SOME INFLUENCES OF SCIENCE AND TECHNOLOGY UPON DUTCH PAINTING FROM ABOUT 1580 TO 1650

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For more than a century before Hugo Grotius' birth (1583) profound metamorphoses in Western man's views of the universe had been under-way. A gradual, sometimes hard-won transition from the medieval to what would become a proto-modern view of the universe's reality must have formed a forceful part of the young Grotius' schooling. These changes had both macro- and microcosmic implications for the art of the distinguished jurist's day. Science waas in the ascendancy, and the former intuitive pantheistic thinking came to be replaced by the much more intellectual and exacting studies of astronomy, mathematics and anthropology.[1]

Among the transitions to which I refer, man's expectations for the position of this planet in the universe had its effects upon his senses of time and distance. Toward the latter part of the sixteenth century the Dane Tycho Brahe, in his **De mundi aetherii recentioribus phaenomenis** (1588) answered Copernicus' view of the centrality of the sun to the universe with a construct that made the earth the unmoving center with all other planets revolving about the sun.[2] In 1609, five years after Hugo Grotius' **De jure praedae** was written, Johannes Kepler's **Astronomia nova** returned to the Copernican view that the planets traveled around the sun.[3] Implicit in Kepler's discussion of the workings of the universe was the issue of the shape of that universe, for he added to Copernicus' view the recognition that the pathways of the planets were ellipsoidal.

Kepler also looked deeply into problems in the new science of optics, approaching it in geometric terms and in terms that had to do with the potency of light itself.[4] For Kepler color was a function of light.

In the art of Grotius' age all of this intellectual ferment seems to have found its reflection. Specifically I refer 1) to a view of the universe that had effects upon cartography and landscape painting; 2) to the new science of optics that, in

painting, led not only to concerns for color but also to subtle formal changes; and 3) to a concern with time that was implicit within the geographical considerations of distance. Despite these concerted explorations into science, the biases of man of the Renaissance continued predominant at least into the first part of the seventeenth century, during which man's life became a measure of time that linked the world of physical reality with that of the hereafter.

Not far from the border of the Netherlands, in Westphalia, the painter Herman Tom Ring provides us in 1555 with a mechanistic view of the Copernican universe in his **Last Judgement**, now in Utrecht's Centraal Museum: it became a useful device with which to shape space. Later in the century space itself became a topic of both interest and speculation with Giordano Bruno's **De l'infinito, universo e mondi** (1584).[5] Bruno's neo-Platonic proposition of an infinite universe in which each celestial body had its own soul seems to have been one of the bases for the organizations of space that appear in Jacopo Tintoretto's Paradise (Venice, Ducal Palace) of 1587 and more so in El Greco's **View and Plan of Toledo** (Toledo, El Greco Museum) of ca. 1610-14.[6] El Greco's work, with a figure to the right foreground holding an unfurled map of Toledo, goes far beyond Tintoretto's to suggest an infinite progression beyond the earthly horizon's curvature. Yet the Copernican universal structure remains, with perhaps continuing support from Dante, especially in the Tintoretto. In the El Greco work this has been almost overdone, not only by the broad curvature of the planet but also by a softened cloud-filled atmosphere admitting of the possibility of the infinite. Indeed a blue opening in the sky on the central axis of the painting addresses a never-ending space beyond the earthly.

A softened cloud-filled sky, opened not to blue but to a brilliant yellow, occurs above the scene of **Christ's Baptism** painted in 1602 by J. A. Wtewael (Ottawa, National Gallery of Canada).[7] The sense of the infinite may be perceived differently in Barent Fabritius' **Rebecca Welcomed by Abraham** (Chicago, Art Institute) of the late 1640's.[8] Attention is called to the sky by a spotlighting effect upon which the scene occurs, and which presents the same potency of light in the same colour that predominates above in the sky, while the scene itself seems to recede almost infinitely beyond the two broad arcs of the hills that border the sky.

By the latter decades of Hugo Grotius' life (he died in 1645), the earthly shackles of space were virtually totally dissolved in the never-ending continuity postulated first by Giordano Bruno. Of the almost countless examples reflecting this in Dutch painting of the time, I call attention to Aert van der Neer's **Winter Scene with Figures Playing Golf,** Jan Lievens' **Panoramic Landscape** of ca. 1640, and Jan van Goyen's **River Landscape with a View of Overschie** of 1642 (all in Pasadena, Norton Simon Museum).[9] Indeed the landscape with infinitely receding space had not only been taken up by Dutch painters but had become a major contribution of Grotius' century to the history of art by the time of the eminent jurist's passing.

While the inquiries of Kepler into the potency of light helped to establish the new science of optics, late in the sixteenth century and during the first years of the seventeenth in Italy light's force was employed in a new way by Caravaggio and his followers.[10] Intense contrasts of light and dark, with light emerging from the darks to soften the latter's borders, seem to have characterized natural effects, while certain sharp shafts of light and consequently sharper accompanying shadows often represented a more spiritual, ineluctable existence. This mode of expression was quickly seized upon early in the seventeenth century by such Dutch painters as Hendrik Terbrugghen in his 1621 **The Calling of St. Matthew** (Utrecht, Centraal Museum),[11] though the **spiritual aspect of light was underemphasized. Often the flame of a candle became the centerpiece of a painting representing a scene at night as in Terbrugghen's** Esau selling his Birthright (South Carolina, Bob Jones University), among others by him; and as in Gerrit van Honthorst's (1590-1656) work, **Christ Before the High Priest** (London, National Gallery, ca. 1617); and in Matthias Stomer's painting, **The Mocking of Christ** (Norton Simon Museum, ca. 1633-9), to cite only a few examples.[12] It was the genius of one of the greatest artists of the western world that transformed the presentation of light in painting into a variety of expressions, many of which seem to have been highly innovative. I refer to Rembrandt van Rijn.

Much of Rembrandt's early work displays the features of our discussion of light immediately above.[13] For instance, in his **The Head Operation** of ca. 1624-1625 (Hoevelaken, N.J. van Alst) from the very dark surroundings of a book-lined interior, light picks out for us two men removing lice from the hair of a third.

Light is so potent here as to be almost tangible, while the darkness seems a thin, almost impenetrable veil reaching from the light into the corners of the picture. In his famous and shocking **Anatomy Lesson of Dr. Tulp** of 1632 (The Hague, Mauritshuis) the same sort of treatment forces us to look at the faces of each of the participants, at the corpse, and at an instruction book that is placed prominently albeit to the lower right. Indeed, the dynamic success of the composition as a whole is predicated upon the use of light to describe its major thrusts. Much the same seems the case for his early portraits, such as of the **Preacher** and of **Mrs. Johannes Elison** of 1634 (Boston, Museum of Fine Arts), although in these particular works he achieves delicate balances between dark forms and lighter spaces.

Yet among his early paintings there are indications of other, newer uses of light. In **The Artist's Studio** of 1628 (Boston, Museum of Fine Arts) we find the painter deep in the studio's space, partly darkened, partly illuminated by an intense light that appears to emanate from the painting upon the easel in the right foreground.[14] Upon the wall and near the artist, two palettes hang concentrically just beyond the beginnings of shadow but in the light. Aside from the artist's white collar and the white sleeve above his right wrist, his right hand that holds palette and brush are accentuatedly light. Light versus dark work together with the formal composition to announce the real theme of this painting. Despite the darkness of its back the easel is thrust into great prominence near the center of the foreground but just off to the right. The two palettes upon the wall and the artist's creative hand are all qualified by the presence of the creative light of and from the picture itself. The thousand-year-old equation of light as a manifestation of Christ is apparently replaced here by light as a manifestation of painting, of art. Rembrandt, then, is interested in the manner in which light alone may qualify a physical object: in this case the painting upon the easel is qualified not directly but instead by indirection. In the artist's mature works this too changes.

Fourteen years after this work, Rembrandt completed his Company of Captain Francis Banning Cocq, **the so-called** Night Watch (Amsterdam, Rijksmuseum), in which his attention to light-- and its omnipresent qualifier, dark -- was greater than his efforts to present individual portraits.[15] Light and dark work to animate the space of the scene, providing us with various riddles.

For example, first and foremost, why can we not identify all of the members of Cocq's company as in other group portraits of the time? What is within the gaping blackness described by the great arch in the left background? Why does light suffuse and in part escape from the seated female figure left of center in the middleground? Neither space nor the context of this paper permit us to pose answers, except to say here that Rembrandt's reasons were based upon his artistry rather than upon any other realities. When we look at the straightforward presentations of similar groups in the work of such artists as Frans Hals, for example, in his **Banquet of the Officers of the St. Hadrian Militia Company** of 1627 (Haarlem, Frans Hals Museum),[16] we see clearly how differently Rembrandt used lighting in his **Night Watch.**

Among Rembrandt's many self-portraits from the 1640s to the end of his life (1669) are several that demonstrate his development of the concept first seen in the **Artist in His Studio** --that light emanates from the painting itself. Technically, by the use of glazes combined with a selective employment of somewhat heavy impastoes, it is the reflection of light returning to us, qualified by various degrees of transparency built into the painting, that enables us to perceive in fact light and color as "emanating" from the painting. Rembrandt used this in a profound and magnificent manner to make his subjects seem invested with intensely spiritual qualities.

Frans Hals, instead of seeking towards the infinite or the spiritual, sought the momentary effects of color and light. His **Merry Drinker** of 1628-1630 (Amsterdam, Rijksmuseum) and his **Malle Babbe** of 1629-30 (Berlin-Dahlem, Staatliche Museen Preussischer Kulturbesitz), each with much of the brushwork clearly visible **per se**, speak of the startling possibilities of movement, figures caught in a flash of action.[17] The same may be said of such works as Judith Leyster's **Jolly Drinker** of 1629 (Amsterdam, Rijksmuseum).[18] In all, the motive that seems a constant in these and many other similarly "momentary" visions is that of the transitory aspect of human life -- or, as William Shakespeare wrote, "all the world's a stage and all the men and women merely players..."[19] In the art of the Low Countries during Grotius' days, we have moved from the macrocosm of an infinite universe to the relative microcosm of man in his momentary existence.

Indeed, a great deal of the Dutch seventeenth century

predilection for genre painting may likewise be understood as reflecting man's human qualities during his brief stay on this earth. I refer here for instance to many of the typical works of Adrian van Ostade (1610-84), Gabriel Metsu (1629-1667) and Jan Steen (1626-1679), with their often robust, even low-life coarseness.[20] Coequal with genre in popularity and often in meaning was still-life painting.[21] Though frequently looked upon by twentieth century commentators as merely decorative displays of a rich seventeenth century middle class in Holland -- and surely this attractive materiality was one aspect of their appeal then and now -- the message of **Vanitas** was carried by such items as the clock, or merely the key that was used to wind it, a skull, half drunk goblets of wine, partially consumed foods of at times lavish partakings.[22] Recently Svetlana Alpers has dealt with some specifics of Dutch seventeenth century genre and still life painting, exploring **in extenso** aspects of their ranges of expression.

The science of optics waas also addressed to minutiae that approached the microscopic in this century of van Leeuwenhoek.[24] E. de Jongh made a rather full case for the meanings of pearls, **for example, some few years ago in "Pearls of virtue and pearls of vice,"[25] while taking great care to avoid speculation. De Jongh mentions that in Vermeer's** Young Lady with a Pearl Necklace of ca. 1660-62 (Berlin-Dahlem, Staatliche Museen), the meaning attached to the pearl necklace that the woman is about to fasten around her neck "... is difficult to discover precisely...since there are no other motifs which could be taken in conjunction with [it]..."[26] The same may be said of the pearl earrings worn by Vermeer's **Young Woman with a Flute** (Washington D. C., National Gallery), accomplished a few years after Hugo Grotius' death, and his **Woman with Pearl** of about 1665 (The Hague, Mauritshuis).

On the other hand, de Jongh makes it clear that in Vermeer's **Allegory of Faith** (New York, Metropolitan Museum of Art), the pearls pertain to faith. Faith and science appear to be virtually one in Vermeer's art. Vermeer's observations of the world around him were enhanced, he must have thought, by his use of the **camera obscura.** [27] Kepler had used this instrument for solar observations,[28] and, after various other writers had discussed it, by 1658 its usefulness for artists was taken up in a work entitled **Graphice, or the Most Excellent Art of Painting** published in English.[29] Imperfections in the lens of this instrument are

apparently recorded by Vermeer in his **Woman with the Feathered Hat** which dates from the early 1660s (Washington, National Gallery),[30] where some few otherwise inexplicable, pearl-like specks appear upon the woman's face and clothing. Scientific instrumentation becomes in this work a factor of unusual and probably unexpected consequences for Vermeer's art: it helps him to see and depict light beams that could have recalled the shapes of pearls which were symbolic of his faith.

The painters of Hugo Grotius' time synthesized science and technology with art so strongly that, after the interlude of Romanticism that concluded toward the middle of the nineteenth century, this synthesis became central to the arts of the modern age in Western Europe and in the New World.[31]

NOTES

1. See for instance Otto Benesch, **The Art of the Renaissance in Northern Europe. Its Relation to Contemporary Spiritual and Intellectual Movements**, revised ed., 1965, London: Phaidon Publishers Inc., 143ff. A balanced unification of the macrocosmic, the universal (whether spiritual or physical) with the microcosmic, the most detailedly represented physical realities, was typical for instance of Northern European achievements for more than a century, since the Ghent Altarpiece (1432) by Jan and Hubert van Eyck. For the microcosm, usually identified with man and his ambience, as mirroring the macrocosm, recognized as the infinite and God, see W. Windelband, "Makrocosmos und Mikrokosmos", **Lehrbuch der Geschichte der Philosophie**, Tübingen, 1916, Ch. IV.

2. Tycho Brahe, **De mundi aetherii recentioribus phaenomenis** in **Tychonis Brahe Dani Opera Omnia** 1913-29, edidit I.L.E. Dreyer, 15 v., Swets & Zeitlinger 1972, collected works, vol. IV, pp.5-378.

3. **Johannes Kepler**, Astronomia nova **(1609) in** Gesammelte Werke, ed. Walther van Dyck and Max Casper, 18 vols., C. H. Beck'sche Verlagsbuchhandlung, 1937 ff., Vol. III.

4. J. Kepler, **Ad Vitellonien paralipomena, quibus astronomiae pars optica traditur** (1604) in **ibid.**, Vol. II, for instance, pp. 150ff. See also, more generally, Alistar C. Crombie, "The Mechanistic Hypothesis and the Scientific Study of Vision: Some Optical Ideas as a Background to the Invention of the Microscope", **Historical Aspects of Microscopy**, ed. S. Bradbury and G.L.E. Turner, Cambridge: W. Heffer and Sons Ltd., 1967, pp. 3-112.

5. **De la causa, principio et uno, De l'infinito universo e mondi**, ed. Giovanni Aquilecchia, Torino: G. Einaudi, 1973, 214 pp., annotated and bibliography. Concerning the cause,

principle and one, see Sidney Greenberg, The infinite in Giordano Bruno, New York, 1950, pp.77-173.

6. See Hans Tietze, Tintoretto: The paintings and drawings, London: Phaidon Press, 1948; and Eric Newton, Tintoretto, London: Longmans Green & Co., 1952, Chap. 14, pp.197-206 and ills. 64, 65, 66. Also see José Gudiol, El Greco, London: Secker & Warburg, 1973, pp. 271-72, figs. 252, 253, 254.

7. Formerly attributed to Abraham Bloemaert, this painting is now generally attributed to Joachim Antonisz Wtewael (also spelled Uytewael), Catalog of Paintings & Sculpture, ed. R. H. Hubbard, University of Toronto Press, 1957, Vol. I, p. 93, no. 3340.

8. J. Richard Judson et al. Rembrandt after three hundred years: An exhibition of Rembrandt and his followers, Art Institute of Chicago, 1969, ill. 53, p. 140.

9. Selected Paintings at the Norton Simon Museum, intro. by Frank Herrmann, London: Scala/Philip Wilson Publisher Ltd., 1980. For van der Neer, ill. p. 60; for Lievens, ill. p. 62; for van Goyen, ill. p. 65.

10. See R. E. Spear, exhib. cat., Caravaggio and his Followers, Cleveland Museum of Art, 1971; and Arthur von Schneider, Caravaggio und die Niederländer, Amsterdam: B. M. Israel, 1967.

11. See von Schneider, ill. 11a.

12. For Terbrugghen see Benedict Nicolson, Hendrick Terbrugghen, London: L. Humphries, 1958, ill. 81b. For van Honthorst see Gods Saints and Heroes: Dutch Painting in the Age of Rembrandt, exhib. Cat., National Gallery of Art, Washington, D. C., 1980-81, fig. 3, p. 103. For Stomer see von Schneider, ill. p. 48.

13. A. Bredius, revised by H. Gerson, Rembrandt, the complete edition of the paintings, London: Phaidon, 1969. For The Head Operation see ill. 421A and O. Benesch, Art Quarterly 3, 1940, p. 10; for the Anatomy Lesson of Doctor Nicolaes Tulp see ills. 317 and 318; for The Preacher Johannes Elison see ill. 163; for Maria Bockenolle, wife of Johannes Elison see ill. 272.

14. J. R. Judson, Rembrandt after three hundred years, entry 2, p. 33.

15. See for example K. Bauch, Die Nachtwache, Reclam, 2nd ed., 1963 for a general discussion of the work.

16. Seymour Slive, **Frans Hals,** 3 vols., London: Phaidon, 1974, Vol. 2, plates 78-80, text p. 45 and Frans Hals Museum Cat. no. 125, pls. 41, 52.

17. Slive, **Frans Hals, Merry Drinker,** Vol. 2, pl. 105-107, text pp. 110-111 and Rijksmuseum Cat. 1976 no. A 135; **Malle Babbe,** Slive #75 Vol. 3, pl. 120-22, text pp. 15, 145-52 and Berlin Staatliche Museen Cat. 1978, no. 801C.

18. Rijksmuseum Cat. 1976, no. A1685.

19. **As You Like It,** II, vii, 139.

20. Peter C. Sutton **et al., Masters of the 17th Century Dutch Genre Painting,** The Philadelphia Museum of Art, Exhib. Cat., 1984, **passim.**

21. See for instance, Laurens Johannes Bol, **Holländische Maler des 17. Jahrhunderts nähe den grossen Meistern. Landschaften und Stilleben,** Braunschweig: Klinkhardt and Bierman (1969); and Ingmar Bergström, **Dutch Still-Life Painting in the Seventeenth Century,** London: Faber & Faber Ltd., 1956, for general discussions.

22. See **A Modest Message as intimated by the painters of the 'Monochrome Banketje',** by N.R.A. Vroom, originally issued in 1945, translated and reissued, Schiedem: Interbook International B.V., 1980. Vroom quotes J. Huizinga on page 15, for example, as saying that every flower, every object is an emblem, but he himself believes the majority are probably not. See also Naomi Popper-Voskuil, "Self portraiture and vanitas still-life painting in seventeenth century Holland in reference to David Bailly's vanitas oeuvre", **Pantheon** 31: 58-74, January, 1973; L. Bergström, "Vanité et Moralité--musée de Leyde, exposition aux 'memento mori' du XVII^{e} **siècle",** Oeil **190:12-17, October, 1970; and B. A. Heezen-Stoll, "Een vanitasstilleven van Jacques de Gheyn II uit 1621, afspiegeling van neostoïsche denkbeelden",** Oud Holland 93 no. 4: 217-50, 1979.

23. Svetlana Alpers, **The Art of Describing. Dutch Art in the Seventeeth Century,** University of Chicago Press, 1983.

24. Clifford Dobell, **Measuring the Invisible World,** London and New York: Abelard Schuman, 1959, **passim.** Also, **Alle de Brieven van Antoni van Leeuwenhoek,** 10 vols., Swets & Zeitlinger, 1939-79.

25. In **Simiolus** 8/2, 1976-77, pp. 69ff.

26. **Simiolus** 8/2, p. 84; and Berlin Staatliche Museen, Cat. no. 912B.

27. For further discussions and bibliography see especially **Arthur K. Wheelock, Jr.,** Perspective, Optics and Delft Artists around 1650, **1973 Ph.D. dissertation at Harvard, published New York: Garland Publishing Co., 1977,** passim, and for Vermeer pp. 261-321. Also see Hyatt Mayor, "The Photographic Eye", **Bulletin of the Metropolitan Museum of New York,** n.s.5 (1946), pp. 15-26; **Bulletin of the Metropolitan Museum of New York,** Summer 1973, "Vermeer" (most of the issue), by John Walsh, Jr., and technical comments by Hubert von Sonnenburg; for the camera obscura and Vermeer see fig. 35 and discussion pp. 198 and 199. Also Charles Seymour Jr., **Art Bulletin** 46 (1964) pp. 323-331; Heinrich Schwartz, **Pantheon** 24 (1966), pp. 170-82; and Daniel A. Fink, **Art Bulletin** 53 (1971), pp. 493-505.

28. Kepler, **Ad Vitellonien paralipomena** (cf. note 4 above).

29. **Graphice. The Use of the Pen and Pensil: or the most excellent art of painting,** in 2 parts, by W. Sanderson, 1658.

30. **Metropolitan Museum of New York,** Summer, 1973, fig. 37.

31. Where in the seventeenth and nineteenth centuries artists' concerns were often centered upon the use of light as an optical phenomenon in their works, today's avant-garde is concenred with the use of lasers, for instance, to create seemingly tangible three-dimensional images in space, images called holographs.