

# References

- Aldwell E. & Schachter C. (1978)** *Harmony and Voice Leading. Vol. 1.* New York: Harcourt Brace Jovanovich.
- Allen P.E. & Dannenberg R.B. (1990)** Tracking Musical Beats in Real Time. *Proceedings of the International Computer Music Conference'1990.* San Francisco: Computer Music Association, 140–143.
- Aloimonos J. & Shulman D. (1989)** *Integration of Visual Modules.* Boston: Academic Press.
- Ashton A. (1971)** *Electronics, Music, and Computers.* Salt Lake City: University of Utah, Computer Science Department, UTEC-CSc-71-117.
- Askenfelt A. (1976)** Automatic Notation of Played Music. Stockholm: Royal Institute of Technology, Report STL-QPSR 1/1976, 1–11.
- Attneave F. (1954)** Some Informational Aspects of Visual Perception. *Psychological Review*, 61, 183–193.
- Attneave F. (1982)** Prägnanz and Soap-Bubble Systems: A Theoretical Explanation. In: Beck J. (Ed.) *Organization and Representation in Perception.* Hillsdale, New Jersey: Erlbaum.
- Bamberger J. (1980)** Cognitive Structuring in the Apprehension of Simple Rhythms. *Archives de Psychologie*, 48, 171–199.
- Barlow H.B. (1972)** Single Units and Sensation: A Neuron Doctrine for Perceptual Psychology? *Perception*, 1, 371–394.
- Barlow H.B., Narasimhan R., & Rosenfeld A. (1972)** Visual Pattern Analysis in Machines and Animals. *Science*, 177, 567–575.
- Barrow H.G. & Tenenbaum J.M. (1993)** Retrospective on “Interpreting Line Drawings as Three-Dimensional Surfaces.” *Artificial Intelligence*, 59, 71–80.
- Benade A.H. (1976)** *Fundamentals of Musical Acoustics.* New York: Oxford University Press.

- Bergevin R. & Levine M. (1993)** Generic Object Recognition: Building and Matching Coarse Descriptions from Line Drawings. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 15(1), 19–36.
- Berlioz H. (1855)** *Grand traité d'instrumentation et d'orchestration moderne*. Paris: Schonenberger.
- Birkhoff G. & Mac Lane S. (1965)** *A Survey of Modern Algebra*. New York: MacMillan.
- Blake A. & Marinos C. (1990)** Shape from Texture: Estimation, Isotropy and Moments. *Artificial Intelligence*, 45, 323–380.
- Bolles R.S. & Cain R.A. (1982)** Recognizing and Locating Partially Visible Objects: The Local-Feature-Focus Method. *International Journal of Robotics Research*, 1(3), 57–82.
- Boroda M.G. (1985)** On Some Rules of Rhythmic Recurrence in Folk and Professional Music. *Kompleksnoye Izutcheniye Muzykalnogo Tvortchestva: Kontseptsiya, Problemy, Perspektivy*. Tbilisi: Nauka, 135–167. (Russian).
- Boroda M.G. (1988)** Towards the Basic Semantic Units of a Musical Text. *Musikometrika*, 1. Bochum: Brockmeyer, 11–68.
- Boroda M.G. (1991)** The Concept of “Metrical Force” in Music with Bar Structure. *Musikometrika*, 3. Bochum: Brockmeyer, 59–94.
- Bouman Ch. (1991)** Multiple Resolution Segmentation of Textural Images. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 13(2), 99–113.
- Bregman A.S. (1990)** *Auditory Scene Analysis: The Perceptual Organization of Sound*. Cambridge, Massachusetts: M.I.T. Press.
- Brooks R. (1981)** Symbolic Reasoning Among 3-Dimensional Models and 2-Dimensional Images. *Artificial Intelligence*, 17, 285–349.
- Cadoz C. (1991)** Timbre et causalité. In: Barrière J.-B. (ed.) *Le timbre. Métaphore pour la composition*. Paris: IRCAM, Christian Bourgois Editeur, 17–46.
- Calude C. (1988)** *Theories of Computational Complexity*. Amsterdam: North-Holland.
- Chafe C. & Jaffe D. (1986)** Source Separation and Note Identification in Polyphonic Music. *Proceedings of the IEEE-IECEJ'ASJ International Conference on Acoustics, Speech, and Signal Processing, Tokyo, 1986*, 1289–1292.

- Chafe C., Jaffe D., Kashima K., Mont-Reynaud B., & Smith J. (1985) Techniques for Note Identification in Polyphonic Music. *Proceedings of the International Computer Music Conference'1985*. San Francisco: Computer Music Association, 399-405.
- Chafe C., Mont-Reynaud B., & Rush L. (1982) Toward an Intelligent Editor of Digital Audio: Recognition of Musical Constructs. *Computer Music Journal*, 6(1), 30-41.
- Chateaufneuf A. (1993) *Letter to A. Tanguiane*. Paris, 7th April 1993.
- Clarke E. (1987) Categorical Rhythm Perception, an Ecological Perspective. In: Gabrielsson A. (Ed.) *Action and Perception in Rhythm and Music*. Stockholm: Publication of Royal Swedish Academy of Music No. 55.
- Clarke E. & Krumhansl C.L. (1990) Perceiving Musical Time. *Music Perception*, 7, 213-252.
- Clynes M. (1977) *Sentics: The Touch of Emotions*. New York: Doubleday Anchor.
- Clynes M. (1983) Expressive Microstructure in Music Linked to Living Qualities. In: Sundberg J. (Ed.) *Studies in Music Performance*. Stockholm: Publication of Royal Swedish Academy of Music No. 39, 76-181.
- Dannenberg R.B. & Bookstein K. (1991) Practical Aspects of a MIDI Conducting Program. *Proceedings of the International Computer Music Conference'1991*. Montreal: Faculty of Music, McGill University, 537-540.
- Dannenberg R.B. & Mont-Reynaud B. (1987) Following an Improvisation in Real Time. *Proceedings of the International Computer Music Conference'1987*. San Francisco: Computer Music Association, 241-248.
- Darwin C.J. (1984) Perceiving Vowels in the Presence of Another Sound: Constants on Formant Perception. *Journal of the Acoustical Society of America*, 76, 1636-1647.
- Desain P. (1992) A (De)Composable Theory of Rhythm. *Music Perception*, 9(4).
- Desain P. & Honing H. (1989) Quantization of Musical Time: A Connectionist Approach. *Computer Music Journal*, 13(3), 56-66.
- Desain P. & Honing H. (1991) Tempo Curves Considered Harmful. *Proceedings of the International Computer Music Conference'1991*. Montreal: Faculty of Music, McGill University, 143-149.

- Desain P., Honing H., & de Rijk K. (1989)** A Connectionist Quantizer. *Proceedings of the International Computer Music Conference'1989*. San Francisco: Computer Music Association, 80–85.
- Dumesnil R. (1979)** *Le Rythme musical*. Paris–Geneve: Slatkine Reprints, serie “Ressources”.
- Ellis D. & Vercoe B. (1991)** A Wavelet-Based Sinusoid Model of Sound for Auditory Signal Separation. *Proceedings of the International Computer Music Conference'1991*. Montreal: Faculty of Music, McGill University, 86–89.
- Fischer M.A. & Bolles R.C. (1983)** Perceptual Organization and the Curve Partitioning Problem. *Proceedings of the 8th Joint Conference on Artificial Intelligence'83, Karlsruhe*, 1014–1018.
- Foster S., Schloss W.A., & Rockmore A.J. (1982)** Toward an Intelligent Editor of Digital Audio: Signal Processing Methods. *Computer Music Journal*, 6(1), 42–51.
- Fraisse P. (1983)** Rhythm and Tempo. In: Deutsch D. (Ed.) *The Psychology of Music*. London: Academic Press.
- Frances R. (1972)** *La perception de la musique*. 2nd ed. Paris: Librairie philosophique J.Vrin.
- Freeman W.J. (1979)** EEG Analysis Gives Models of Neuronal Template Matching Mechanism for Sensory Search with Olfactory Bulb. *Biological Cybernetics*, 35, 221–234.
- Friedland N.S. & Rosenfeld A. (1992)** Compact Object Recognition Using Energy-Function-Based Optimization. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 14(7), 770–777.
- Gelfand S.A. (1981)** *Hearing. An Introduction to Psychological and Physiological Acoustics*. New-York–Basel: Marcel Dekker.
- Gibson J.J. (1950)** *The Perception of the Visual World*. Boston: Houghton Mifflin.
- Gibson J.J. (1966)** *The Senses Considered as Perceptual Systems*. Boston: Houghton Mifflin.
- Gibson J.J. (1979)** *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Giunchiglia F. & Walsh T. (1992)** A Theory of Abstraction. *Artificial Intelligence*, 57, 323–389.

- Gong S. & Buxton H. (1992) On the Visual Expectations of Moving Objects. *Proceedings of the 10th European Conference on Artificial Intelligence '92, Vienna*. Wiley: Chichester, 781-784.
- Gut S. (1976) Intervalle. In: Honnegger M. (Ed.) *Dictionnaire de la Musique. Science de la Musique. Formes, Technique, Instruments. Vol. 1*. Paris: Bordas.
- Handel S. (1989) *Listening: An Introduction to the Perception of Auditory Events*. Hillside, New Jersey: Erlbaum.
- Helmholtz H. (1877) *On the Sensation of Tone as a Psychological Basis for the Study of Music*. 4th ed. English transl.: New York: Dover, 1954.
- Hewlett H.B. & Selfridge-Field E. (Eds.) (1990) *Computing in Musicology. A Directory of Research*. Menlo Park, California: Center for Computer-Assisted Research in the Humanities.
- Hewlett H.B. & Selfridge-Field E. (Eds.) (1991) *Computing in Musicology. A Directory of Research*. Menlo Park, California: Center for Computer-Assisted Research in the Humanities.
- Hochberg J. & McAlister E. (1953) A Quantitative Approach to Figural "Goodness". *Journal of Experimental Psychology*, 46, 361-364.
- Hoffmann A.G. (1992) Phenomenology, Representations and Complexity. *Proceedings of the 10th European Conference on Artificial Intelligence '92, Vienna*. Wiley: Chichester, 610-614.
- Horn B.K.P. (1975) Obtaining Shape from Shading Information. In: Winston P.H. (Ed.) *The Psychology of Computer Vision*. New York: McGraw-Hill.
- Horn B.K.P. (1986) *Robot Vision*. New York: McGraw-Hill.
- Horn B.K.P. & Schunck B.G. (1981) Determining Optical Flow. *Artificial Intelligence*, 17, 185-203.
- Horn B.K.P. & Schunck B.G. (1993) "Determining Optical Flow": A Retrospective. *Artificial Intelligence*, 59, 81-87.
- Horn B.K.P. & Weldon Jr. (1988) Direct Methods for Recovering Motion. *International Journal of Computer Vision*, 2(1), 51-76.
- Hummel R. (1987) The Scale-Space Formulation of Pyramid Data Structures. In: Uhr L. (Ed.) *Parallel Computer Vision*. Boston: Academic Press.

- Ikeuchi K. (1993)** Comment on "Numerical Shape from Shading and Occluding Boundaries." *Artificial Intelligence*, 59, 89–94.
- Ikeuchi K. & Horn B.K.P. (1981)** Numerical Shape from Shading and Occluding Boundaries. *Artificial Intelligence*, 17, 141–184.
- Kanade T. (1993)** From a Real Chair to a Negative Chair. *Artificial Intelligence*, 59, 95–101.
- Kanatani K. (1984)** Detection of Surface Orientation and Motion from Texture by a Stereological Technique. *Artificial Intelligence*, 23, 213–237.
- Kanatani K. & Chou T. (1989)** Shape from Texture: General Principle. *Artificial Intelligence*, 38, 1–48.
- Kass M., Witkin A., Terzopoulos D., & Barr A. (1988)** Snakes: Active Contour Models. *International Journal of Computer Vision*, 1, 321–331.
- Katayose H. & Inokuchi S. (1989a)** The Kansei Music System. *Computer Music Journal*, 13(4), 72–77.
- Katayose H. & Inokuchi S. (1989b)** An Intelligent Transcription System. *Proceedings of the First International Conference on Music Perception and Cognition, Kyoto, Japan, 17–19 October, 1989*, 95–98.
- Katayose H. & Inokuchi S. (1990)** The Kansei Music System'90. *Proceedings of the International Computer Music Conference'1990*. Glasgow, 308–310.
- Katayose H., Kato H., Imai M., & Inokuchi S. (1989)** An Approach to an Artificial Music Expert. *Proceedings of the International Computer Music Conference'1989*. San Francisco: Computer Music Association, 139–146.
- Katuar G. (1926)** *Muzykalnaya Forma. 1. Ritm.* Moscow. (Russian).
- Keller H. (1955)** *Schule des Generalbass-spiels*. Kassel:Bärenreiter-Ausgabe 490.
- Kendall G.S. & Martens W.L. (1984)** Simulating the Cues of Spatial Hearing in Natural Environment. *Proceedings of the International Computer Music Conference'1984*. San Francisco: Computer Music Association, 111–125.
- Kendall G.S., Martens W.L., Freed D.J., Ludwig M.D., & Karstens R.W. (1986)** Simulating the Cues of Spatial Hearing in Natural Environment. *Proceedings of the International Computer Music Conference'1986*. San Francisco: Computer Music Association, 285–292.

- Knowlton P.H. (1971)** *Interactive Communication and Display of Keyboard Music*. Ph.D. Dissertation. Salt Lake City: University of Utah.
- Knowlton P.H. (1972)** Capture and Display of Keyboard Music. *Datamation*, May.
- Kolmogorov A.N. (1965)** Three Approaches to Defining the Notion "Quantity of Information". *Problemy Peredatchi Informatsii*, 1(1), 3–11. Reprinted in: Kolmogorov A.N. *Theory of Information and Theory of Algorithms*. Moscow: Nauka, 1987, 213–223. (Russian).
- Leeuwenberg E.L.J. (1971)** A Perceptual Coding Language for Visual and Auditory Patterns. *American Journal of Psychology*, 84, 307–350.
- Leeuwenberg E.L.J. (1978)** Quantification of Certain Visual Properties: Saliency, Transparency, Similarity. In: Leeuwenberg E.L.J. & Buffart H.F.J.M. (Eds.) *Formal Theories in Visual Perception*. Chichester UK: Wiley.
- Lerdahl F. & Jackendoff R. (1983)** *A Generative Theory of Tonal Music*. Cambridge, Massachusetts: M.I.T. Press.
- Leyton M. (1986)** Generative Systems of Analyzers. In: Rosenfeld A. (Ed.) *Human and Machine Vision II*. Orlando: Academic Press, 149–189.
- Lifshitz L.M. & Pizer S.M. (1990)** A Multi-Resolution Hierarchical Approach to Image Segmentation Based on Intensity Extrema. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 12(3), 234–254.
- Longuet-Higgins H.C. (1976)** The Perception of Melodies. *Nature*, 263, 646–653.
- Longuet-Higgins H.C. (1987)** *Mental Processes*. Cambridge, Massachusetts: M.I.T. Press.
- Longuet-Higgins H.C. & Lee C.S. (1982)** The Perception of Music Rhythms. *Perception*, 11, 115–128.
- Longuet-Higgins H.C. & Lee C.S. (1984)** The Rhythmic Interpretation of Monophonic Music. *Music Perception*, 1, 424–441.
- Longuet-Higgins H.C. & Prazdny K. (1984)** The Interpretation of a Moving Retinal Image. *Proceedings of the Royal Society*, B208, 385–397.
- Marr D. (1982)** *Vision*. San Francisco: W.H. Freeman.
- Marr D. & Nishihara H.K. (1978)** Representation and Recognition of the Spatial Organization of Three-Dimensional Shapes. *Proceedings of the Royal Society*, B200, 269–291.

- Marr D. & Poggio T. (1976)** Cooperative Computation of Stereo Disparity. *Science*, 194, 283–287.
- Martens W.L. (1987)** Principal Components Analysis and Resynthesis of Spectral Cues to Perceived Direction *Proceedings of the International Computer Music Conference'1987*. San Francisco: Computer Music Association, 274–281.
- McAdams S. (1989)** Segregation of Concurrent Sounds. I: Effects of Frequency Modulation Coherence. *Journal of the Acoustical Society of America*, 86, 2148–2159.
- McAdams S. (1991a)** Segregation of Concurrent Sounds. II: Effects of Spectral Envelope Tracing, Frequency Modulation Coherence, and Frequency Modulation Width. *Journal of the Acoustical Society of America*, 89, 341–351.
- McAdams S. (1991b)** Perceptual Organization of Audio Environment. In: Nosulenko V. (Ed.) *Problems of Ecological Psychoacoustics*. Moscow: Institute of Psychology of the Academy of Sciences, 28–50. (Russian).
- McAdams S. (1993)** Recognition of Sound Sources and Events. In: Bigand E. & McAdams S. (Eds.) *Thinking in Sound: Cognitive Perspectives on Human Audition*. Oxford: Oxford University Press, 146–198.
- McAdams S. & Bregman A. (1979)** Hearing Musical Streams. *Computer Music Journal*, 3(4), 26–43, 60, 63. Reprinted in: Roads C. & Strawn J. (Eds.) *Foundations of Computer Music*. Cambridge, Massachusetts: M.I.T. Press, 1985, 658–698.
- Mellinger D. & Mont-Reynaud B. (1991)** *Proceedings of the International Computer Music Conference'1991*, Montreal: Faculty of Music, McGill University, 90–93.
- Messiaen O. (1944)** *Technique de mon langage musical. Vol. 1*. Paris: Leduc.
- Meygret A. & Thonnat M. (1990)** Segmentation of optical Flow and 3D Data for the Interpretation of Mobile Objects. *Proceedings of the 3rd International Conference on Computer Vision, Osaka*. 238–245.
- Michon J.A. (1964)** Studies on Subjective Duration. *Acta Psychologica*, 22, 441–450.
- Milner P.N. (1974)** A Model for Visual Shape Recognition. *Psychological Review*, 81(6), 521–535.



- Minsky M. & Papert S. (1988) *Perceptrons*. 2nd ed. Cambridge, Massachusetts: M.I.T. Press.
- Minsky M. (1975) A Framework for Representing Knowledge. In: Winston P.H. (Ed.) *The Psychology of Computer Vision*. New York: McGraw-Hill.
- Mohan R. & Navatia R. (1992) Perception of 3-D Surfaces from 2-D Contours. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 14(6), 616-635.
- Mont-Reynaud B. (1985) Problem-Solving Strategies in a Music Transcription System. *Proceedings of the 9th International Joint Conference on Artificial Intelligence*. Los Angeles, 916-918.
- Mont-Reynaud B. & Goldstein M. (1985) On Finding Rhythmic Patterns in Musical Lines. *Proceedings of the International Computer Music Conference'1985*. San Francisco: Computer Music Association, 391-397.
- Mont-Reynaud B. & Gresset E. (1990) PRISM: Pattern Recognition in Sound and Music. *Proceedings of the International Computer Music Conference'1990*. Glasgow, 153-155.
- Mont-Reynaud B. & Mellinger D. (1989) Source Separation by Frequency Co-Modulation. *Proceedings of the First International Conference on Music Perception and Cognition, Kyoto, Japan, 17-19 October, 1989*, 99-102.
- Moore B.C.J. (1982) *Introduction to the Psychology of Hearing*. 3rd ed. London: Academic Press.
- Moore F.R. (1978) An Introduction to the Mathematics of Digital Signal Processing. *Computer Music Journal*, 2(1), 38-47; 2(2), 38-60. Reprinted in: Strawn J. (Ed.) *Digital Audio Signal Processing: An Anthology*. Madison: A-R Edition, 1985, 1-67.
- Moorer J.A. (1975) *On the Segmentation and Analysis of Continuous Musical Sound by Digital Computer*. Ph.D. Thesis. Stanford: Stanford University, Dep. of Music Report STAN-M-3.
- Moorer J.A. (1977) On the Transcription of Musical Sound by Computer. *Computer Music Journal*, 1(4), 32-38.
- Morita S., Kawashima T., & Aoki Y. (1992) Hierarchical Shape Recognition Based on 3-D Multiresolution Analysis. In: Sandini G. (Ed.) *Computer Vision - ECCV'92*. Lecture Notes in Computer Science 588. Berlin: Springer, 843-851.

- Moses Y. & Ullman S. (1992)** Limitations of Non-Model-Based Recognition Schemes. In: Sandini G. (Ed.) *Computer Vision – ECCV’92*. Lecture Notes in Computer Science 588. Berlin: Springer, 820–828.
- Navab N. & Zhang Z. (1992)** From Multiple Objects Motion Analysis to Behavior-Based Object Recognition. *Proceedings of the 10th European Conference on Artificial Intelligence’92, Vienna*. Wiley: Chichester, 790–794.
- Neisser U. (1966)** *Cognitive Psychology*. New York: Appelton-Century-Crofts.
- Niihara T. & Inokuchi S. (1986)** Transcription of Sung Song. *Proceedings of the International Conference on Acoustics, Speech, and Signal Processing’86, Tokyo, April 7–11, 1986*, 1277–1280.
- Oppenheim A.V. & Schaffer R.W. (1975)** *Digital Signal Processing*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Palmer S.E. (1975)** Visual Perception and World Knowledge: Notes on a Model of Sensory-Cognitive Interaction. In: Norman D.A., et al. (Eds.) *Exploration in Cognition*. Hillsdale, New Jersey: Erlbaum.
- Palmer S.E. (1982)** Symmetry, Transformation, and the Structure of Perceptual Systems. In: Beck J. (Ed.) *Organization and Representation in Perception*. Hillsdale, New Jersey: Erlbaum.
- Palmer S.E. (1983)** The Psychology of Perceptual Organization: A Transformational Approach. In: Beck J., Hope B., & Rosenfeld A. (Eds.) *Human and Machine Vision*. New York: Academic Press, 269–339.
- Pentland A. & Horowitz B. (1991)** Recovery of Nonrigid Motion and Structure. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 13(7), 730–742.
- Pistone D. (1977)** Tempo. In: Honnegger M. (Ed.) *Dictionnaire de la Musique. Science de la Musique. Formes, Technique, Instruments*. Paris: Bordas.
- Piszczałski M. & Galler B.A. (1977)** Automatic Music Transcription. *Computer Music Journal*, 1(4), 24–31.
- Piszczałski M., Galler B.A., Bossemeyer R., Hatamian M., & Looft F. (1981)** Performed Music: Analysis, Synthesis, and Display by Computer. *Journal of the Audio Engineering Society*, 29(1/2), 38–46.

- Pitts W. & McCulloch W.S. (1947) How we Know Universals: The Perception of Auditory and Visual Forms. *Bulletin of Mathematical Biophysics*, 9, 127-147.
- Pollard H. (1950) *The Theory of Algebraic Numbers*. Baltimore: Mathematical Association of America/Wiley.
- Porte D. (1977) Rythme. In: Honnegger M. (Ed.) *Dictionnaire de la Musique. Science de la Musique. Formes, Technique, Instruments*. Paris: Bordas.
- Posner M.I. (1978) *Chronometric Explorations of Mind*. Hillside, New Jersey: Erlbaum.
- Posner M.I. & Henik A. (1983) Isolating Representational Systems. In: Beck J., Hope B., & Rosenfeld A. (Eds.) *Human and Machine Vision*. New York: Academic Press, 481-543.
- Povel D.J. & Essens P. (1985) Perception of Temporal Patterns. *Music Perception*, 2(4), 411-440.
- Preparata F.P. & Shamos M.I. (1985) *Computational Geometry*. New York: Springer.
- Pridmore T.P., Mayhew J.E.W., & Frisby J.P. (1990) Exploiting Image-Plane Data in the Interpretation of Edge-Based Binocular Disparity. *Computer Vision, Graphics, and Image Processing*, 52, 1-25.
- Rabiner L.R. & Gold B. (1975) *Theory and Applications of Digital Signal Processing*. Englewood Cliffs, New Jersey: Prentice-Hall.
- Rangarajan K. & Shah M. (1991) Establishing Motion Correspondence. *Computer Vision, Graphics, and Image Processing: Image Understanding*, 54(1), 56-73.
- Raynaut F. & Samuel A. Oriented Shift of Representational Bias for Elementary Patterns. *Proceedings of the 10th European Conference on Artificial Intelligence'92, Vienna*. Wiley: Chichester, 487-489.
- Rédei L. (1967) *Algebra. Vol. 1*. Oxford: Pergamon Press.
- Richard D.M. (1990) Gödel Tune: Formal Models in Music Recognition Systems. *Proceedings of the International Computer Music Conference'1990*. Glasgow, 338-340.
- Richards W. & Hoffmann D. (1986) Parts of Recognition. In: Pentland A.P. (Ed.) *From Pixels to Predicates*. Norwood, New Jersey: Albex Publishing Corp.

- Risset J.-C. (1971) Paradoxes de hauteur: le concept de hauteur sonore n'est pas le même pour tout le monde. *Proceedings of the 7th International Congress of Acoustics*. Budapest, 205–210.
- Risset J.-C. (1978) *Paradoxes de hauteur*. Paris: IRCAM Report No. 10.
- Roads C. (1980) Artificial Intelligence and Music. *Computer Music Journal*, 4(2), 13–25.
- Roads C. (1982) McLeyvier Music Transcriber. *Computer Music Journal*, 6(2), 90–91.
- Roads C. (1987) Sinclavier Music Printing. *Computer Music Journal*, 11(2), 77–78.
- Rock I. (1983) *The Logic of Perception*. Cambridge, Massachusetts: M.I.T. Press.
- Roederer J.G. (1975) *Introduction to Physics and Psychophysics of Music*. New York: Springer.
- Rosenthal D. (1988) A Model of the Process of Listening to Simple Rhythms. *Proceedings of the 14th International Computer Music Conference*. Köln: Feedback-Studio-Verlag, 189–197.
- Rosenthal D. (1989) A Model of the Process of Listening to Simple Rhythms. *Music Perception*, 6(3), 315–328.
- Rosenthal D. (1992) Intelligent Rhythm Tracking. *Proceedings of the International Computer Music Conference'1992*. San Francisco: Computer Music Association, 227–230.
- Rossing T.D. (1990) *The Science of Sound*. 2nd ed. Reading, Massachusetts: Addison-Wesley.
- Schloss W.A. (1985) *On the Automatic Transcription of Percussive Music. From Acoustical Signal to High Level Analysis*. Stanford: Stanford University, Dep. of Music Report STAN-M-27.
- Shepard R.N. (1964) Circularity in Judgements of Relative Pitch. *Journal of the Acoustical Society of America*, 27, 2346–2353.
- Shoham Y. (1988) *Reasoning about Change: Time and Causation from the Standpoint of Artificial Intelligence*. Cambridge, Massachusetts: M.I.T. Press.

- Skrjabin A. (1960) *Poem for Piano. Op. 32 No. 1. The Text of Author's Performance by Recording on "Velte-Mignon". Transcribed by P.Lobanov.* Moscow: Gosudarstvennoye Muzykalnoye Izdatelstvo. (Russian).
- Sundberg J. & Tjernlund P. (1970) A Computer Program for a Notation of Performed Music. Stockholm: Royal Institute of Technology, Report STL-QPSR 2-3/1970, 46-49.
- Tanguiane A.S. (1977) *On Parallel Fifths, Doubling, and Orchestration.* Moscow: Moscow State Conservatory. Typescript. (Russian).
- Tanguiane A.S. (1987) *Recognition of Chords for Automatic Note Transcription of Polyphonic Music.* Preprint. Moscow: The All-Union Ethnomusicology Commission of the Union of Composers of the USSR, the Computer Center of the USSR Academy of Sciences. (Russian).
- Tanguiane A.S. (1988a) Recognition of Chords, Interval Hearing, and Music Theory. In: Alekseev E., Andreeva E., Boroda M., & Tanguiane A. (Eds.) *Quantitative Methods in Ethnomusicology and Music Theory.* Moscow: Soviet Composer, 155-186. (Russian).
- Tanguiane A.S. (1988b) An Algorithm of Recognition of Chords. *Proceedings of the 14th International Computer Music Conference.* Cologne: Feedback-Studio-Verlag, 199-210.
- Tanguiane A.S. (1989a) Recognition of Chords with the Help of the Model of Interval Hearing. *Doklady Akademii Nauk SSSR*, 308(3), 552-556. (Russian).
- Tanguiane A.S. (1989b) A Model of Relativity of Perception and Its Applications to Pattern Recognition in Analysis of Performed Music. *The First International Conference on Music Perception and Cognition, Kyoto, 17-19 October, 1989*, 261-266.
- Tanguiane A.S. (1990) A Principle of Correlativity of Perception and Its Applications to Pattern Recognition. *Matematicheskoye Modelirovaniye*, 2(8), 90-111. (Russian).
- Tanguiane A.S. (1991a) Recognition of Chords, Perception Correlativity, and Music Theory. *Musikometrika*, 3. Bochum: Brockmeyer, 163-199.
- Tanguiane A.S. (1991b) Criterion of Data Complexity in Rhythm Recognition. *Proceedings of the International Computer Music Conference'1991*, Montreal: Faculty of Music, McGill University, 559-562.
- Tanguiane A.S. (1992a) Time Determination by Recognizing Generative Rhythmic Patterns. *Musikometrika*, 4. Bochum: Brockmeyer, 83-99.

- Tanguiane A.S. (1992b)** Artificial Perception and Music Recognition: a Heuristic Approach. *Proceedings of the 10th European Conference on Artificial Intelligence '92, Vienna*. Wiley: Chichester, 169–173.
- Tanguiane A.S. (1992c)** Artificial Perception and Music Recognition: Theoretical Grounds. *Advances in Artificial Intelligence—Theory and Application. Proceedings of the 6th International Conference on Systems Research Informatics and Cybernetics, Baden-Baden, 17–23 August, 1992, Vol. II*. Windsor, Ontario: the International Institute for Advanced Studies in Systems Research and Cybernetics, 165–170.
- Tanguiane A.S. (1993)** A Model of Correlative Perception and Its Applications to Music Recognition. *Music Perception*. (Forthcoming).
- Teaney D.T., Mourizzi V.L., & Mintzer F.C. (1980)** The Tempered Fourier Transform. *Journal of the Acoustical Society of America*, 67(6), 2063–2067.
- Terzopoulos D., Witkin A., & Kass M. (1988)** Constraints on Deformable Models: Recovering 3D Shape and Nonrigid Motion. *Artificial Intelligence* 36(6), 91–123.
- Thibadeau R. (1986)** Artificial Perception of Actions. *Cognitive Science*, 10, 117–149.
- Ullman S. (1979)** *The Interpretation of Visual Motion*. Cambridge, Massachusetts: M.I.T. Press.
- Ullman S. (1990a)** Aligning Pictorial Descriptions. In: Winston P. & Shellard S. (Eds.) *Artificial Intelligence at MIT: Expanding Frontiers, Vol. 2*. Cambridge, Massachusetts: M.I.T. Press, 344–403.
- Ullman S. (1990b)** Recovery of 3-D Structure from Motion. In: Winston P. & Shellard S. (eds.) *Artificial Intelligence at MIT: Expanding Frontiers, Vol. 2*. Cambridge, Massachusetts: M.I.T. Press, 404–435.
- Ulupinar F. & Navatia R. (1993)** Perception of 3-D Surfaces from 2-D Contours. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 15(1), 3–18.
- van der Waerden B.L. (1953)** *Modern Algebra. Vol. 1*. New York: Frederick Ungar Publishing Co.
- Vercoe B. & Cumming D. (1988)** Connection Machine Tracking of Polyphonic Audio. *Proceedings of the 14th International Computer Music Conference, Cologne, September 20–25, 1988*. Cologne: Feedback-Studio-Verlag, 211–218.

- Viret J. (1977) Mesure. In: Honnegger M. (Ed.) *Dictionnaire de la Musique. Science de la Musique. Formes, Technique, Instruments*. Paris: Bordas.
- Warren R.M. (1982) *Auditory Perception: A New Synthesis*. New York: Pergamon Press.
- Wertheimer M. (1923) Untersuchungen zur Lehre von der Gestalt, II. Psychologische Forschung, 4, 301–350. Condensed transl. in: Ellis W.D. *A Source Book of Gestalt Psychology, Selection 5*. New York: Humanities Press 1950. Also in: Beardslee D.C. & Wertheimer M. (Eds.) *Readings in Perception, Selection 8*. Princeton, New Jersey: Van Nostrand Reinhold, 1958.
- Widmer G. (1990) The Usefulness of Qualitative Theories of Music Perception. *Proceedings of the International Computer Music Conference'1990*. Glasgow, 341–344.
- Widmer G. (1992) Qualitative Perception Modeling and Intelligent Music Learning. *Computer Music Journal*, 16(2).
- Wightman F.L. & Kistler D.J. (1989) Headphone Simulation of Free-Field Listening. II: Psychophysical Validation. *Journal of the Acoustical Society of America*, 85, 868–878.
- Witkin A.P. (1981) Recovering Surface Shape and Orientation from Texture. *Artificial Intelligence*, 17, 17–45.
- Witkin A.P. (1983) Scale-Space Filtering. *Proceedings of the 8th International Joint Conference on Artificial Intelligence, Karlsruhe, West Germany*, 1019–1024.
- Witkin A., Kass M., Terzopoulos D., & Barr A. (1990) Linking Perception and Graphics: Modeling with Dynamic Constraints. In: Barlow H., Blackmore C., & Weston-Smith M. (Eds.) *Images and Understanding*. Cambridge: Cambridge University Press.
- Witkin A.P. & Tenenbaum J.M. (1983a) What is Perceptual Organization for? *Proceedings of the 8th Joint Conference on Artificial Intelligence'83, Karlsruhe*, 1023–1026.
- Witkin A.P. & Tenenbaum J.M. (1983b) On the Role of Structure in Vision. In: Beck J., Hope B. & Rosenfeld A. (Eds.) *Human and Machine Vision*. New York: Academic Press, 481–543.
- Wyse L., Carl R., Disher T., & Labriola S. (1985) Sinclavier II Updates. *Computer Music Journal*, 9(4), 81–83.

- Xenakis I. (1954)** La crise de la musique sérielle. *Graversaner Blätter*, No. 1.
- Xenakis I. (1963)** *Musiques Formelles*. Paris: Edition Richard-Masse.
- Xenakis I. (1971)** *Formalized Music*. Bloomington: Indiana University Press.
- Zhang Z. & Faugeras O.D. (1990)** Tracking and Grouping 3D Line Segments. *Proceedings of the 3rd International Conference on Computer Vision, Osaka*. 577–580.
- Zucker S.W., Rosenfeld A. & Davis L.S. (1975)** General Purpose Models: Expectations About the Unexpected. *Proceedings of the 4th International Conference on Artificial Intelligence*, 716–721.



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