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Perspective From Antiquity to the Nineteenth Century

Perspective has been described (Edgerton 1975) as the most important discovery of the West. In the fifteenth and sixteenth centuries it involved many of the key individuals in Renaissance art and architecture, notably Brunelleschi, Alberti, and Piero della Francesca. The projection methods of perspective were linked with astronomy (astrolabes and sundials), cartography, stonecutting, and surveying. Leonardo da Vinci linked perspective with physics and made it one of the cornerstones in his new approach to science through his pyramidal law, a principle that also inspired the first universal analogue reckoning instruments: the sector and proportional compass. Since the seventeenth century, the development of perspective has entailed some of the leading mathematicians: Desargues, Pascal, Euler, Monge, Poncelet. In its metaphorical sense, perspective has been explored by philosophers such as Leibniz and Nietzsche; played a fundamental role in the work of Schutz, one of the founding fathers of modern sociology, and has affected profoundly most major disciplines, including anthropology, ethnography, literature, psychology and even theology.

This course reconsiders the history of perspective. It examines optical adjustments methods among the Egyptians and the Greeks; debates concerning ancient perspective, mediaeval contributions and focusses on the period 1300-1600. Developments in Italy, Burgundy, Germany and France are explored. A survey is made of major themes: instruments, shadow projection, regular and semi-regular solids, intarsia, interiors, quadratura, trompe l'oeil, anamorphosis, stage scenery, columns, ideal architecture, ruins and gardens. Links with mathematical themes such as planisphere projection, conic sections, sundials, and stonecutting are addressed. Developments from the seventeenth to the nineteenth century are considered. The significance of perspective is assessed in terms of science, art, the environment and the imagination, in order to draw attention to a paradox: How was it that a method of representation that imposed scientific rules became a new key to artistic freedom and creativity?

Basic readings include:

Sir Ernst Gombrich, *Art and Illusion*, Princeton: Princeton University Press, 1960.

John White, *The Birth and Rebirth of Pictorial Space*, London: Faber, 1967

Lewis B. Andrews, *A Space of Time: Continuous Narrative and Linear Perspective in Quattrocento Tuscan Art*, PhD, Columbia University, 1988.

Martin Kemp, *The Science of Art. Optical Themes in Western Art from Brunelleschi to Seurat*, New Haven: Yale University Press, 1990 and 1992.

Kim H. Veltman, *Sources of Perspective*.

Perspective From Antiquity to the Nineteenth Century

Lectures: Autumn Term

1. Optical Adjustments in Antiquity
2. Basic Shapes in the Late Middle Ages

3. Surveying, Instruments and Geometry
4. Proportional Compass

5. Transformational Geometry and Science
6. Towns, Topography and Geography

7. Narrative (Italy)
8. Roomscales and Landscapes (Netherlands)

9. Sacred and Secular Spaces (Germany)
10. Geometry and Architecture (France)

11. Shadow Projection
12. Regular Solids

13. Semi-Regular Solids
14. Intarsia

15. Interiors
16. Quadratura

17. Anamorphosis
18. Stage Scenery

19. Columns
20. Roman Ruins

21. Ruins and Capriccios
22. Ideal and Real Buildings

23. Fountains, Gardens, and Landscapes
24. Stonecutting and Descriptive Geometry

25. Architecture and Urbanism
26. Optics and Psychology (1850-1900)

Perspective From Antiquity to the Nineteenth Century

Readings:

1. Optical Adjustments in Antiquity

Heinrich Schäfer, *Principles of Egyptian Art*, ed. E. Brunner-Traut, Oxford: Clarendon Press, 1974, pp. 159-198.

A. M. G. Little, *Roman Perspective Painting and the Ancient Stage*, New York: Moretus Press, 1971.

2. Basic Shapes in the late Middle Ages

John North, "The Astrolabe", *Scientific American*, New York, Vol. 230., Nr.1, January 1974, pp.96-101.

Miriam Schild Bunim, *Space in Medieval Painting and the Forerunners of Perspective*, New York: AMS Press Inc. (1940), 1970, pp. 175-192.

John White, *The Birth and Rebirth of Pictorial Space*, London: Faber, 1967, pp. 135-198.

3. Surveying, Instruments and Geometry.

B.A. R. Carter, "Perspective", *Oxford Companion to Art*, ed. Harold Osborne, Oxford: Clarendon Press, 1970, pp. 840-861.

Kim. H. Veltman, *Military Surveying and Topography: the Practical Dimension of Renaissance Linear perspective*, Lisbon: Junta de Investigações Científicas do Ultramar, 1979, pp. 338-368.

4. Proportional Compass

Galileo Galilei, *Operations of the Geometric and Military Compass*, trans. Stillman Drake, Washington: Smithsonian Institution, 1978.

5. Transformational Geometry and Science

J. McCabe, *Leonardo da Vinci's De Ludo Geometrico*, PhD University of California at Los Angeles, 1972.

6. Towns, Topography and Geography

Lewis B. Andrews, *A Space of Time: Continuous Narrative and Linear Perspective in Quattrocento Tuscan Art*, PhD, Columbia University, 1988.

Marilyn Aronberg Lavin, *The Place of Narrative: Mural Decoration in Italian Churches, 431-1600*, Chicago: University of Chicago Press, 1990.

7. Narrative (Italy)

Erwin Panofsky, "Die Perspektive als symbolische Form," *Vorträge der Bibliothek Warburg 1924-1925*, Hamburg, 1927. Trans. *La perspective comme forme symbolique*, Paris: Les Editions de Minuit, 1975, pp. 37-93. Trans. *Perspective as a Symbolic Form*, New York: Zone Books, 1997.

Leon Battista Alberti, *On Painting*, ed. John Spencer, New Haven: Yale University Press, 1956, pp. 43-49, 68-73.

8. Roomscapes and Landscapes (Burgundy and the Netherlands)

James Mitchell Collier, *Linear perspective in Flemish Painting and the Art of Petrus Christus and Dirk Bouts*, PhD Dissertation, University of Michigan, 1975, pp. 105-184.

9. Sacred and Secular Spaces (Germany)

J. G. Links, *Townscape Painting and Drawing*, New York: Harper And Row, 1972.

10. Geometry and Architecture (France)

Liliane Brion-Guerry, *Jean Pélerin, Viator. Sa place dans l'histoire de la perspective*, Paris: Société d'Édition les Belles Lettres, 1962, pp. 116-150.

William M. Ivins, *On the Rationalization of Sight*, New York: Da Capo Press, 1973.

11. Shadow Projection

Thomas Da Costa Kauffman, "The perspective of shadows: the history of the theory of shadow projection," *Journal of the Warburg and Courtauld Institutes*. 38. 1975.

12. Regular Solids

H.M. Cundy, and A. P. Rollett, *Mathematical Models*, Oxford: Clarendon Press, 1951.

13. Semi-Regular Solids

Kim H. Veltman, *A Brief History of the Not so Regular Solids*,.

14. Intarsia

André Chastel, "Cités idéales", *L'Oeil*, Paris, n. 36, 1957, pp. 32-39.

Cecil H. Clough, "Federigo da Montefeltro's Private Study", *Apollo*, London, vol. 81, October 1967, pp. 278-287.

15. Interiors

L. Sandström, *Levels of Unreality*, Uppsala: Almqvist and Wiksell, 1963, (Figura. Uppsala Studies in the History of Art, New Series, 4).

16. Quadratura

Ingrid Sjöström, *Quadratura. Studies in Italian Ceiling Painting*, Stockholm: Almqvist and Wiksell, 1978, pp. 11-48. (Acta universitatis Stockholmiensis).

17. Anamorphosis

Jurgis Baltrusaitis, *Anamorphoses*, Paris: O. Perrin, 1969.

18. Stage Scenery

G. Kernodle, *Perspective and the Renaissance Stage*, PhD, Yale University, 1937.

Eckert, W., *The Renaissance Stage in Italy: A Study of the Evolution of the Perspective Scene*, PhD, State University of Iowa, 1961.

19. Columns

Onians, John, *Bearers of meaning: the classical orders in antiquity, the Middle Ages, and the Renaissance*, Princeton, N.J.: Princeton University Press, c1988..

20. Ruins

Forero-Mendoza, Sabine, *Le temps des ruines : l'éveil de la conscience historique à la Renaissance*, Seyssel (Ain): Champ Vallon, 2002.

21. Ruins and Capriccios

Hartmann, Lucrezia, "*Capriccio*"--*Bild und Begriff*, Nürnberg: Druckschnelldienst Nürnberg, 1973.

21. Ideal and Real Buildings

Rosenau, Helen, *The ideal city in its architectural evolution*. London : Routledge and Paul, 1959.

23. Fountains, Gardens, and Landscapes

F. Hamilton Hazlehurst, *Gardens of Illusion, The Genius of André Le Nostre*, Nashville: Vanderbilt University Press, 1980.

24. Stonecutting and Descriptive Geometry

Friederich, Karl, *Die Steinbearbeitung in ihrer Entwicklung vom 11. bis zum 18. Jahrhundert*, Augsburg: B. Filser Verlag, G.m.b.H., 1932.

25. Architecture and Urbanism

Marianne Marcussen, "L'évolution de la perspective linéaire au XIXe siècle en France", *Hafnia. Copenhagen Papers in the History of Art*, Copenhagen, No. 7, 1980, pp.51-73.

26. Optics and Psychology (Nineteenth Century)

Hermann von Helmholtz, *Treatise on Physiological Optics*, trans. James P. C. Southall, New York: Dover, 1962, vol. 3. pp. 179-185.

Maurice Pirenne, *Optics, Painting and Photography*, Cambridge: Cambridge University Press, 1970, pp. 145-150.

Perspective in the Twentieth Century and Today

Perspective in the twentieth century has evoked fundamentally different interpretations. On the one hand, developments in abstract art led scholars such as Novotny (1939) to claim that perspective died with Cezanne. On the other hand, more books have been published on perspective in this century than in any previous century. In art, perspective has remained important for surrealists, super-realists and hyper-realists. In architecture and technical drawing, perspective has become increasingly important. The rise of computers has greatly enhanced this interest in systematic treatment of space and has led to the four C's: computer aided design (CAD); computer aided engineering (CAE); computer aided manufacture (CAM) and computer integrated manufacture (CIM). This course explores these developments, and raises questions about their consequences.

It begins with changes in classification, examples in art, particularly spherical and alternative methods. This leads to the importance of illusions, the blind, spatial development and parallel perspective in connection with psychology. The impact of architecture and technical drawing is examined. Particular attention is given to the significance of new technologies: photography, cinema, video, computer graphics, robotics, fractals, holography, stereoscopy, auto-stereoscopy, the integration of Geographical Information Systems (GIS), Global Positioning Systems (GPS) and Universal Mobile Telecommunications Systems (UMTS) as well as virtual and augmented reality. It is shown that the past two decades entail a revolution in imaging and visualisation that is as dramatic as the invention of perspective in the Renaissance. No technical knowledge is assumed. The concern is philosophical: what are the consequences of these new methods of spatial representation for our approaches to the world, for concepts of knowledge, for the problem of knowing ourselves?

Basic readings include:

Maurice Pirenne, *Optics, Painting and Photography*, Cambridge: Cambridge University Press, 1970.

Lenny Lipton, *Foundations of the Stereoscopic Cinema. A study in Depth*, New York: Van Nostrand Reinhold Company, 1982.

Nadia Magnenat Thalmann, Daniel Thalmann, *Image Synthesis. Theory and Practice*, Tokyo: Springer Verlag, 1987.

Richard Mark Friedhoff, Mark Benzon, *The Second Computer Revolution. Visualization*, New York: Harry Abrams, 1989.

Kim H. Veltman, *The Literature of Perspective*.

Perspective in the Twentieth Century and Today

Lectures: Spring Term

1. Classification
2. Art

3. Spherical Methods
4. Alternative Methods

5. Illusions
6. Blind

7. Development
8. Architecture

9. Technical Drawing
10. Psychology

11. Photography
12. Aerial Photography

13. Stereography
14. Holography

15. Computer Graphics 1960-1989
16. Computer Graphics 1990-1999

17. Computer Graphics and the Web 3-D Consortium
18. Cinema

19. Image Based Rendering and Multiple Viewpoints
20. Video

21. Coordinate Conversion, Transformation, Fractals
22. GIS, GPS, UMTS

23. Autostereoscopy
24. 3-D Television

25. Virtual Reality
26. Augmented Reality

1. Classification

Kim H. Veltman, "Classification" in Ibid., *The Sources of Perspective*, pp. 112-139.

2. Art

H. H. Arnason, *A History of Modern Art*, London: Thames and Hudson, 1969.

3. Spherical Methods

André Barre et Albert Flocon, *La perspective curviligne. De l'espace visuel ... l'image construite*, Paris: Flammarion, 1968. Cf. English Translation: *Curvilinear Perspective*, trans. Robert Hansen, Berkeley: University of California Press, 1988.

4. Alternative Methods

Robert Hansen, "This curving world: hyperbolic linear perspective," *Journal of aesthetics and art criticism*, 32. 1973.

5. Illusions

M. Luckiesh, *Visual Illusions*, New York: D. Van Nostrand, 1922; New York: Dover, 1965

J.O. Robinson, *The Psychology of Visual Illusions*, London: Hutchinson and Co., 1972. .

6. Blind

John M. Kennedy, Paul Gabias, Andrea Nicholls, "Tactile Pictures": *Touch Perception*, ed. M. Heller and W. Schiff, Hillsdale: L. Erlbaum, 1991.

Kennedy, John M., *Haptic pictures*, Toronto: University of Toronto, Scarborough College, 1980.

7. Development

Suzi Gablik, *Progress in Art*, London: Thames and Hudson, 1976

Sidney J. Blatt, *Continuity and Development in Art. The Development of Modes of Representation*, Hillsdale: Lawrence Erlbaum, 1984.

8. Architecture

Lionel March, Philip Steadman, *The Geometry of Environment*, London: R.I. B.A., 1971.

Anders, Peter, *Envisioning cyberspace: designing 3-D electronic spaces*, New York: McGraw-Hill, c1999.

9. Technical Drawing

Peter Jeffrey Booker, *A History of Engineering Drawing*, London: Chatto and Windus, 1963.

10. Psychology

Kennedy, John M., *A psychology of picture perception*, San Francisco, Washington, London: Jossey-Bass Publishers, 1994.

11. Photography

Keeling, Derek, *Foundations of photography*, Text/fiche publications series. no.3, London: World Microfilms Publications, 1987.

12. Aerial Photography

Abrams, Talbert, 1895-, *Essentials of aerial surveying and photo interpretation*, New York: McGraw-Hill, 1944.

13. Stereography

Dewhurst, H., *Introduction to 3-D; three dimensional photography in motion pictures. With chapters on wide-screen, Cinemascope, Cinerama, and stereo television*, London: Chapman & Hall, 1954.

Lenny Lipton, *Foundations of the Stereoscopic Cinema. A study in Depth*, New York: Van Nostrand Reinhold Company, 1982.

Hayes, R. M., 1947-, *3-D movies: a history and filmography of stereoscopic cinema*, Jefferson, N.C.: McFarland, c1989.

Reynaud, Françoise; Tambrun, Françoise; Timby, Kim, *Paris in 3D: from stereoscopy to virtual reality 1850-2000*, London: Booth-Clibborn Editions; [Paris]: Paris-Musées, 2000.

See: http://www.pulltime3d.com/02_tv/02_00tv.html

14. Holography

Yu. N. Denisyuk, *Fundamentals of Holography*, Moscow: MIR Publishers, 1984.

15. Computer Graphics 1960-1989

William M. Newman, Robert F. Sproull, *Principles of Interactive Computer Graphics*, Tokyo: McGraw Hill Kogakusha Ltd., 1973.

Nadia Magnenat Thalmann, Daniel Thalmann, *Image Synthesis. Theory and Practice*, Tokyo: Springer Verlag, 1987.

Richard Mark Friedhoff, Mark Benzon, *The Second Computer Revolution. Vizualization*, New York: Harry Abrams, 1989.

16. Computer Graphics 1990-1999

Foley, James D.; Andries van Dam, Steven K. Feiner, John F. Hughes, *Computer Graphics: Principles and Practice*, 2nd Edition, Boston: Addison-Wesley Pub Co; 2nd edition, 1995.

Street, Rita, *Computer animation : a whole new world : groundbreaking work from today's top animation studios*, Rockport, Mass.: Rockport Publishers ; Cincinnati, Ohio : Distributed by North Light Books, c1998.

17. Computer Graphics and the Web 3-D Consortium

Vince, John; Earnshaw, Rae, eds. *Computer Graphics International* (2002: University of Bradford, UK), *Advances in modelling, animation, and rendering* / John Vince and Rae Earnshaw, London; New York: Springer, c2002.

See: <http://www.web3d.org/>

18. Cinema

Pocock, Lynn; Rosenbush, Judson, *The computer animator's technical handbook*, San Francisco, Calif. : Morgan Kaufmann ; London : Harcourt, 2002.

Capistran, France L. L., *Lexique: postproduction, cinéma, télévision : digital numerique*, Montréal: Parlimage, c1996.

19. Image Based Rendering and Multiple Viewpoints

Andrew Lippman, Michael Naimark, *Aspen Movie Map*, 1978. See: [http://seminare.design.fh-aachen.de/inmotion/stories/storyReader\\$17](http://seminare.design.fh-aachen.de/inmotion/stories/storyReader$17)

Paul Debevec. See: <http://www.debevec.org/>

Takeo Kanade, Takeo, "The Eye Vision at Super Bowl and The Virtualized Reality System: 4D Digitization of a Time-Varying Real Event and Its Application," Euroimage, ICAV3D 2001. Cf. <http://www.ri.cmu.edu/events/sb35/tksuperbowl.html>. Cf. http://www.ri.cmu.edu/people/kanade_takeo.html

20. Video

Lin, I-Jong, 1971-; Kung, S.Y., *Video object extraction and representation: theory and applications*, Boston, Mass.: Kluwer Academic Publisher, 2000.

21. Coordinate Conversion, Transformation, Fractals

Benoit Mandelbrot, *The Fractal Geometry of Nature*, New York: W. H. Freeman and Co.

22. GIS, GPS and UMTS

Heywood, D. Ian; Cornelius, Sarah; Carter, Steve, *An introduction to geographical information systems*, Harlow, England ; New York : Prentice Hall, 2002. 2nd ed.

Longley, Paul A., *Geographical information systems*, New York: Wiley, 1999, 2nd ed.

El-Rabbany, Ahmed. *Introduction to GPS : the Global Positioning System*, Boston, Mass.: Artech House, c2002

Bossler, John D.; Jensen John R., McMaster Robert B.; Rizos, Chris, eds., *Manual of geospatial science and technology*, London; New York: Taylor & Francis, 2002.

Steede-Terry, Karen. *Integrating GIS and the Global Positioning System*, Redlands, Calif. : ESRI Press, c2000.

23. Autostereoscopy

Philips

<http://www.extra.research.philips.com/euprojects/icecream/public-presentations/DBC%20workshop-day-2-2.pdf>

<http://vip.bu.edu/Publications/local/jpapers/Konr01cm.pdf>

Rainbow Lab: <http://www.cl.cam.ac.uk/Research/Rainbow/projects/asd.html>

24. 3-D Television

<http://www.icme2003.org/TutorialInfo.asp?TutorialID=8>

<http://bs.hhi.de/ICOB-Workshop/Announcement.pdf>
<http://atwww.hhi.de/~pastoor/>

25. Virtual Reality

Forte, Maurizio, ed., *Virtual Archaeology: Great Discoveries Brought to Life Through Virtual Reality*, London: Thames and Hudson, 1997.ⁱ

Schroeder, Ralph (ed.), *The social life of avatars: presence and interaction in shared virtual environments*, London: Springer, c2002.

Kerlow, Isaac Victor, 1958-, *The art of 3-D: computer animation and imaging*, New York: John Wiley & Sons, c2000. 2nd ed.

26. Augmented Reality

IWAR '98 (1998 : San Francisco, Calif.) Augmented reality : placing artificial objects in real scenes : proceedings of IWAR '98 / edited by Reinhold Behringer, Gudrun Klinker, David W. Mizell, Natick, Mass. : A K Peters, c1999.

IEEE and ACM International Symposium on Augmented Reality (2001: New York, New York); IEEE and ACM International Symposium on Augmented Reality: proceedings: 29-30 October, 2001, New York, New York / organized and sponsored by Siemens Corporate Research, Columbia University Computer Graphics & User Interfaces Lab; co-sponsored by Sony Computer Science Laboratory ... [et al.] ; in cooperation with ACM SIGCHI, ACM SIGGRAPH, Eurographics.

IEEE and ACM International Symposium on Mixed and Augmented Reality (1st : 2002 : Darmstadt, Germany) International Symposium on Mixed and Augmented Reality : ISMAR 2002 : September 30-October 1, 2002, Darmstadt, Germany : proceedings / sponsored by IEEE Computer Society Technical Committee on Wearable Information Systems (TCWIS) and Task Force on Human Centered Information Systems (TFHIS), Fraunhofer IGD ; in cooperation with ACM ... [at al.].

Ambroziak, Brian M. (Brian Michael), 1970-Infinite perspectives: two thousand years of three-dimensional mapmaking / Brian M. Ambroziak and Jeffrey R. Ambroziak with an introduction by Ray Bradbury. New York : Princeton Architectural Press, 1999

ⁱ http://www.learningsites.com/Support_pages/BFS_VRinA_intro.html