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Literature on Perspective. A Select Bibliography (1971-1984)

1. Introduction

Schüling's (1975) bibliography of secondary literature on perspective covered the period 1870-1970.[1] The present survey is limited to a small sample of literature since 1971. Readers wishing more information concerning specific titles and or more literature are referred to Vagnetti's (1979) annotated bibliography, the most important survey of primary and secondary literature to date, and to the summaries provided by the *Répertoire d'Art et d'Archéologie* and the *Répertoire Internationale de Littérature de l'Art* (*RILA*). Primary literature on perspective is beyond the scope of the present survey which identifies major trends in research and indicates desiderata under three general headings: history; technical problems; methodological and methaphorical applications.

2.1. History. General

For the non-specialist and scholar alike Doesschate remains basic. Wright (1983) provides an excellent survey of perspective and themes which it involves: vision, instruments, scenography, architecture and photography. Bǿggild (1978) has made a useful collection of excerpts from standard texts. Vagnetti's (1979) introductory remarks to various sections of his bibliography provide a useful survey of the history of perspective.

Panofsky's 1924 lecture (1927), which links perspective to changes in world view and theories of vision, has awakened unprecedented interest in the past decade. There has been an Italian edition (1973), a new German edition (1974), a partial typescript translation into English[2] (1979), a French (1975) and a Spanish (1978) translation. Veltman (1980) has examined Panofsky's sources and criticized his method (in this publication, 1986).

Panofsky began with an interest in the objective mathematical and scientific characteristics of linear perspective. Ironically, his work has brought into vogue a notion that perspective is merely a convention (see below § *3* Philosophy), and has led some, such as Dubery and Willats (1972) to treat linear perspective as one of a number of

drawing methods. In the interest of clarity, such accounts skim over and sometimes omit significant historical details.

Panofsky's essay has also been a source for psychologists (see below § 3 Developmental Psychology) who have been struck by parallels between Piaget's developmental model of spatial concepts in a child and historical concepts of space. This has led to a revival of comparisons between phylogeny and ontogeny that intrigued and (partially) seduced the neo-Darwinians and neo-Kantians of the last century. Gablik (1976) offers a radical version of this approach. While persuasive on the basis of the examples cited, the author's sample is too small and too biased to reflect honestly the complexities of history. Blatt (1984) offers the best exploration of this approach to date. Blatt relates his work to the philosophy of the behaviorists (e.g. Chomsky), but remains optimistic concerning human freedom to develop new modes of representation.

Abels (1982), drawing on both philosophy and sociology, and using ideas of Marx and Holzkamp (1976) considers a developmental model in which perception and representation become functions of class level, and other societal structures.

Art historians have remained wary of such developmental models of psychologists, philosophers and sociologists. Gombrich, for instance, is fundamentally opposed to general notions of 'progress in art.'[3] Art, he claims, has to do with quality, which involves an object's having an autonomous value and as such it cannot be measured against an exterior standard. Indeed, he notes, one can only speak of progress, if there be a single goal. Since there are many goals of artistic expression, it is impossible to submit all works of art to one line of progress.

Gombrich has examined some of these goals in detail. One possibility is to represent the natural world convincingly (mimesis as in *Art and Illusion*). Another is to distort the natural world deliberately (caricature as in *Meditations on a Hobby Horse*). A third possibility is to focus on images from the inner world (emblems, allegories as in *Symbolic Images*). A fourth is to emphasize regular structures in the inner and/or the outer world (ornament as in a *Sense of Order*). A fifth is a non-deliberate mixing of inner and outer forms (primitive art). The problem with developmental psychologists is that they have concentrated on the growing spatial mastery and perspectival features of the mimetic tradition as if this were the sole goal of art.

2.2. History-Non Western Cultures

The recognition and use of perspective in „primitive" and underdeveloped countries is considered below in connection with § 3 Perceptual Psychology. Here only advanced civilizations such as China, Japan and Russia, which had their own alternatives to linear perspective, will be considered.

China

Needham (1971) has given a brief survey of perspectival methods in China. Edgerton (1976) has made general comparisons between West and East in terms of perspective and has since (in Hagen, ed., 1980) examined the impact of perspectival techniques of the Jesuits on seventeenth century Chinese drawing. For the purposes of a larger bibliography

being prepared by the present author, the National Library of Beijing has generously sent a list of c. 130 Chinese titles on linear perspective, most of them written in the twentieth century.

Japan
The National Diet Library in Tokyo has sent a corresponding list which also includes a number of titles in English. A book in Japanese by Yokoyama (1977) whose title in translation is: „Eye of perspective - Space of Renaissance Italy and Japan" indicates an increasing interest in comparing Eastern and Western methods.

Russia
For the purpose of the same bibliography, both the Pedagogical Academy in Moscow and the Saltychov-Schedrin State Public Library have kindly sent lists of titles. These confirm a growing interest in perspective. An article by Ikonnikov (1973) deals with the spatial language of Japanese art.

In the West the spatial characteristics of Russian art are usually described in general terms as inverted perspective. In Russia, L.F. Shegin, or Zhegin (1892-1969), who was part of an illustrious circle which included the artists M.F. Larionov and W.N. Tschekrygin; the poet Majakowski; the philosopher, P.A. Florenski and the mathematician N.N. Lusin, developed a highly sophisticated explanation (German ed. Shegin 1982) of spatial composition, particularly in traditional icons. He related this to theories of optics, and also to more general problems of what he termed the language of images. This is also the title of a recent collection of essays by Mitchell (1980). Shegin's book has an introduction and commentary by Boris Uspensky whose own work on perspectival metaphors in literature (1973) in turn draws on Shegin's insights.

Misler's introductory essay and Italian translation of Florenski(j)'s article on inverted perspective and other writings (1983) provide valuable insights into the role of perspective in the early twentieth century avantgarde movement in art. Striking are the connections with European discussions, such as Favorski's Russian translation of Hildebrand's *Das Problem der Form in den bildenden Künsten*.

2.3. HISTORY. Eras

3000 - 1000 B.C. (Egypt)

The standard work remains Schäfer (1974) now available in an English translation with an essay by Brunner-Traut, who uses the term „perspective-like" (German *aperspektivisch*, a term also used by Jean Gebser[4]) to describe Egyptian methods of spatial representation.

1000 B.C. - 300 A.D. (Greece and Rome)

The basic question whether linear perspective was or was not known in Antiquity is still a matter of debate. The standard arguments against the claim remain those of Richter (1970). Arguments in favour of the claim are summarized by Little (1971) and Gigante (1980). (De) Franciscis' (1975) publication of the recently uncovered frescoes in the villa at Oplontis add important evidence that the Romans had convincing methods of spatial representation. However, none of these examples reveals the vanishing point of linear perspective.

Keuls (1975) evidences recent work on etymological problems involved in the term *sciagraphia*. Unfortunately, many classicists tend to use the term perspective very loosely to refer to a sense of depth, with no interest whether a vanishing point, a distance point, or other technicalities were involved. This applies to most of the articles listed under perspective in the *Archäologischer Anzeiger*.

300 - 1400 A.D. (Middle Ages)

Although Panofsky (1927) devoted considerable attention to Mediaeval spatial methods, his work focussed attention on Brunelleschi's theoretical demonstrations of perspective. Since then it has become the fashion to concentrate on Brunelleschi and his followers, and ignore the Mediaeval period. Bunim (1940) and White (1957) are still the standard works for the period 1300-1400. Prandi's (1971) article on Giotto is among the few contributions to the question of proto-perspectival methods.

Gombrich (1967, new edition, 1976) showed that Brunelleschi's drawing of the octagonal shaped Baptistery of San Giovanni had numerous 14th century precendents. This applies also to other geometrical shapes which were gradually mastered in painting practice and subsequently entered the repertoire of images in theoretical treatises. A systematic study of how this repertoire evolved has yet to be made. Also deserving of more attention is the interplay of spatial forms in painting practice with those in manuscript illustrations and books of hours in particular.

1400 - 1600 (Renaissance)

By far the most important contribution to this field has been the world conference (1977) organized by Dalai-Emiliani (1980) with essays on Alberti, Brunelleschi, Masaccio, Masolino, Mantegna, Leonardo da Vinci, Carpaccio, Correggio, Commandino, Baldassare Lanci and others. An unpublished thesis by Veltman (1975) has reassessed the connections between the *costruzione legittima* and distance point construction. Harnest (1971) has studied perspectival construction in Germany. Collier (1975) has examined perspective in Dirk Bouts' paintings and has emphasized connections between the Netherlands and Italy. Such connections have also been emphasized by Ragghianti (1977). Bora (1980) has also demonstrated these links in an important article on the theory and practice of drawing foreshortened human figures. A fundamentally different claim is made by Alpers (1983) who seeks to polarize methods in the North and South. Edgerton has developed his claims concerning the implications of Renaissance perspective for Western civilization (1976, 1980). There have also been articles on new sources and on particular individuals. These will be considered below.

Renaissance Sources

Arrighi (1974) discovered a Lucca manuscript of Alberti's *De pictura*. Pedretti (1973) drew attention to the four Zaccolini manuscripts based on Leonardo da Vinci. One of these has since been analysed in detail by Clearfield-Bell (1983). Marinelli (1981) has discovered a sheet by Carlo Urbino based on the „Codex Huygens" and used this to claim that Carlo Urbino was the author of the Codex.

At the instigation of Dalai-Emiliani, Martinelli and Pino (1980) compiled a useful list of optical and perspectival treatises in Milanese libraries, and Olivato (1980) has made a similar list for the Veneto.

Renaissance Theoreticians and Practitioners

Most work in recent years has been in the form of articles on individual theoreticians and practitioners. These will be considered in chronological order.

Ghiberti

A series of essays on this artist's role in the early history of linear perspective are conveniently collected in the acts of a conference on Lorenzo Ghiberti (1980).

Brunelleschi

Evidence of Brunelleschi's perspectival experiments is limited to approximately ó lines of text by Manetti, his biographer. Nevertheless, because Brunelleschi has become a symbol of revolution in spatial representation there have been well over 100 articles written about these 6 lines in the past 50 years.

Gioseffi's (1957) interpretation remains important. Edgerton's reconstruction using a camera (1973, 1975) has become one of the most popular interpretations of the experiment involving San Giovanni in Florence. Others are to be found in a conference on Brunelleschi (1980). A good summary of the chief interpretations is provided by Martin Kemp (1978). Recently, psychologists have also become interested in the implications of Brunelleschi's experiment, as witnessed by Arnheim (1978) and Pastore (1979).

Alberti

Grayson's (1972) edition and translation of *De pictura* and Gambuti's (1972) edition of *Elementa picturae* have made these sources more accessible. Panofsky's (1927) interpretation of Alberti's *costruzione legittima* remains standard. Even so the diagrams in the Lucca manuscript discovered by Arrighi (1972) raise new problems concerning the relationship between *costruzione legittima* and distance point construction, as discussed by Veltman (in press).

Masaccio

Polzer's (1971) careful analysis of perspectival lines in Masaccio's *Trinitá* brings to light the importance of claims based on the actual work, rat-her than on photographs.

Domenico Veneziano

Holmes' nearly finished Courtauld thesis on the Pala di Santa Lucia raises new questions concerning the role of models in perspectival constructions. Battisti's (1971) appendix,

written in collaboration with J. Ubans, remains one of the only published analyses of Veneziano's perspective.

Mantegna

Fasolo's (1965) analysis of Mantegna's perspective remains basic. Battisti (1971) has discussed the 15th and 16th century context of Mantegna's interests. Smith (1974) has analysed the perspectival construction in Mantegna's *Dead Christ.*

Antonella da Messina

Trutty-Coohill (1982) has drawn attention to the importance of light and shade in creating perspectival relief (*eminentia*). Leonardo terms this *chiaroscuro* (Veltman, in press). This important branch of perspective deserves much further study.

Piero della Francesca

During the Renaissance it was considered that Piero della Francesca had written three perspectival treatises: *De prospectiva pingendi*, *De corporibus regularibus* and *Trattato d'abaco*" (cf. E. Danti, introduction to his edition of Vignola's *Le due regole*, 1583). Daly-Davis (1977) has thrown light on the connections between these works. Smedley (c. 1982), in an unpublished typescript, has made sculpted reconstructions of the heads described in Piero's *De prospectiva pingendi* and has linked these with Platonic ideals of the time. Berry (Columbia, Missouri) is said to be making computerized reconstructions of diagrams in Piero's treatise. Nonetheless, the *De prospectiva pingendi* still awaits an edition that takes into account the various manuscript versions.

Leonardo da Vinci

At the instigation of and in consultation with Keele, Veltman (in press) has made a comprehensive study of Leonardo's perspectival and optical writings.

There have been a number of interpretations of the perspectival construction used in the *Last Supper*; some appear in Dalai-Emiliani (1980). Brambilla Barcillon's painstaking restoration is due to take another three to five years. This will call for a revision of earlier interpretations.

Correggio

Correggio's perspectival di *sotto in su* figures have been examined by Shearman (1980) and analysed by Battisti (1979).

Lotto

(De) Vecchi (1978) has analysed the perspectival construction in Lotto's *Pala Martinengo*.

Dürer

Schüritz (1919) remains a standard study of the perspectival constructions in Dürer's paintings. Schröder's (1980) book analyses several pain-tings and provides elegant projections for the *Melencolia*. Schröder rejects the possibility of number symbolism in the geometric body shown in the engraving. Since then Lynch (1982) has analysed the perspectival shape in *Melencolia I* independently and has produced a strong case to claim that number symbolism is involved, indeed that the irregular body is linked with the magic number square in the right hand of the engraving.

Stevin

Sinisgalli's (1978) edition and Italian translation of Stevin's Latin treatise is of particular interest because of his introductory essay in which he produces three-dimensional reconstructions of Stevin's abstract diagrams and relates these to dia-grams of other major theorists notably Piero della Francesca, Giacomo Barozzi da Vignola, Frederico Commandino and Guidobaldo del Monte. Sinisgalli, a student of Fasolo and Vagnetti, is one of the only individuals at present who emphasizes the important links between perspective and the tradition of high mathematics.

Veronese and Tintoretto

Marinelli (1974, 1980) has analysed perspectival constructions in the paintings of Veronese and Tintoretto respectively.

Other Renaissance Practitioners and Theoreticians

Scholars in this century have written over 100 articles on the perspectival activities of Brunelleschi. This is also the case with Alberti and Piero della Francesca. Meanwhile, much remains to be done. In the realm of practice, the perspectival constructions of Crivelli, Filippo Lippi, Botticelli, Perugino or Carpaccio have not yet been seriously analysed. At the level of theory, the importance of Guidobaldo del Monte is universally recognized. But while there are over 30 editions of Alberti, the first modern edition and Italian translation of Guidobaldo has only recently been made by Sinisgalli (1984). His commentaries are important but more detailed work is desirable as is an English translation.

Sinisgalli also deserves praise for having drawn attention (1978, 1984) to Guidobaldo's manuscript in the Bibliothèque Nationale, Paris, but a proper edition is still needed. There is evidence of a connection between linear perspective and the origins of the proportional compass. Guidobaldo del Monte was active on both fronts. He was, moreover, a patron of Galileo who first developed the proportional compass. This makes a detailed study of Guidobaldo's work all the more desireable.

But he is not the only theoretician to have been neglected. Effectively no systematic work has yet been done on the treatises of Jacques Androuet du Cerceau, Jacopo Bellini, Jean Cousin, Joachim Fortius (Ringelbergius), Georg Has, Augustin Hirschvogel, Heinrich Lautensack or Paul Pfintzing.

Details concerning these and other theoreticians are available in Schüling's (1972) bibliography. His work points to a radical re-assessment of Panofsky's claim that theoretical works on linear perspective were primarily Italian. Of the 140 treatises published before 1600, one was published in Florence, 28 appeared in Venice and 35 in Nürnberg. 70 % of the treatises were published North of the Alps. We are still a long way from having an authoritative history of Renaissance linear perspective.

1600-1700 (Baroque)

An important study by Sinisgalli (1981) demonstrates that Borromini's corridor in the Palazzo Spada has 15 different vanishing points which accomodate the observers' different viewpoints as they walk through it.

The role of perspective in Dutch paintings in Delft in the period around 1650 has been the subject of doctoral dissertations by both Liedtke (1974) and Wheelock (1973, as book 1977). Wheelock's work is important because it challenges recent assumptions concerning Vermeer's use of camera obscuras in his painting practice. Both Wheelock and Liedtke have drawn attention to the role of theoretical treatises by Vredeman de Vries, Hondius and Marolois. Liedtke (1975-1976, cf. 1983) noted discrepancies between Saenredam's perspectival sketches and his finished paintings. Ruurs (1980, 1982) has since analysed these discre-pancies with greater precision.

Outside the Delft scene, perspectival theory in the seventeenth century remains largely unexplored. To be sure there has been earlier work on Desargues, some study of the circle surrounding Abraham Bosse in the early days of the French Academy and some study of French anamorphic perspective (especially Baltrusaitis, 1955, 1977). But one can easily make a roughly chronological list of authors of perspectival treatises whose work has thus far received little or no attention: Levinus Hulsius, Johann Faulhaber, Salomon de Caus, Filippo Nunes, Pietro Accolti, Peter Halt, D. Polienus (also known as Fernando di Diano da Diano), Andreas Albrecht, Johann Jacob Fuellisch, Guilio Troili, Nicolas Battaz, Frans van Schooten, Bernhard Contino, Nicolaus Haartsoeker and Abraham de Graaf.

The seventeenth century brought more than a list of new authors. It also brought a change in centres. Throughout the 15th and 16th centuries Urbino had been the meeting place of theoreticians concerned with the mathematical principles of linear perspective: to Urbino came Piero della Francesca, Luca Pacioli, Frederico Commandino, John Dee and Guidobaldo del Monte. During the 1630's Paris had become the new European centre where mathematics and perspective were studied together. During this decade (1630-1640) while Descartes was laying the foundations of co-ordinate geometry, Pascal was exploring the perspectival properties of conic sections, and Desargues was formulating the principles of perspéctival vanishing points geometrically. In the same city there were also mathematicians such as Aléaume, Migon, Nicéron and Vaulezard working on both perspective and anamorphosis.

The mathematical solutions that resulted from these researches proved too complex for the average man. As Baltrusaitis (1955, 1977) has noted, Father Dubreuil, (who wrote under the pseudonym of „a certain Jesuit"), attempted to write a popular version of these principles. Desargues objected vehemently to how he did it, but, nonetheless the idea took hold.

Indeed, from the 1640's onwards three levels of discussion can be traced. One is highly mathematical and continues at a high level with thinkers such as Brook Taylor, Lambert and Poncelet. A second level is still technical but more accessible. This involves names such as those listed above. A third level is popular, is initiated by Jesuit encyclopaedists such as Kircher, Bettini, Schott and Milliet de Chales and then adopted by others such as Schwenter, Le Clerc and Ozanam. A future history will need to trace how these three levels interact and yet maintain a certain independence.

1700-1800

Pirenne (1970) has explored the relationship between Pozzo's seventeenth century practice and theory as expressed in his 1707 treatise. The perspectival views of Bibiena and Piranesi are fairly well known, although precise studies are few. For the most part, however, our knowledge of the 18th century perspectival theory remains minimal. General histories may mention the name Brook Taylor. But no one has yet studied the 30 editions and adaptations produced by Kirby, Highmore, Fournier, Malton, Cowley, Rivoire and Jacquier.

The same holds true for a long list of authors of eighteenth century perspectival treatises such as Bernard Lamy, Leonard Sturm, s'Gravesande, Jean Courtonne, J.J. Schübler, Paul Heinecke, John Peele, Abbé Deidier, J.A. von Segner, Georg Heinrich Werner, Caspar Philips Jacobszoon, Claude Lagardette, Johann Adam Breysig or John Wood. None of these authors has yet been studied in detail, although the majority of the names have at least been mentioned by experts.

1800-1900

There has been some recent work on the history of perspective in the 19th century. In this connection Wenzel (1979) has written on a transformation in French landscape painting from Valenciennes to Corot, 1787 to 1827. Marcussen (1977) has also studied Corot's perspectival interests and has subsequently (1980) given an outline of French treatises on perspective in the nineteenth century, a topic on which she is now preparing a more detailed bibliography. Her work deserves praise and encouragement.

There has been some study of how nineteenth century painters used alternatives to linear perspective, as, for instance, Adams' (1975) essay on Cézanne or Rewald's work on Van Gogh, recently adapted by Heelan (1983).

There has also been considerable polemic concerning the relationship between latter nineteenth century painting, impressionism in particular, and photography. One side, epitomized by Scharf (1974) claims that photography introduced new ways of seeing which inspired the so called innovations of the impressionists. Perucchi-Petri's (1976) study of Bonnard, Vuillard and Denis accepts that both Japanese art and photography were influences. On the other side of the spectrum W. Kemp (1978) claims that it was actually the painters who were the innovators; photographers at the time were more conservative than their colleagues with the brush. Varnedoe (1980) has since made this argument in more dramatic terms.

Kemp (1983) has also attempted to characterize differences in perspectival theory and practice before and after 1860. The question poses itself, however, whether we are yet in a position to appreciate the complexity of developments in the nineteenth century. The number of theoretical treatises increases dramatically. In the period 1800-1825 more than 100 treatises appear. Between 1825 and 1850 there are more than 200. From 1850 to 1875 there are more than 300. From 1875 to 1900 there are more than 400. In short, between 1800 and 1900 there appeared upwards of 1000 treatises. (By contrast in the period 1400-1500, one perspectival treatise was actually published). Most of these thou-sand treatises have not yet been studied, many of the authors may even be unfamiliar to some experts: Maurice Keatinge, Samuel Prout, Paul Laurent, George-Tom Richard, Guiseppe Castagnoli, Emile Lefranc, Howard Frank, Giambattista Berti, Jean Christian Jacques Kempees, Alexandre Boniface or Nathaniel Whittock to cite only examples from the period 1800 to 1850.

1900-1980

Ever since Novotny's (1938) book, it has become a commonplace to assume that linear perspective died with Cézanne and that its impact on twentieth century artists has therefore been absent. Recent work points to a more complex situation. Holländer (1973) notes links between the tradition of anamorphic perspective and the surrealists. Clair (1977-1978) documents very carefully how Duchamp's painting builds on seventeenth century exemplars by Nicéron and Dubreuil. Henderson (1983) documents how early twentieth century artists, responding to developments in both mathematics and science, were attempting to integrate a fourth dimension in space and not simply abandon space altogether.

As yet we have no clear picture of what was happening at the level of perspectival theory. In terms of textbooks published there was a decline. Between 1900 and 1925 there were only c. 300 published and between 1925 and 1950 there were but 200 new texts on perspective published, i.e. only half of that published in the heyday of Impressionism (1875-1900). Between 1950 and 1975 the amount has again risen to 350. In all, from 1900 to the present, upwards of 900 treatises on linear perspective have been published. Hence contrary to Novotny's claims perspective is alive and well and living in the twentieth century.

3. TECHNICAL PROBLEMS

Here only some technical problems of perspective will be considered in alphabetical order, namely, anamorphosis, computers, curvilinear perspective, gardens, intarsia, inverted perspective, quadratura, scenography and trompe l'oeil.

Anamorphosis

Baltrusaitis (1955) remains the standard work. It is now also available in English translation (1977), and serves as the basis for Leeman's more popular account (1975). Margolin (1977) has made stimulating comparisons between anamorphic images in art and allegorical images in literature. Battisti (1980) has reported on Masters' computer generated anamorphic images.

Computers

Carlbom (1978) explored the use of computers for technical problems in perspective. Ragghianti (1978) and Christiani Testi (1978) have outlined some uses of computers for analysing artistic perspective. Carletón (1982) has since shown how computers can simulate the perspectival lines of a painting such as Jan van Eyck's *Arnolfini Portrait*.

Curvilinear Perspective

Because the retina is curved a number of persons have assumed that curvilinear perspective must come closer to representing visual truth than does linear perspective. Thus curvilinear perspective has been praised by artists such as Hansen (1973), and prompted comment by Arnheim (1974). Maltese (1980) has explored historical aspects of the pro-blem. Fuentes Alonso (1975) has worked out a practical method and used this to explain earlier works of art. Reggini (e.g. 1974) has written a number of papers on computer generated versions.

On the other hand, Pirenne (1952, 1970) and Gombrich, among others, have claimed that linear perspective is an objective method of recording visual information.

Gardens

Hazlehurst's (1980) study of Le Nostre's use of perspective in landscape gardening is a welcome contribution. The use of perspective in this field deserves more study. In the eighteenth century the debate concerning the curvilinear nature of vision stemmed from claims that one needs to plant trees in curved rows if they are to appear parallel. (Varignon vs. Bouguer).

Intarsia

Ciati (1974-1975) has explored the cultural context and significance of the intarsia work done by the Lendinari brothers. Dalai-Emiliani has drafted long term plans for a census of all Italian intarsia.

Inverted perspective

Almgren (1971) has analysed the use of inverted perspective in children's drawings. Shegin (Ger-man edition, 1982) has claimed that inverted perspective, which is prevalent in non-western cultures, is much more than an intuitive method. He has argued that a deliberate theoretical method, based on optical principles is involved. Rauschenbach (1983) believes that both parallel and inverted perspective can be understood in terms of perceptual realities. In other words, inverted perspective corresponds to how we actually see objects, particularly those that are nearby.[5]

Photography

The best analysis to date of technical principles of perspective involved in photography occurs in two series of articles by Keeling (1973-1975). Also of interest in this context is Bartoll (1975). Gombrich (1983) has explored the consequences both scientific and

aesthetic of variable viewpoints in modern photography. He notes that although the camera is based on objective principles, its images are often subjective. Thus photography has made us familiar with various standards of truth.

Quadratura (Illusionistic ceilings)

Sjöström's standard work has now been translated into English (1978). Knall-Brskovsky (1984) has provided a good survey of Austrian examples.

Scenography

The collection of essays by Cevese (ed., 1974) on the architecture of theatres from Greek Antiquity to Palladio will remain a standard work for those concerned with connections between stage-scenery and perspective. Lang (1980) has argued for a connection between Vitruvian stage scenery and Brunelleschi's perspectival panels. Pochat (1980) has drawn attention to architectural drawings with scenographic motifs from Nothern Italy. A volume edited by Matteucci, Lenzi et al. (1980) sheds light on connections between architecture, scenography and landscape drawing in Northern Italy during the eighteenth century.

Trompe-l'Oeil

In extreme cases linear perspective creates illusionistic spatial effects which challenge our perception of objects in the natural world. Cf. Battersby (1974) and Baur-Heinhold (1975) concerning painted facades. Bordini (1974) provides an important study of illusionism in panoramas.

Pirenne (1970, 1975) has studied such illusions from a physiological and scientific standpoint. Gombrich and Gregory (1973) have edited a series of essays on illusion in nature and art, including a notable contribution by Hinton on optical camouflage and illusion in the world of insects and animals. In the same volume Gregory believes illusions can be used to explain the nature of the brain. Weale (1982) denies this and demonstrates that different kinds of illusion involve different parts of the visual process.

4. Methodological and metaphorical Applications

Perspective is being used as a practical conceptual tool in a wide variety of fields ranging from anthropology and linguistics, through music to semiotics and sociology. The use of perspective as a metaphor is increasing so rapidly that it is difficult to assess the dimensions of the phenomenon.

Some indication is obtained from an examination of periodicals with „perspective" in their title. The standard „Union List of Serials" (1965 edition, which includes all serials until 1950) contains 4 titles under perspective and 6 under perspectives. The „New Serial Titles 1950-1970" contains 40 titles under perspective and 50 under perspectives. For the period 1971-1975 the numbers are 10 and 25 and for the period 1976-1980 they are 13 and 20 respectively. In short since 1950 there are 63 new periodicals with the word perspective in their titles and 95 new periodicals with the term perspectives in their title. Another indication of how multivalent is the use of this metaphor is obtained through consultation of the *Science Citation Index* and the *Arts and Humanities Citation Index*.

A full analysis of all these developments is not yet possible. In the interest of clarity, discussion in this essay will be limited to trends in three fields, literature, philosophy and psychology. Each of these will be considered in turn.

Literature

A fine essay by Guillen (1971) remains one of the best explorations of connections between perspective in art and literature. A more abstract and speculative study of such connections is offered by Uspensky (1973).

There have also been detailed historical studies in literature. Pfister (1975) has examined perspectival structures in Elizabethan and Jacobean comedy. Gilman (1978) has examined perspectival and anamorphic allusions in both literature and art of the seventeeth century with particular reference to Shakespeare, Donne, Herbert, Greville and Marvell. Kurth-Voigt (1974) has studied the back-ground for and Wieland's use of perspectival metaphors. Sammern-Frankegg (1976) has analysed perspectival images in Storm's „Immensee". Such detailed studies of individual authors and particular works of literature are becoming the fashion. In addition there are other studies in which perspec-tive is used more loosely to mean a cultural view-print as, for instance, in Wong (1978) who compares American and Chinese perspectives on Roger Fry.

Philosophy

Kant's claims concerning space and time as a priori concepts implicitly made perspective a central concept for philosophy. Abels (1982) has outlined the impact of Kant's ideas on Hegel, Husserl and Merleau-Ponty. Marxist theories of perception, such as those of Holzkamp (1976), although presumably sociological and psychological, also draw more inspiration from this philosophical tradition than is usually acknowledged. Boehm (1969) or Damisch (1972) offer instances of recent philosophers' views on perspective.

Prinz (1977) in an historical study on the use of manniquins and models in perspective, has touched on important philosophical questions of how linear perspective relates to reality which deserve closer attention. Such questions have been broached from another standpoint by Puttfarken (1971) who discusses connections between scale and perspective, a problem which Chapeaurouge (1975) has considered briefly and which Blatt (1984), drawing on a framework provided by Stevens,[6] has attempted to integrate within his developmental model.

The philospher Goodman (1969) has argued that linear perspective is merely a convention, is not objective, and has no necessary connection with reality. Directly opposed to this claim is Gombrich (1972). In the last decade Goodman and Gombrich have become two poles of a vigorous debate concerning the ontological status of perspective. Included in this debate have been historians and philosophers of science as different as Wartofsky (1979) and Heelan (1983).

Psychology

Interest in linear perspective has been particularly marked in both developmental and perceptual psychology. Each of these will be considered in turn.

Developmental Psychology

Jean Piaget's study of the development of spatial concepts in children (1948) led him to suggest that the ability to recognize a given form from different viewpoints or perspectives marked an important stage in the emergence of personality. Others have coined this ability to look at a given object from different viewpoints as „perspective taking", which has, in the meantime become a new field closely related to role-taking (cf. Feffer)[7] and interpersonal communication systems (Williamson, 1975). A good account of key individuals in the develop-ment of perspective-taking is provided by Marsh (1977). Meanwhile, Alfred Schutz (1976) has identified this ability of taking the viewpoint of the other as a central phenomenon of sociology. Curiously enough, the psychologists and sociologists appear to have reached their views independ-ently, and many, even now, are not aware of parallel developments in a related field.
Perceptual Psychology

In no branch has interest in perspective been greater than among the perceptual psychologists who, in turn, belong to various factions. Hochberg (1963) outlined a historical tradition of two main schools of nativism and empiricism. Haber (1974) spoke also of two chief schools involving the empiricist and psychophysical point of view respectively. Hagen (1980) identifies no less than five chief schools: Constructivists, Gestaltists, Perspectivists, Invariant Information Theory and Generative Theory. The connections between these various schools are outlined in chart I.

These schools have focussed on a series of problems involving perspective: space in the inner world, illusions, grids, motion, drawings vs. real world; drawings in primitive cultures; drawings by sub-humans and non-humans; the nature of drawings. Each of these will be considered in turn.

Space in the Inner World

What is the nature of inner space and what hap-pens to this space when patients become mentally disturbed? Brutsche (1976), trained both in Hegelian philosophy and Jungian psychology, has attempted to answer these questions. Coffman (in Hagen, ed. 1980) also considers perception of the mentally disturbed. The use of language in communicating inner space has become a subject of study in psycholinguistics as outlined by Bösch (1981). A recent discussion of inner representation is found in Olson and Bialystock (1983).

Illusions

Ames' demonstrations involving rooms, chairs and trapezoidal windows seen from a fixed view-point implied that there are a near infinite combination of lines which could produce the information of a given perspectival situation. This seemed to prove that perspective is not an objective method, that one cannot rely strictly on sensory stimuli and must therefore emphasize memory, learning and personality. This helps explain studies on how

instructions affect perception, such as that of Predebon, Wenderoth and Curthoys (1974). Braden (1972) studied how rotation of an Ames' window affects perception.

Nearly five centuries ago Leonardo da Vinci devised his own solution for the problem of objective perspectival representation of complex objects: he insisted that such an object be drawn from four or six viewpoints (cf. figs. 1 and 2). As long as perspective is defined in terms of one static viewpoint of an object, it cannot always convey as much objective information as may be desired.

However, once it is accepted that perspective is a method permitting a systematic correlation of viewpoints, then its objectivity is fully restored. The hologram, an invention which relies on a systematic correlation of only two viewpoints, provides an implicit confirmation of this objectivity.

Grids

The empiricists recognized that when one produces systematic perspectival foreshortening in isolated outline shapes, they specify only different families of equivalent configurations."[8] When this same shape is used as the basis of a textual back-ground and one produces the same foreshortening, it „provides a continuous scale of the visual world."[9] This is one reason why perspectival grids and patterns have become such objects of study.

A second reason stems from Gibson's work. This began with a distinction between the visual field, which changes with every movement of the viewer and the visual world, which does not move. Gibson became convinced that in everyday perception, the visual world is more important than the visual field and hence he focussed attention on invariant information in the visual world. Perspective gradients and texture thereby gained new importance.

Motion

In his earlier work Gibson devoted more attention to the visual field which constantly changes as one moves. Motion perspective thus became an important factor in psychological studies. Haber (1973) provides an introduction to these problems. Braunstein (1976) brings together a wide range of research on depth perception through motion, and includes an appendix on computer animation.

A.   B.   C.

Fig. 1 When an observer at A 1 attempts to draw the man at C 1 on the picture plane at B 1, the information available to him remains ambiguous.
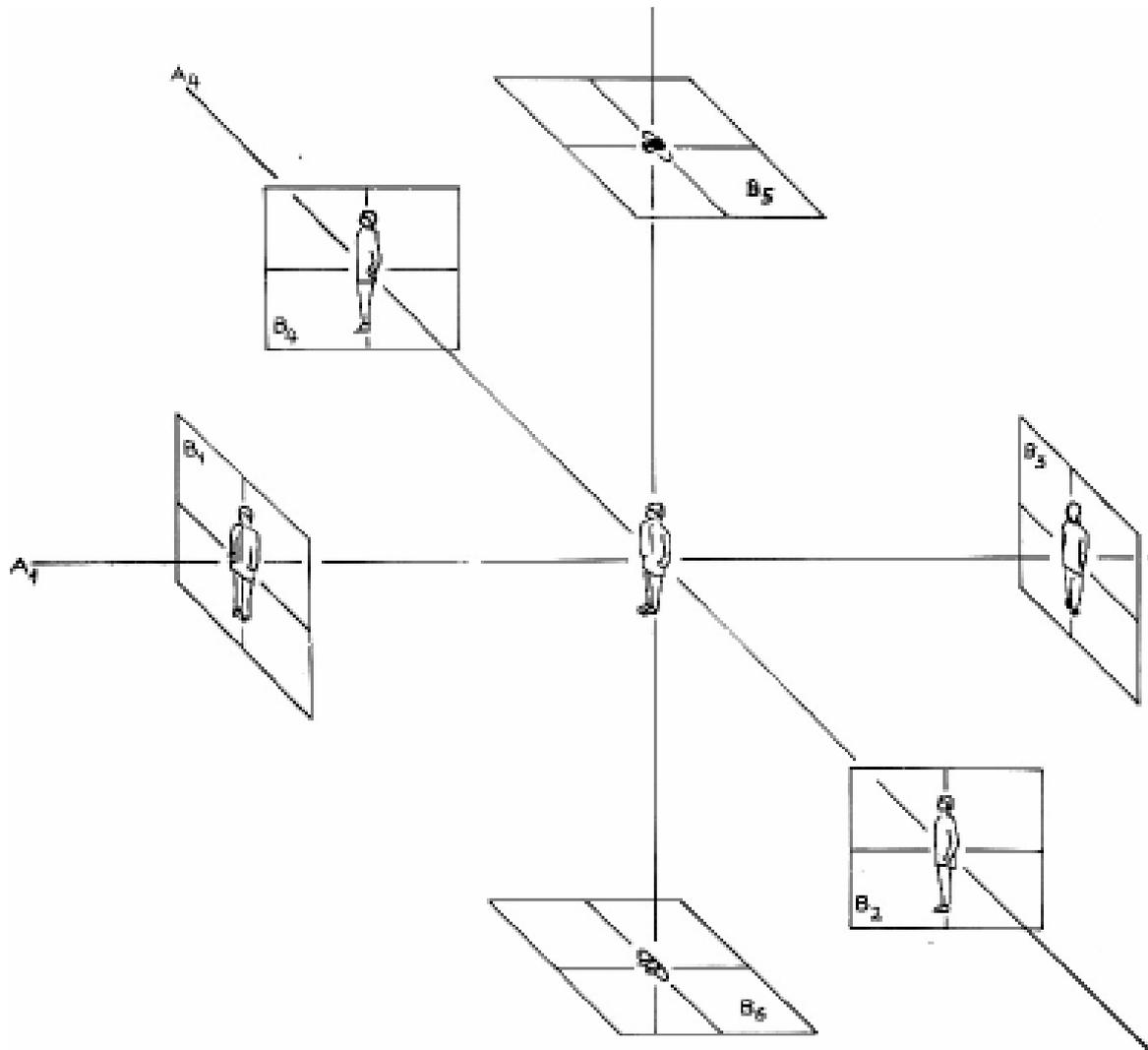

Fig. 2 When an observer, A 1 wishing to draw a man, C 1 accurately takes six viewpoints, as shown above, then potential ambiguities are removed and the objectivity of perspective is confirmed.

Pictures vs. Real World

Gibson's studies of motion perspective persuaded him that perception of the natural world is somehow different from the perception of pictures. He went on to claim that pictures have helped civilized man become aware of the visual field. Gombrich (1974 reprint 1982) took issue with him and a debate continues whether the way we perceive pictures, especially perspectival pictures, is different from the way we perceive perspectival features of the natural world.

Drawings in Primitive Cultures

Gibson assumed that both children and cultures need to learn how to recognize perspectival pictures. This, coupled with Piaget's developmental theories, led psychologists into the realm of cultural anthropologists, whose traditional assumptions Kennedy (1973) called into question. Jones and Hagen (1980) report on more recent research which challenges the assumptions and claims of anthropologists.

At the same time persons with long term experience in developing countries such as Fussell and Haaland (1976) have done important work independently. They took photographs of different subjects fairly common in Nepal and used these as a basis for pictures in six different styles: 1) ordinary photograph; 2) block out (i.e. a photograph without any background); 3) three tone drawing; 4) line drawing; 5) silhouette and 6) stylised drawing. They found that three-tone drawings, (i.e. in perspective) and block-out photographs were best recognized. Moynihan and Mukherjee (1981) report other field studies which corroborate these findings. Such evidence sweeps away earlier assumptions that primitive persons are unable to recognize perspectival space.

In this connection mention should also be made of recent developments in visual sociology, a new field concerned with a) the use of film and other media in sociology and anthropology and b) asses-sing the importance of visual information (pictures, diagrams, sketches) in both contemporary and historical terms. An International Journal of Visual Anthropology has been initiated by Professor Leonard Henny, Centre for International Media Research, Mijndenseedijk 74, 3631 NS Niuwersluis (Utrecht), Netherlands. Curry (1984) surveys these developments. It can be predicted that visual sociology will have a great influence on cultural anthropologists' discussions of perspective among primitives.
Sub-humans and non-humans

Parallel with studies of the making and perception of pictures among primitive people, there has been increasing research into these abilities in borderline human and non-human cases. Kennedy (in Hagen, ed., 1980) has explored such abilities in blind people."[10] In the same collection of essays Coffman studied pictorial perception in neurologically impaired humans, while Cabe surveyed research involving non-human subjects. Followers of Gibson and Arnheim alike are agreed that the ability to make representational pictures is a uniquely human privilege.

Nature of Drawings

Meanwhile the question `what is a picture?' has become more elusive than ever. Kennedy (1973) identified four major theories concerning pictures in terms of convention, similarity, station prints and information respectively. His teacher, Gibson formulated four theories of his own between t954 and 1971 (cf. Gibson 1979, p. 270) all of which he subsequently abandoned. In his last published sta-tement (in Hagen, ed., 1980, pp. xü-xvü) Gibson identified seven ways in which „properties of sur-faces and the properties of the forms and figures produced on a surface are different" and he also noted ten different meanings of the term image.

Margaret Hagen's important two volume collection of essays, which brings together research from anthropology, art, history, education, information, life science, neurological toxicology, neuro-psychology, philosophy and different schools of psychology is one

measure of the impact of Gibson's theories. The volume edited by Fisher (1980) with contributions by Tormey and Wartofsky is a second. The vehement response of major figures such as Gombrich and Arnheim is another.

In an important thesis Lombaerde (1982) discusses the impact of theories of vision and representation on town planning from fifteenth century to the present. His comparison and contrast of perspectival and semiological approaches implicitly raises problems about the nature of drawing. Meanwhile, there have been attempts to identify the nature of visual language as a whole. Irvine (1981) devotes some attention to space and perspective in this connection. By contrast, in Saint Martin's (1985) introduction to a semiology of visual language, perspective emerges as a crucial factor. She identifies three basic types of perspective, each with a number of subheadings: 1. proxemic (optical, parallel, arabesque, focal reversible, unistic, tachiste, chessboard); 2. intermediary or mixed perspective (spheric, axial, frontal, analytic and synthetical perspective of Cubism, folding back, "cavaliere", projective, angular, isometric and 3. far distance perspectives (linear or central, atmospheric, inverted, oblique, bird's eye staggering, height). One can predict that there will be basic disagreements about this particular classification of branches of perspective. Important, however, remains the emphasis on perspective in these methodological discussions concerning the nature of art.

5. Conclusions

In the nineteenth century perspective was primarily of interest to historians of science (notably Poudra, Cremona) who saw therein a forerunner of descriptive geometry. This culminated in Gino Loria's standard history. Meanwhile, for art historians such as Doehlemann (1906) perspective appeared to hold a key to debates concerning chronology. Panofsky was stimulated by such ideas, but focussed attention on links between philosophical systems, theories of vision and methods of representation. He himself never analysed the perspectival construction of a single painting. His fellow art historians remained even more wary of perspective, the assumption being that if art be a question of genius and inspiration, it cannot have to do with technical laws.

Ironically it was a practicing artist who re-awakened an interest in reconstruction of perspectival space. In an article with his friend R. Wittkower, B.A.R. Carter (1953) analysed the perspective of Piero della Francesca's *Flagellation*. This study remains a model for reconstructions. In Milan, Dalai and her students have applied this method to a number of important paintings. Meanwhile, Degl'Innocenti (1977-1978) proposed a method which gives an idealized reconstruction of the space in a painting. While the results are optically pleasing, they are misleading because they hide the historical realities of the works themselves. Most of us need reminding that even a mathematician such as Dürer only produced two engravings accurately in perspective. (cf. Schuritz, 1919).

Looking back on the past two decades, however, it is the impact of psychologists on the study of perspective that is most striking. Art historians may not agree with their sometimes facile notions of the development of perspective in art. Nor, for that matter, would modern theorists of evolution, who are developing a new field called cladistics (cf. Renfrew, ed. 1979).

Nonetheless, the psychologists have challenged us all to think anew about spatial perception. If the laws of linear perspective apply to both the natural world and painting do we perceive both differently or do we not?

In the late nineteenth century perspective still appeared of incidental interest in explaining a branch of mathematics or a school of paintings. In the latter twentieth century perspective is emerging as a central problem of perception, as a basic factor in the debate how we perceive pictures, indeed how we define pictures. And if pictures are uniquely human, perspective promises new insight into our human uniqueness.

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Notes

[1] Those interested in treatises prior to 1601 are referred to Schüling's careful bibliography (1972) which includes major locations. Descargues' (1976) illustrated work gives a good introduction to the scope and variety of treatises from the 16th through the nineteenth centuries. Vagnetti's (1979) bibliography lists many treatises, including at least 30 published since 1970.

[2] Erwin Panofsky, *Perspective as Symbolic Form*. Unauthorised, undated, anonymous translation ... 1979. 18 p. (said to be by a student at Columbia University). Without footnotes. There is a copy in the Warburg Institute (CAO 355). Before he died Panofsky was in touch with Dalai-Emiliani concerning an official English edition. This has not yet appeared.

[3] See, for instance, E.H. Gombrich, *Kunst und Fortschritt*, Köln: Dumont Verlag, 1978.

[4] Jean Gebser, *Ursprung und Gegenwart 1. Teil, Die Fundamente der aperspektivischen Welt* (geschrieben: Winter 1947/48 und 1951/52, ergänzt 1964/65), München: Deutscher Taschenbuch Verlag, 1973.

[5] B.A.R. Carter, personal communication, has expressed similar views.

[6] S.S. Stevens, Mathematics, "Measurement and Psychophysics," in S. Stevens, ed. *Handbook of Experimental Psychology*, New York: Wiley, 1951, pp. 1-49.

[7] E.G. M. Feffer, "The Cognitive Implications of Role-Taking Behavior," *Journal of Personality,* 27, 1959, pp. 152-168.

[8] See Haber, 1973, p. 299.

[9] Ibid, p. 300.

[10] I assume this is also dealt with in a title which recently came to my attention through the Washington Library Network but which I have not yet been able to obtain: See: First Museum of Blind ... 1976 ... in bibliography.