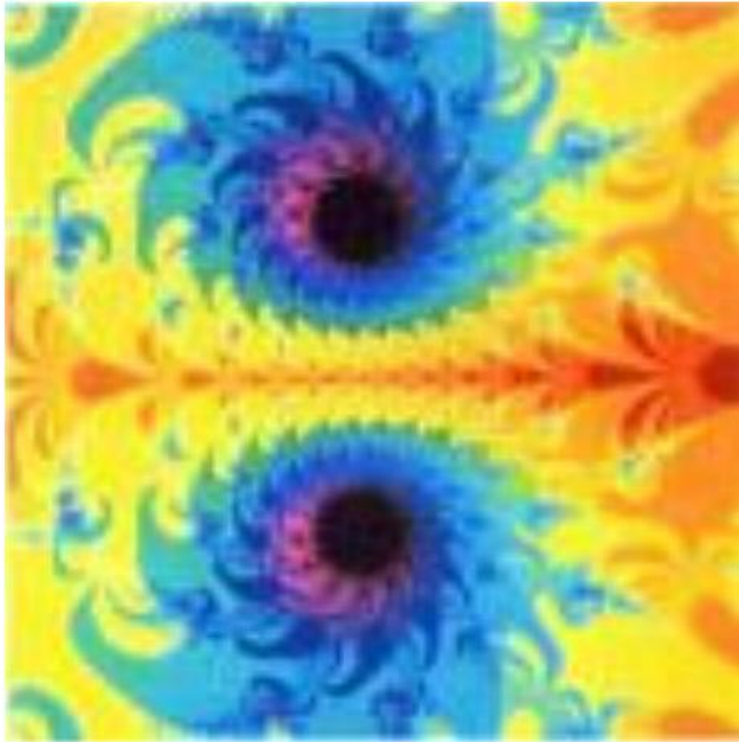
30 **Modulation !!!!!**  
30 Transpose to 5th up the next bar ! 31 32 33 34

35 36 37

Harpischord

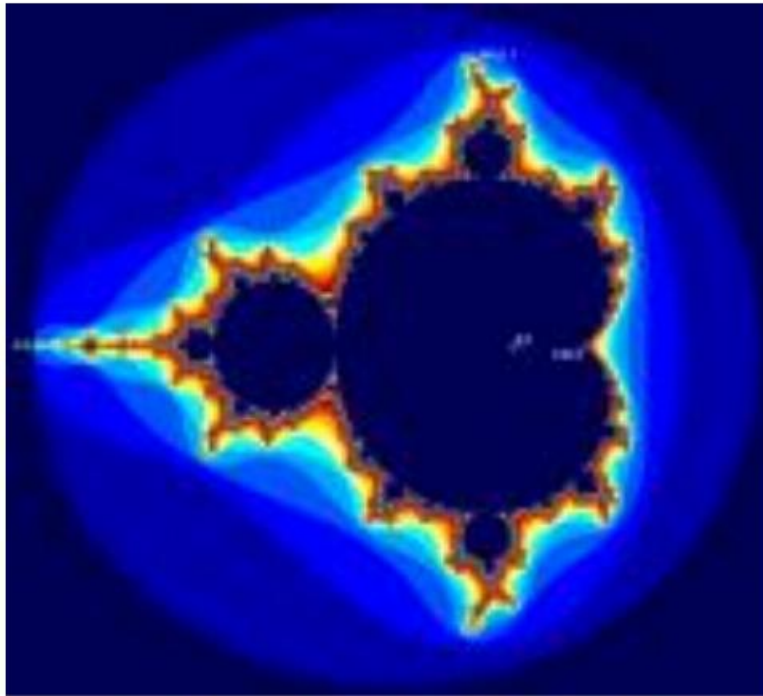
35 36 FINE(ad lib.) 37

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## ***Julia Set***





# ***Mandelbrot Set***

**Serban NICHIFOR**

Nascut la Bucuresti in anul 1954, a absolvit ca sef de promotie pe tara Universitatea Nationala de Muzica din Bucuresti (1977) si Facultatea de Teologie a Universitatii din Bucuresti (1994). A urmat cursuri de specializare la Munchen (cu Sergiu Celibidache), Darmstadt, Weimar, Breukelen si Amsterdam. A fost bursier USIA (1982), laureat al Premiilor Academiei Romane (1982), UCMR (1980, 1982, 1989), precum si al Concursurilor Internationale de Compozitie de la Amsterdam (Premiul I Gaudeamus - 1977), Tours (1977), Evian (1978), Atena (ISCM-1979), Toledo (1980), Urbana-Illinois (1983), Trento (1984, 1994), Roma (1985), Bydgoszcz (1986), Hong Kong (ISCM-1988), Jihlava (1995), Karlsruhe (1996), Koln (1997), Newtown-Wales (1998), Birmingham-Alabama (1999). Este Comandor al Ordinului National Pentru Merit (2000). Doctor in Muzicologie (1994), este autor al tratatului "Musica Caelestis - anamorfoza Sacrului in arta sunetelor" (UNMB-2000) si al cursului universitar "Introducere in Computer Music". Este conferentiar la Universitatea de Muzica din Bucuresti (Facultatea de Interpretare Muzicala, Catedra Muzica de Camera), membru in juriile internationale ale Concursurilor de Compozitie de la Trento (1985) si Pescara (1998), fondator si vicepresedinte al Asociatiei Romania-Belgia, membru titular al UCMR, al SABAM (Belgia) si al Fundatiei "Living Music" (SUA). Creatia sa componistica cuprinde trei opere - "Domnisoara Christina" (dupa Mircea Eliade), "Talaria" (dupa Etienne De Sadeleer) si "Le Martyre de Saint Claude Debussy" (pe un libret propriu, bazat pe corespondenta marelui muzician francez), sapte simfonii (Simfonia Nr. I "Umbre", Simfonia Nr. II "Via Lucis", Simfoniile Americane Nr. III si IV, Simfonia Nr. V "Pro Patria", Simfonia Nr. VI "Arcuri in Timp", Simfonia Nr. VII pentru violoncel si orchestra), piese simfonice ("Constelatii", "American Air", "Turkish Bolero", s.a.), un Requiem dedicat Tinerilor Martiri ai Revolutiei Anticomuniste din 1989, un Oratoriu de Craciun, cantatele "Izvoare 2050", "Gloria Heroum Holocausti" si "Remember" (dupa un poem de Victor Barladeanu), lucrari concertante (Concerto GRIEGoriano pentru pian si orchestra), camerale, vocale, corale si electroacustice - parte din ele publicate la Bucuresti, New York, Munchen, Tours, Metz, Koln, Roma si Pescara si Palermo. Ca violoncelist, activeaza in duo-ul "Intermedia", alaturi de compozitoarea si pianista Liana Alexandra, impreuna cu care a organizat la Bucuresti mai multe manifestari de muzica contemporana, sub genericul "NUOVA MUSICA CONSONANTE-LIVING MUSIC FOUNDATION".

Serban NICHIFOR

Born in Bucharest (Romania), 25.08.1954. Studies: National University of Music - Bucharest, Doctor in Musicology; University of Bucharest (Theology Faculty). International courses at Darmstadt, Weimar, Breukelen and Munchen; USIA Stipendium (USA). At present: Professor at the National University of Music - Bucharest (Chamber Music Department); Member of UCMR (Romania), SABAM (Belgium), ECPMN (Holland); Vice-president of the ROMANIA-BELGIUM Association; Cellist of the Duo INTERMEDIA and co-director of the NUOVA MUSICA CONSONANTE-LIVING MUSIC FOUNDATION Festival - with Liana ALEXANDRA. Composition prizes at: Amsterdam, Tours, Athens, Urbana-Illinois, Evian, Toledo, Trento, Roma, Bydgoszcz, Köln, Karlsruhe, Newtown-Wales, Birmingham-Alabama. Comandor of the "Merit National Order" (2000). Works published at: Editura Muzicala (Bucharest), Edition Modern (Munchen), "Pro musica Studium"(Roma), "Quadrivium Music Press" (New York), "Mnemes" (Palermo). Principal works: "Postludium" per Org. (1975); "Sorcova" per Coro Misto a capella (1995); Quartetto per Archi I - "Anamorphose" (1976); "Constellations" for Orchestra (1977); Symphony I "Shadows" (1980); Cantata "Sources" (1977); "Carols" per Trombone e Percussione (1978); Cantata "Gloria Heroum Holocausti" (1978); Opera "Miss Christina" (libretto by Mircea ELIADE, 1981); "Canto di Speranza" per Fl., Vn, Vn, Vlc. e Pf. (1981); "Onirophonie" per Fl., Vn.e Pf. (1982); "Chanson d'Antan" per Vn.e Pf.(1983); "Aprite le porte di questo castel" per Coro Maschile (1984); "Carnyx" per Clarinetto (1984); "Tango for Yvar" per Pf.(1984); Quartetto per Archi II - "Vallons de l'Oubli" (1984); Symphony II "Via Lucis" (1985); "6 Melodies Irlandaises d'Amerique" per 2 Ob.,C.i. e 2 Fg. (1985); "Horn Call Rag" per Corno e Pf. (1986); "Czarna Rosa" per Mezzo-Soprano e Pf. (1986); "7 Canti Rumeni di Natale" per 4 Tbe, 4 Tni ed Org. (1986); Symphony III "American Symphony - I" (1986); Symphony IV "American Symphony - II" (1987); Symphony V "Pro Patria" (1987); "AVE MARIA" per Soprano ed Organo (1987); "Isola di Euthanasios" per Pianoforte (1988); Symphony VI "Time Archways" (1988); Cantata "Remember" (1988); "Transgressio" per Fl.,Ob. e Fg. (1989); "Battuta" per Percussione (1989); "Missa da Requiem" (1990); Missa "Actio Gratiarum Oecumenica" per Coro Misto (1991); "NATALIS DOMINI" per Coro Misto (1992); "Isihia" per Vlc. (1992); "Epiphania" per Cello e Pianoforte (1993); "Musica Caelestis" – treatise (1994); "Rorate Caeli" per Soprano ed Orchestra (1994); Chamber-Opera "Talaria" (libretto by Etienne DE SADELEER, 1994); "Medium per Arpa" (1995); "Medium per Flauto" (1995); Cantata "Per CHRISTUM" (1997); "Concerto GRIEGoriano" for Piano and Orchestra (1997); "3 Christmas German Chorals" for Organ (1997); "Hommage a DEBUSSY" per 2 Pf. - ossia Pf. e Nastro Magnetico (1998); "La Nuit Obscure" per Orchestra da Camera (1998); Chamber-Opera "Le Martyre de Saint Claude DEBUSSY" (libretto after Claude DEBUSSY and E.A.POE, 1999); "Turkish Bolero" for 4 Cellos and Orchestra (2002); Symphony-Concerto for Cello and Orchestra (2003-2004); "Introduction to Computer Music" – handbook (2003-2005); Symphony No. VII for Cello and Orchestra (2004); "Sounds of Mars" (computer music, 2004); "American Air" for Orchestra (2005); "Tribute to Joseph Smith, The American Prophet" (computer music, 2005).

.....