Other interests were luring Tycho Brahe from his true love, astronomy, when on November 11, 1572, he noticed a bright new star in the constellation, Cassiopeia. Tycho demonstrated that this fading supernova lay beyond the sphere of the moon, and thus that changes could take place in the heavenly realm official dogma had reserved for the immutable stars.

The supernova changed Tycho's life and the course of Western thought as well. Rededicated to astronomy, Tycho spent the next twenty years building his observatory, Uraniborg, designing the most precise astronomical instruments of the time, and compiling the most accurate and detailed records of heavenly positions and motions to that point. On his deathbed, Tycho bequeathed these astronomical observations to Johannes Kepler with instructions to find the sense of order hidden in them. They were the raw data Kepler needed to formulate his laws of planetary motion.

Before Tycho's data could be used to obtain the laws of planetary motion, errors caused by the refraction of light in the atmosphere had to be eliminated. Kepler had the genius to treat this nuisance as one aspect of the more general problem of light transmission, and in a modestly titled treatise, the Supplement to Witelo (1604), laid the foundations of modern geometric optics. Here he obtained an approximation to the law of refraction, and provided the first satisfactory explanations of the optics of the eye, the camera obscura, and spectacles. Seven years later, in 1611, when asked to comment on Galileo's astronomical discoveries, Kepler expanded on his findings to explain the optics of telescopes and microscopes.

Tycho, Kepler and Galileo worked in a world increasingly devoted to obtaining the measure of all things. World maps appeared within a few years of the discovery of America, and cartographers such as Gerardus Mercator transformed them into pieces of art with sufficient accuracy to facilitate both commerce and further explorations. The scientific revolution followed on the heels of the period of exploration and mapping, and was accompanied by a profusion of new scientific instruments, which began to appear around the year 1600.

So, light and motion were scientifically betrothed in the presence of a newly mapped world and charted sky. The great scientists of the seventeenth century - Kepler, Galileo, Descartes, Newton, and Huyghens - found that most of their important work revolved around the two issues of light and motion, and hinged on accurate measurements.

Artists were strongly affected by the triumphant discoveries of seventeenth century scientists and explorers. Paintings require effective means for representing light and motion, and, like maps, are two-dimensional transcriptions of three-dimensional scenes. The attentions of seventeenth century artists were redrawn to solving these problems anew. Their solution represented a new synthesis.

The Enlightened Dutch Overview

New artistic approaches to the representation of space, light and motion arose all over Europe in the seventeenth century, but it was in Holland, where the sky, an eternal symbol of human aspirations, rose to its greatest heights. How appropriate that the preeminent landscape invention of the century - the panoramic view under a spacious sky filled with noble clouds - was a home brew concocted in the open and newly freed fields of cosmopolitan Holland!
Holland's costly revolt against Spain dragged on from the sixteenth century and continued with breaks until 1648. But after the defeat of the Spanish Armada in 1588, the seafaring Dutch began to prosper, while Spain's economy declined. By 1609, the threat of bankruptcy finally forced Spain to sue for a temporary cessation of hostilities.

The truce, which was essentially a public acknowledgement of Dutch sovereignty, ushered in a new age of prosperity and optimism. No longer was it necessary for the Dutch to conduct their affairs surreptitiously confined to the tidal inlets and forests, or under cover of darkness. Now they were free to roam the high seas, reclaim and survey their own land, and paint their open skies in broad daylight.

As the Dutch ventured abroad their sea pilots began to map the world and its weather. They pieced together a good picture of the prevailing winds over the oceans and used that knowledge to commercial advantage. In 1611, Captain Hendrik Brouwer cut six months from the old slow route to the East Indies that hugged the east coast of Africa. After rounding the Cape of Good Hope, he used the prevailing westerlies to sail due east for 4000 miles before turning north to reach the Spice Islands.

The Dutch also gained some early glimmerings into the nature of storms. They learned that hurricanes are large moving whirlwinds, as Varenius indicted in his classic General Geography (1650). They also knew the sky and weather conditions that attended and preceded extratropical cyclones (lows), although no one in the seventeenth century, except perhaps a few secretive sea pilots, had even the vaguest idea of their structure or indeed, of their very existence. Lows remained unknown because of their large size, complex structure, and rapid motion and evolution.

The long task of discovering lows and deciphering their structure began in the seventeenth century when the necessary meteorological instruments were invented and calibrated. But a coordinated effort to collect and map simultaneous weather measurements at a number of locations was also needed and this proved to be a more difficult task. Descartes broke ground on this front also. He realized the need for taking simultaneous measurements and proposed doing so on December 13, 1647, in a letter sent to his friend, Mersenne along with a calibrated barometer. In 1657, Ferdinand II of Tuscany actually established a weather observation network in Italy that operated for ten years. Nevertheless, no maps were constructed and no coherent picture of extratropical cyclones resulted from these efforts, which then lay dormant for another two centuries.

Only in the nineteenth century did the picture of lows begin to emerge. Heinrich Wilhelm Brandes was apparently the first to construct weather maps to determine the geography and movement of storms. In 1820, Brandes published a few weeks of daily weather maps for the year, 1783! This work attracted so little attention that the idea of constructing weather maps had to be rediscovered once again in the United States around 1840.

Weather maps finally came of age in the late 1840's, when the telegraph made it possible to construct maps using current data from Portland, Maine to New Orleans and from New York to St. Louis. Almost immediately, Benjamin Franklin's century-old proposal that storms move from west to east was confirmed by telegraph operators who noticed the eastward progress of weather-related transmission problems. Soon thereafter, several nations established weather services that produced daily weather maps and began the slow task of unravelling the structure and behavior of storms.

Nineteenth century meteorologists assembled many of the pieces of the cyclone puzzle. They began to apply the laws of physics to explain air motions and precipitation processes. They deciphered the ground-level
wind patterns and even obtained some idea of the winds aloft by combining physical principles with careful observations of the motions of higher clouds. They identified the typical patterns of weather and cloud types in relation to the cyclone. They pointed out the existence of lines of discontinuity which we now identify as cold fronts and even began to incorporate these lines or fronts into their cyclone models.

The culmination of these efforts came in the twentieth century with the conquest of the air and of space. In 1919, 21 year old Jacob Bjerknes proposed the frontal model of moving cyclones. Over the next few years, Jacob, together with several colleagues, continued to investigate the movement and life cycles of these storms and the associated cyclone wave patterns. In the 1930's routine use of instrumented balloons began to provide meteorological observations above ground level.

The essentially modern, three-dimensional view of extratropical cyclones was completed by the late 1940's, a short time after a network of upper air weather stations was established. But it was not until 1960, when TIROS, the first meteorological satellite was launched, that the magnificent extratropical cyclone vortices were finally seen in their entirety (Fig. 7-1). Since then, satellites have revealed additional
features and phenomena associated with extratropical cyclones but have, for the most part, confirmed the outstanding detective work of earlier meteorologists.

Lows are asymmetric storms that can be divided into three basic regions (see Fig. 7-2). Warm air is confined to the southeastern side of each low, which is called the warm sector. North and east of the low center are the storm's main clouds and precipitation. Cold and dry weather occurs to the west of the storm center.

In the warm sector, tropical air, which is often hazy and humid, moves northward. Morning fog and afternoon cumulus or cumulonimbus with thundershowers (particularly in spring and summer) frequently form in this air, while cirrus and altocumulus are common all year.

Further north, the ground is covered by a huge dome of polar air. When the tropical air encounters this dome of dense polar air, it slides over the dome and covers it with an extensive shield of stratiform clouds and precipitation, all the time slowly forcing the dome's edge back to form a warm front. As the warm air ascends the dome, it gradually turns northeastward so that the low-based nimbostratus in the south evolve into the progressively higher and thinner altostratus, cirrostratus and finally, furthest to the north and east, cirrus.

Cold and dry polar air dominates the western side of the cyclone. Northwest of the low center, some of this air is drawn under the fringe of the cloud shield where it raises visibility and can help lift the dissipating stratus deck or sunder it into rounded and possibly shower producing clouds that resemble smooth cumulus. Further south and west, the weather is crisp and often clear. This allows a bright sun to heat the ground vigorously and make puffs of heated air rise except in the dead of winter. If the air has acquired enough vapor afternoon cumulus or stratocumulus will result. Brisk northwest winds often align these clouds into long parallel rows or streets. Such cloud streets are particularly common over Northwest Europe, where the polar air has just been charged with vapor from its passage over some arm of the Atlantic Ocean.

The cold front, extending southwestward from the low center, marks the polar air's leading edge. Along the front the advancing cold air dome wedges the warm air aloft, and particularly on spring and summer afternoons, can produce thunderstorms. A short distance north and west of the cold front, the jet stream flows overhead and can produce long, aligned bands of altocumulus or cirrus in otherwise mostly clear skies. Spectacular coronas or iridescence can be produced by such altocumulus because the crystalline air below cloud level offers no obstruction to vision.

Lows give warning of their approach because they are herded from west to east by strong jet stream winds aloft. This results in a few standard sequences of changing clouds and weather that can be seen from ground level every time a cyclone passes overhead. Some of these sequences were recognized from ancient times, and formed the basis for an arsenal of practical weather rules that was well known to seventeenth century Dutch sky painters. Earlier artists had applied knowledge of local sky conditions, but the seventeenth century Dutch painters did so with such frequency and insight that seventeenth century Dutch sky art can be compiled into an atlas of the skies and weather around extratropical cyclones. The likely locations for paintings shown in this chapter are indicated in Fig. 7-2.

The first forerunners of an approaching low are the cirrus. These invade the western sky and are followed by a lowering and thickening cloud mantle that grades almost imperceptibly from cirrostratus with halos, to altostratus with a watery sun or moon and finally, to nimbostratus. The entire sequence of clouds and precipitation typically lasts more than a day.
As the storm moves overhead, the cloud and weather sequence depends on whether the low center passes by to the north or to the south. If the low center passes by well to the south, so does the warm air. The weather then remains cold and snow is likely in winter. Finally, so long as no other storm is right behind, the storm sputters out and the sky clears fitfully. A fresh wind begins to gust from the north. For a few hours, ragged cloud shreds may race across the sky beneath a higher overcast, or clearings may alternate with brief and sometimes intense showers or flurries. These clearings contain some of the deepest blue skies because the cold, dry air above the cloud deck is sinking and the air beneath has been purified by all the fallen precipitation. Within hours, especially as the sun goes down, the blast of cold, dry arctic air either drives the cloud remnants away or else evaporates them completely, revealing the limitless frigid blue firmament.

If the storm center passes by to the north of a point, so does the coldest air. Rain is then far more likely than snow. The cloud mantle gets progressively lower, sometimes reaching the ground as thick fog. Then the warm front passes by and southerly winds with rising temperatures and clearing skies follow. In the warm and often hazy air of the warm sector, cirrus, altocumulus and cumulus are common. The cumulus may grow into cumulonimbus that produce thunderstorms, some of which may be severe. Eventually, perhaps with a final shower or thundershower, the cold front passes overhead. The wind begins to blow from the northwest, the air turns colder and drier, and the sky clears dramatically. Within hours, long bands of altocumulus or streamers of cirrus might whiz by in the jet stream overhead, while small cumulus begin to sprout up in the limpid air.

The Dutch sky dawned cautiously, overcast, cold, misty, and right in the middle of the cloud shield of a low. In 1608, after one of the more memorable Dutch winters but still a year before the truce, Hendrick Avercamp revived the Dutch snow scene with "A Winter Snow Scene With Skaters Near a Castle" (Fig. 7-3). This is modeled directly after Bruegel's prototypes. It uses an elevated viewpoint from which we look down on snow-covered ground and frozen waterways. The narrow gauge view, high horizon line and restricted visibility focus attention on the goings on at ground level while diverting attention from the unlimited spaces in the sky above. Nevertheless, the mood is expansive for happy ice skaters swarm all over the place, as in virtually all Avercamp's works. People in Holland were beginning to have fun again and expand their horizons. And as they did, their painters learned to turn their eyes skyward and depict more panoramic, wider angle views.

Fig. 7-3. Hendrick Avercamp. A Winter Snow Scene With Skaters Near a Castle. 1608. National Gallery, London.

In 1609, the year of freedom and one year after his Winter Snow Scene With Skaters Near a Castle, Avercamp painted a far more panoramic winter scene with a lower viewpoint and 50% sky. The panoramic viewpoint was actually introduced to Dutch art around 1603.
by Hendrick Goltzius. Many of the views seem so photographic they suggest the use of or inspiration by the camera obscura. The Dutch showed off their low-lying land the way a person sees it - from ground level or perhaps from a sand dune. Looking across the largely open fields, only the steeples and towers of distant towns break the line of the horizon. And over this newly freed, precious land one monarch alone could claim dominion - the sky, attended by its royal court of clouds. Some Dutch painters increased the sky's domain so much that the land was confined to a narrow strip at the painting's bottom. This love of sky became so fashionable after midcentury that the Dutch 'updated' many older paintings by grafting an extra panel of sky to their tops.

Despite their aerial acrobatics, the Dutch sky painters remained bound to the earth by the dictates of their climate. Avercamp's paintings and the various Dutch winter scenes of the next fifty or sixty years serve as a reminder that the Little Ice Age had not gone away. Following both Bruegel and the climate of Western Europe, Dutch artists covered many of their winter skies with an almost uniform deck of stratus and frequently used either mist or a light snowfall to reduce visibility. In skating scenes yellow or pink highlights brightened the overcast, misty skies, transforming the stratus into its higher, thinner cousin, altostratus.

Fig. 7-4. Esajas van de Velde. View of Zierikzee. 1618. Dahlem Gallery, Berlin

Whenever Europeans revived the snow scene they did so under cloudy and misty skies. By contrast, American and Canadian snow scenes painted by artists not encumbered by European influence often show deep blue skies with unlimited visibility. These choices are
dictated by the prevailing climate, which quietly compels our aesthetics.

East of the Rocky Mountains most snowstorms end with a dramatic clearing. Crisp, dry Arctic air sweeps down from northern Canada, and for several days the pure white snow sparkles under deep blue skies with almost unlimited visibility.

But in most of Western Europe and along North America's West Coast north of California, winter storms (low pressure areas or extratropical cyclones) do not come one at a time but form links in a cyclone wave train. The cyclone wave train lies along a boundary known as the Polar Front that separates huge masses of tropical and polar air, and contains the temperature contrasts that drive both the cyclones and the jet stream. The individual cyclones are located at the northerly crests of the waves. Each forms a low pressure area about 1000 miles across, a gyre into which the winds spiral counterclockwise. As the air converges it rises to produce the clouds and precipitation associated with low pressure areas.

When a cyclone wave train passes overhead, misty, overcast skies of can become entrenched for two or three weeks. Each succeeding storm in the wave train can cloud the sky for several days and each follows closely upon the heels of its predecessor, moving along almost the same path or track. Clearings between storms are at best brief interludes in an otherwise interminable epoch of overcast. Only when the last storm in the wave train passes does a cold front sweep through and clear the sky convincingly.

Esajas van de Velde's panoramic View of Zierikzee (Fig. 7-4) suggests such a dramatic clearing. The painting presents an actual view of Zierikzee as seen from the dredged river just south of the city. The view faces slightly west of north. In Dutch Landscape Painting of the Seventeenth Century, Wolfgang Stechow used this work to demonstrate van de Velde's compositional genius. Van de Velde created a small bank for the fishermen on the lower left while using the sky, with its "ascending light streaks" to counteract the "falling diagonal of the town silhouette". But the "ascending light streaks" are really long bands of jet stream cirrus blowing in from the west in the wake of a cold front. The unlimited visibility is common right after a cold front, and the air is apparently too dry for cumulus. The jet stream clouds have thus inserted the element of time into a work whose sense of quiet would otherwise have imparted a timeless, static quality.

Despite its increasing allegiance to the sky and its compositional precocity, the View of Zierikzee represents a meteorological dead end in Dutch art, for almost never did the Dutch allow high clouds to fly solo in a limpid sky. Shortly after the View of Zierikzee, clouds from the next storm on the Polar Front began to lower and thicken once again.

Interestingly, the cloud mantle set in soon after 1621 when the Spanish resumed hostilities, and did not clear out convincingly until shortly before the Peace of Westphalia (1648), which brought the Eighty Years War between the Dutch and Spanish to its official conclusion. Dutch painted skies during the generation from 1625 to 1645 are both meteorologically compelling documents and lyrical sublimations of the winds of war and skies of strife.

Just as most battles of the protracted war were shunted to the fringe of Dutch soil, so the ever vigilant Dutch painters kept their skies at the fringe of the storm. The higher cloud layer remained in constant attendance although the sun was sometimes allowed to thin it to a milky blue translucence. The air beneath the stratiform covering filled with a delicate mist that slightly reduced visibility but added greatly to the sky's earth tones. Low clouds invariably appeared in this humid air layer, but almost all of them had indistinct edges since they were engendered in mist and set against the gray or tan of the higher clouds, and were
Either produced by weakened sunlight or else caught in the process of evaporating, it was only after 1645, when the threat of invasion had evaporated, that the Dutch painters began to cleanse the sky and allow robust clouds to sprout up.

Every Dutch artist who painted the sky in this generation was conscripted to paint tonal skies and vapid clouds. Jan Porcellis may have led the pack with some earlier works but returned to the theme with a vengeance after 1625. Even Rembrandt kept his cloud edges indistinct despite the dramatic lighting of his skies. Hercules Seghers, whose landscapes served as models for Rembrandt, rendered clouds so tenuous that one good puff of dry air could dissipate them. But Segher's clouds are paradigms of solidity in comparison with the almost indiscernable nebulae of Isack van Ostade, who specialized in tonal winter skies during a brief career. Jan van Goyen and Salomon van Ruysdael painted both winter and summer scenes, but for two decades could not clear their tonal skies at any season. Even the tropical summer sky was unable to arouse a true convective cloud in Dutch art during these years. Frans Post, who worked in Brazil from 1637 to 1644, came home to graft vapid, high-latitude cumulus onto his near equatorial scenes.

As always, a firm physical foundation underlies good cloud paintings constrained by convention. Dissipating or slowly forming juvenile clouds often have such low droplet concentrations at their edges that the cloud boundary is not well defined (Chapter 4). During winter the sun in Holland is too weak to rouse buoyant convective clouds with sharp edges. Instead, air radiates its heat away slowly, thereby producing misty clouds with indistinct edges.

The overcast generation was launched fittingly in 1625, when the Spanish took Breda and threatened Amsterdam. This represented the low water mark of Dutch fortunes and Pieter van Santvoort marked the occasion by painting the advancing storm in his Landscape with a Road and Farmhouse (Fig. 7-5).

Fig. 7-5. Pieter van Santvoort. Landscape with a Road and Farmhouse. 1625. Gemaldegalerie, Staatliche Museen Preussischer Kulturbesitz, Berlin.

Fig. 7-6. Altostratus with a darker lower layer of stratus or altostratus.

Santvoort's Landscape is one of few paintings with two layers of stratiform clouds. Such broken lower layers of altostratus or stratus often appear beneath altostratus when precipitation is imminent (Fig. 7-6). They form as discrete layers of humid, rising air slide overhead. As the storm approaches the cloud layers tend to thicken, merge and lower to nimbostratus.
The lower attendant cloud layer constitutes one of three classical distinguishing features of altostratus. Before such layers appear the undersides of altostratus are often marked by striations or wavelike corrugations. The corrugations are produced the same way as the ripples and rows of altocumulus, but with the clear gaps between the cloud elements filled in. They appear most striking when the air beneath cloud base is dry. Once rain or especially snow begins falling from the cloud base, but perhaps an hour before it reaches the ground, visibility is reduced and the cloud base assumes a smooth, often blurred appearance. It is usually around this time, when precipitation is imminent, that lower cloud layers appear.

The third dramatic attendant feature of altostratus is a watery sun or moon. This glows like a dim light shining through ground glass, but is a phenomenon few artists have ever captured.

A gleaming patch of sunlit ground stands out from darkly shaded surroundings in the Landscape with a Road and Farmhouse. Breaks in the cloud fields and openings in the woodlands allowed Dutch painters to draw patches of ground from the shadows with invisible shafts of sunlight. Artists had discovered that clouds cast shadows around 1500, when their clouds first grew large. El Greco had worked a miracle with this discovery in the View of Toledo (see Fig. 6-35), but it was the Dutch, who were more at home with partly sunlit ground, who learned to treat those two imposters, sun and shade, with equanimity.

Since altostratus covers the sky from end to end and is invariably too thick to allow sunbeams to reach the ground, the sunlit patch in Santvoort's Landscape is almost certainly a purely compositional feature. The painting is an exercise in both lighting and diagonals. The diagonals that rise as they lead into the distance - the path and the field of tilted wheat - are brightly sunlit, while the falling diagonals of the distant rainstreaks, the line marking the tree tops, and the edge of the lower cloud layer, have been cast into a profound darkness.

Santvoort's Landscape is also an early exercise in tonality. The brown cloud layers echo the golden and brown wheat and dirt paths, while the trees are too deeply shaded to be green! Blue was a fleeting phantom in the skies of this overcast generation. Sky paintings became monochrome or tonal with yellows, tans and browns dominating. Convective clouds, with their pronounced lighting contrasts, were largely suppressed.

The master of earth tone skies with severely repressed convective clouds was Jan van Goyen. At first, I neither liked nor trusted van Goyen's skies because they lack the limpid air with pronounced cloud forms in a deep blue sky I had been trained to look for. But his skies are legitimate as I discovered much to my surprise when I walked out of Bruges's Groeninge Museum on a day of breaking clouds. As I looked up at the sky near the sun before my eyes had grown accustomed to daylight, I learned in one blinding flash what Jan van Goyen is all about.

Jan van Goyen often faced the sun on humid days and allowed its light to saturate his retina and flood the canvas. This viewpoint gives van Goyen's works their almost monochrome tan quality and helps blur the cloud outlines, even if van Goyen did overstate the earth tones and place the sun off to the side. More than two centuries earlier, Robert Campin had shown that the sky is bleached or reddened and cloud forms are more difficult to distinguish amid the general glare in the vicinity of the sun (see Fig. 5-17 and Fig. 5-18). Van Goyen built upon this knowledge by choosing humid days and either nascent or dissipating cloud fragments rather than robust cumulus. On humid days, aerosols become engorged with moisture and scatter more sunlight, further reddening the sky and blurring cloud outlines even more.
By the time Jan van Goyen came to paint his *View of the City of Arnhem* (Fig. 7-7) in 1646, the Spanish threat had withered away. Tonal colors still dominate this work. The earth is predominantly brown and the clouds are laced with yellow, but some pale blue sky has finally managed to filter through the mist and there are hints of convective activity.

The *View of the City of Arnhem* is a topographic work from which a weather forecast can be ventured. The painter shows the city from the plateau to the NW and from a height of almost 100 meters since only the tops of the churches break the horizon line. The view faces ESE up the northern branch of the Rhine River, while the Issel River flows into it in the right background but lies just out of sight in the distant left. The scarp on the horizon line marks the southern edge of a hill called the Hettenheuvel, about 15 miles to the ESE. The windmills are facing the NE, making that the most likely surface wind direction.

The lighting on the clouds and shadows on the ground show that the sun lies about 70º to the left - the ENE. This makes it early morning around the summer solstice.

The sky in the *View of the City of Arnhem* is often seen at the end of lows whose centers pass by to the south. The broken lower cloud layer has little vertical development and appears to be evaporating. Even the central turret has very smooth edges and a top that fades so gradually into the background sky it cannot last much longer. The pale, milky blue sky appears to be filled with a translucent veil of sun-weakening cirrostratus, seen more commonly when winter storms approach but also as they take their leave.

Although the storm is departing the NE wind and the morning setting create doubts
about clearing. The NE wind shows that either the storm has not yet moved away or the outer fringe of the next storm in the cyclone wave train has already arrived. Furthermore, if the air at the edge of a storm does not sink vigorously, the sun will revive a breaking stratocumulus layer and give it a few more hours of renewed hope. Van Goyen could not easily part with 20 years of overcast.

Fig. 7-8. Aert van der Neer. Winter Landscape in a Snowstorm. 1655-60. Private Collection. Plate 43, Sutton.

Fig. 7-9. Clouds at sunset as sky clears from a storm near Louisville, KY on 21 Jan 1995.
The titillating prospect of clearing drew closer with Aert van der Neer. His *Winter Landscape in a Snowstorm* (Fig. 7-8) is a textbook example of a showery sky seen in the waning hours at the western edge of a winter storm (Fig. 7-9). The snow that dots the canvas falls from one of several showers that comprise a shattered layer of stratus. A seemingly opaque upper layer of altostratus appears to fill the gaps between the low clouds but still allows bright crepuscular rays to beam down from the left and alternate with dark fallstreaks from other snow showers near the horizon.

The crepuscular rays provide the key to the forecast by fixing the compass orientation of the painting's setting. They point to a sun so high in the sky for winter in Holland that the time must be just about noon despite the dark ground and pink highlights on the bases of the nearby stratocumulus. Since the sun is in the south at noon the scene faces SW. Now the wind comes into play. The tilting trees and leaning people show that a brisk wind is blowing from the right or NW, the classical direction of clearing.

Aert van der Neer even had a difficult time clearing his skies at night. The sky might seem to be mostly clear in the *River by Moonlight* (Rijksmuseum, Amsterdam) because a full moon appears about 5° above the horizon, but a slightly divergent pillar of light extends downward from it to the horizon. This is a moon pillar (not a crepuscular ray), which is produced by a translucent veil of cirrostratus consisting of plate-shaped ice crystals that tilt about 5° from the horizontal as they fall.

Most of the major Dutch sky painters experienced difficulties in clearing their sky, but still managed to reveal some bright blue patches of sky by the time the Peace of Westphalia was signed.

Rembrandt van Rijn was one of the pioneers in clearing the Dutch sky. Even so, he began his landscape career steeped in fog and mist. Before 1630, he had learned to highlight foreground actions and relegate the background to darkness and obscuration with the most extreme form of chiarascuro ever employed in Dutch art. This he first applied to the landscape in the *Abduction of Prosperine* (1632, Dahlem Galery, Berlin), which has visibility so low that the foliage of the nearby trees is blurred. No one else would render such indistinct verdure until Watteau and Fragonard in the next century. With such fog and luxuriant foliage, Rembrandt carried Dutch art into the warm sector. He then used the swelling cumulonimbus to transform light into a religious experience by beaming light down onto a few select spots of land through aerial openings of blinding intensity, while the rest of the sky and earth was cast into the almost Stygian gloom of an impending Deluge. In the *Landscape with a Stone Bridge* (Fig. 7-10), two trees near the bridge have been chosen as the blessed recipients of God's own light in the midst of a world seemingly doomed to everlasting darkness.

Rembrandt's apocalyptic landscapes were all done in the mid to late 1630's. By 1640, Rembrandt admitted a few patches of blue, but only after a cold front passed did he clear the sky and restore sobriety to the earth. The *Winter Day* (1646, Staatliche Gemaldegalerie, Kassel) is unique in Dutch
sky art. Its deep blue sky, debuting over frozen ground, is streaked with cirrus and cirrostratus, but not tainted by so much as one tiny cumulus.

Other Dutch artists used the warm sector weather of Italy to help clear Dutch skies. Herman van Swanevelt settled in Rome by 1629, where he specialized in hazy golden sunsets, and may have actually influenced Claude Lorrain. Jan Both, who lived and worked in Rome from 1638 to 1641 brought these placid sunsets back to Holland and helped popularize them among his countrymen.

A generation of Dutch painters arose who used Italianate skies whether or not they ever left Holland, even placing them above ice skating scenes on occasion. Several of the Italianate Dutch painters were wise enough to fleck patches of altocumulus across their sunrise or sunset skies. Nevertheless, few Dutch painters devoted anywhere near the measure of attention to the higher clouds that they lavished upon the cumulus or stratocumulus.

Cumulus rose to its greatest height in Dutch art soon after the sky cleared. Clouds full of motion and life tower overhead and splotch the sunlit ground with shadows. Sky color grades subtly from pale blue in the gaps between clouds near the horizon to a deeper blue in the gaps above. Clouds near the top of the paintings are shown from below while those nearer the horizon are displayed in profile. The percentage of sky blocked by cloud increases toward the horizon, where the oblique viewing angle makes it more likely to see the sides of adjacent clouds than the clear gaps between (Fig. 7-11).

Something is usually amiss in these tantalizingly real cumulus-filled Dutch skies. Discrepancies between real and painted Dutch skies gradually surface and help expose Dutch sky art as a lure to a naturalism deliberately infiltrated and permeated by a subtle world of artifice. The Dutch developed an arsenal of stylistic devices for treating cumulus, some of which acquired the status of law and constrained the skies of a generation of painters.

The vast majority of later Dutch cumulus were displayed in their youth, with sharply corrugated, swelling tops that contrast sharply with the color and brightness of the background sky. Often, the turrets of cumulus appear to diverge upward from some significant landmark such as a church spire in the same way exploding puffs of smoke erupt from a cannon blast. Many cumulus were designed to sprout upward in an almost arboreal manner plainly intended to mirror a grove of trees. This was a favorite trick of Meindert Hobbema. In Hobbema’s Woodland Road (Fig. 7-12), the tilted cumulus mimic the crowns of the windswept deciduous trees.

A major aim of these devices was to disguise or block a view of the clouds' flat bases. The almost total censorship of the flat base of cumulus was the single most insidious Dutch cloud convention. After a few early portraits of flat based cumulus by Salomon van Ruysdael, the feature virtually disappeared from Dutch painted skies. Any excuse was used to justify the practice. If no nearby trees or buildings could be strategically located to offer their services, the irregular cloud fragments that fifteenth century Flemish artists had routinely exterminated could be resurrected on the spot to interpose themselves between the main cloud and the observer. In stormy scenes the
clouds sometimes had no bases, and terminated at the ground or sea surface. When all else failed, as George Siscoe noted, the cloud base was stretched into a long, tapering `tail' that merged inconspicuously with the distant cloud field, an artifice used repeatedly by the young Jacob van Ruisdael.

Why the Dutch purged the flat bases of cumulus and stratocumulus is a question I can only answer partially. Surely, the Protestant Dutch did not want to be associated with their Catholic Flemish predecessors, whose static view of cumulus required flat bases and excluded irregular cloud fragments. The Dutch also strove to emphasize the dynamism and almost infinite spaciousness of their skies, qualities apparently reinforced by swelling corrugated tops and cloud shreds, but seemingly denied by motionless flat bases. In a way, nature even seems to condone these associations, for in many dynamic skies, particularly those seen at the end of lows, the cloud puffs are tilted or even torn and the flat bases are inconspicuous or absent.

Jacob van Ruisdael was one of the artists who never painted a flat-based cumulus yet few artists have known the weather or the tricks for representing it as well. He depicted a variety of weather situations in all seasons with profound insight and sometimes revealed enough pertinent information for us to venture a weather forecast. He included several optical phenomena, painting a sun pillar in a winter scene and a double rainbow with the sky brighter below the primary bow in a storm at sea. He portrayed optically thick clouds such as active cumulus as solid bodies but duly noted that optically thin cloud shreds and dissipating stratocumulus are translucent. (Aelbert Cuyp failed to make this distinction and reduced his clouds to personal signatures.)

Seldom was fact and artifice interwoven as masterfully as in van Ruisdael’s View of Haarlem with Bleaching Grounds (Fig. 7-13). Its exuberantly convincing sky represents a profound meteorological document riddled with aerial improbabilities.

The sky occupies more than 2/3 of the canvas. It has the slight purple tinge favored by Ruisdael and often seen west of lows in cool or cold air with a humid air layer near the ground. The gradation from a pale horizon sky to a much deeper blue above is also impeccable.

Three parallel cumulus cloud streets cross the sky diagonally from the left foreground to the distant right horizon. The furthest street hugs the horizon and is seen in profile while the nearest street towers overhead and is seen from below. The street occupying center stage consists of towering cumulus turrets that dwarf the city in the distance. The most impressive turret has been strategically placed exactly in the center of the sky. The turrets appear to diverge upward explosively from narrow focal points rather than broad bases (Fig. 7-14).

The cloud streets remain faithful to the skies over Holland and reveal van Ruisdael as an unsurpassed artistic narrator of weather changes. The View of Haarlem with Bleaching Grounds shows a topographic view of the city as seen from the northwest. The horizon is dominated by the great Church of
St. Bavo, which is oriented like a compass. Sunlight streams in from the right, striking the right half of the cloud turrets and the western face of the church but not its northern side. This places the sun slightly south of west and sets the time as mid afternoon, prime time for cumulus.

Fig. 7-13. Jacob van Ruisdael. View of Haarlem with Bleaching Grounds. c. 1670-1675. Zurich, Kunsthaus.

The cloud streets are aligned north-south. This is almost parallel to the northerly surface wind, which is indicated by a single small smoke plume emanating from the chimney of a cottage on the left that is half hidden by trees.

Cumulus cloud streets are produced as cool air arrives from the North Sea, gets heated by contact with the sunlit ground (also used for bleaching), rises and, in the name of efficiency, is lined up by the wind in rows almost parallel the airflow (see Fig. 7-21). The windmills give a mixed signal but provide possible evidence of a recent wind shift. Most seem to be facing the south or southeast, presumably where the wind came from somewhat earlier.

The View of Haarlem With Bleaching Grounds therefore takes place on a cool, brisk summer day with northerly winds probably a little less than 24 hours after a cold front has swept across Holland, clearing the skies in the wake of an extratropical cyclone. The cold front is probably some distance to the south because the cumulus are well developed and there are no high clouds.

Fig. 7-14. A cumulus cloud street at Jacob Lake, AZ that resembles the street in Fig. 7-12 but has a flat base.

But there is also design in the sky. There is little chance that the base of a long cloud street would exhibit profound curvature. Yet the base of the central cloud street dramatically sweeps upward on the left after hugging the horizon on the right. There is even less chance that nature would fit the edges of the cloud streets so perfectly as to leave a long, narrow clear corridor between the base of a nearby cloud street and the turrets of a more distant street. But there is no chance at all that any cloud shred extending across this corridor from the top of a more distant cloud could touch or block part of a nearby cloud base. Yet this is precisely what van Ruisdael did. A few shreds from the nearby cloud base just touch the right edge of the central turret while just to the right of St.
Bavo’s, an extension of the furthest cloud street obstructs the view of a piece of the darker base of the central street.

Van Ruisdael was highly original in his flirtations with the paradoxes of perspective. What was his purpose in these games? When he extended cloud threads improperly from the base of a nearby cumulus to the top of a more distant one, he wove the cloud matrix into an unending fabric that confused the ordered concepts of the intellect. Almost a century later, William Hogarth jokingly did much the same thing in his frontispiece, *Perspectival Absurdities*, to Joshua Kirby's, *Dr. Brook Taylor's Method of Perspective Made Easy* (1754), where nearby store signs and fishing rods extended deep into the landscape background. Two centuries after Hogarth, Maurits Escher brought the absurdities of perspective to their illogical conclusion with endlessly spiraling staircases and tumbling waterfalls. But while Escher and Hogarth blatantly challenged viewers to find the paradoxes inherent in representing three-dimensions on a flat surface, van Ruisdael's prescient skies quietly drug the critical faculties and lure you unwittingly into the imagined depths of the canvas.

Jan Vermeer's *View of Delft* uses a strip of golden beach to lure you into the distance (Fig. 7-15). This quiet work may represent the consummation of seventeenth century Dutch sky painting for it involves all the major issues of the time. Its dynamic sky is impeccable and contains an implicit forecast. It incorporates an up to date knowledge of optics. It is also a topographic work of the city.

The scene faces north, showing Delft from the Rotterdam Gate with almost photographic accuracy. Vermeer has even pinpointed the time of day. The clock on the central building indicates it is 7:10, while the shadows and illumination show that the sun lies behind and to the right, or in the southeast, thus making it morning.

The large, smoothed, rounded cumulus of the *View of Delft* irked me for quite some time before it dawned on me that they are not cumulus at all! Rather, they are the disintegrating remnants of a deck of stratus, often seen at the western edge of lows. As the openings in the cloud deck are widened by evaporation, the pure blue sky above seems to pour through, sundering the cloud mass into large but separate elements.

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Fig. 7-16. Margaret Winslow. Fractostratus of clearing skies on Unga Island.

The landscape appears unusually bright for good reason. The air is just about as pure
and deep blue as it ever gets because it has recently been swept clean by rain and is sinking from on high. This makes the sunlight reaching the ground far brighter than normal so that everything it strikes is illuminated with an exceptional intensity. A close look even reveals glistening, almost microscopic dots that cling like recently fallen raindrops to the woodwork of the ship, the masonry of a number of the brick buildings, and in the nearby trees. This is the precise meteorological moment that Vermeer has captured.

My colleague, Margaret Winslow, observed a similar clearing on Unga Island of Alaska's Shumagin Islands (a branch of the Aleutians) after four days of solid overcast (Fig. 7-16). The sky was deep blue and the clouds were rounded and smoothed, much as in the View of Delft.

Despite the similarities, there are fundamental differences between the photograph and the painting. Even though the tundra on Unga Island is bathed in direct sunlight it still seems quite dark. In many meteorological photographs, especially those facing the sun, the sky is so much brighter than the land that the land appears black. Except near sunrise or sunset, cool tones dominate the skies of most photographs. In most landscape paintings, no matter how much space is devoted to the sky, the artist plays the role of a neutral density filter, distributing light more equably between air and land. Painters also apply generous quantities of the warmer colors - pinks, yellows, light greens and earth tones - to the foreground objects and even to the sky.

It was by comparing the View of Delft to my sky photographs that I first learned that it is crucial to include some bright, warmly colored sunlit objects in the foreground to counterbalance the brilliant blue and white of the sky when photographing the landscape. In the View of Delft, Vermeer did this by giving the nearby beach and buildings a golden glow that keeps the cool sky in check. But he even warmed the shaded sides of the clouds with a healthy dose of earth tones. The shaded sides of low clouds do reflect light of the ground below but not to the degree Vermeer did. Landscape painting is a most subtle and delicious artifice.

Everything in the View of Delft contributes to the morning's brightness. Not only do the buildings around the Nieuekerke gleam in the light of a bright shaft of sunlight, but even the part of town cast into shadow has a suffused glow. A final glitter is added by the few leftover sparkling drops of rain. No painting could have better conveyed the reigning Dutch spirit of light.

Although Holland played a leading role in this dynamic century of light, the foundations for the times can be traced to Italy, where scientists and artists began experimenting with optical instruments in the sixteenth century. Around 1510, Leonardo da Vinci compared the camera obscura or dark room (Fig. 7-17) to the human eye and may even have placed a spherical lens at the opening. Descriptions of glass lenses used for the camera obscura were given by Maurolico in 1521 (not published until 1611), Geronimo Cardano in 1551, Daniello Barbero in 1568 and Giovanni Battista della Porta in 1589. In his Magia Naturalis, della Porta even anticipated the telescope and microscope when he wrote,

With the concave lens you can see distant objects as small but distinct, with the convex lens you...can see near objects bigger but not well defined; if you know how to combine properly these types...of lenses you will be able to see distinctly and enlarged both near and distant objects.

Della Porta later used this quote as evidence that he had invented the telescope, but the Dutch seem to have brought the ideas
to fruition, making the first known telescopes and microscopes. It was news from Holland of Hans Lippershey's telescopes that first focused Galileo's attention on the instrument. Ironically, Lippershey failed to obtain a patent for his telescope since the Dutch government argued the instrument was already well known.

The Dutch fascination with light and lenses led Willebrord Snell van Royen to his discovery of the law of refraction in 1621. Seven years later the other claimant to the law of refraction, Rene Descartes, moved to the Netherlands where he could have quiet and freedom amidst the bustle. There he worked out his explanation for the rainbow. Christian Huygens, a contemporary of Newton, proposed the wave theory of light and gave some good reasons for it. And finally, in the city of Delft, Anton van Leeuwenhoek devoted much of his long life to revealing new worlds seen through a microscope.

How did these discoveries and inventions about light influence Vermeer? All Holland was touched by them but Vermeer had an inside line. Leeuwenhoek was his neighbor, friend, and even executor of his will. Vermeer had the opportunity of looking into his friend's newly revealed world. It may well be that Leeuwenhoek designed a camera obscura complete with lenses for Vermeer.

**Fig. 7-17. Model of a camera obscura.**

The camera obscura is the direct predecessor of the camera. Its principle was known in the time of Aristotle. During the Middle Ages the Arabs worked with it and it was a plaything of Chinese artists by the eleventh century. It was equipped with lenses by the middle of the sixteenth century and was known to artists. It may have played a far greater role in the mastery of realistic depiction of scenery than we suspect.

The camera obscura consists of a closed box with a narrow opening, often equipped with a lens. Light from the outside passes through the opening and strikes the far side of the box, where it produces an image of the scene outside. In early versions, the camera obscura was really a room or tent, and an artist standing inside would trace the image of the scene on paper. Later versions were typically boxes equipped with a mirror to reflect the image upward to a transparent plate on which the artists could trace the outlines of the scenes.

The artistic possibilities of the camera obscura were rapturously praised by Constantijn Huyghens and were familiar to seventeenth century Dutch draftsmen and painters. Even Kepler, who designed a camera obscura to observe eclipses, was inspired to use the device to trace the outlines of a few buildings.

Did Vermeer use a camera obscura to create the View of Delft? There is not a single document on the matter, but there are many compelling reasons to believe he (as well as many of his contemporaries) did. To begin with, the View of Delft stands apart from Vermeer's other known paintings and it is highly improbable that anyone could have achieved such immediate command of landscape art unaided. But there is even more compelling evidence. The tiny sparkling dots of light I somewhat facetiously attributed to raindrops correspond closely to the so-called circles of confusion that form around
highlights of unfocused images seen through the camera obscura. After Vermeer's paean to light the wellspring of Dutch innovation in sky painting took a decided turn to bleaker prospects. The Dutch were still rich, even richer than before, but Holland's youthful adventure was coming to an end. France was sniping at her from the land and England was clipping her wings on the high seas. More and more, the Little Ice Age's wintry gloom occupied Dutch thoughts while the British toasted their growing fortunes with frost fairs on the frozen Thames River.

Holland awoke to find that her cloudy, wintry skies were no longer a source of gaiety. In 1672, Gerrit Berkheyde, the `sober poet of the town view' according to Stechow, painted the Bocht van de Herengracht, Amsterdam (Fig. 7-18). A thin layer of altostratus dims the sky and dulls the land below, reinforcing the painting's almost photographic quality. Berkheyde illicitly allowed the sun, albeit a weak sun, right through the opaque altostratus in order to illuminate parts of the buildings.

Even if altostratus does not produce precipitation, it is often a harbinger of the next winter storm blast. In 1672, the year of Berkheyde's altostratus, French armies, coveting Dutch soil, blasted their way across the low-lying countryside. The Dutch responded in desperation by opening the dikes and allowing the sea to reclaim their hard-won efforts. This did succeed in sending the French scurrying back home but it helped darken the buoyant spirit of Holland.

This new gloomy side to the Dutch spirit was captured with poignant accuracy in a number of Jacob van Ruisdael's winter scenes. Several of these scenes are dimly lit by the


feeble winter sun and have dark, almost brown skies and clouds. Van Ruisdael's *Winter Landscape* (Fig. 7-19) has been cited as evidence of a turn to more sinister prospects.

There is no trace here of the traditional gaiety of Avercamp's or even van Goyen's and van den...Neer's scenes nor of the lyrical elegance of van de Cappelle's; it would be altogether absurd to...think of skaters before this picture; the real topic is the forlorn, tragic mood of a winter day, of nature in shackles.


The *Winter Landscape* certainly does seem to convey an unrelieved impression of bleak meteorological prospects. The ground is covered with a layer of dirty snow. In the perpetual dusk, the sky is no longer blue but is too washed out and dirty to be golden or rosy. The feeble sun, like a dying ember, is barely able to pierce a thin, translucent veil of altostratus or cirrostratus and is certainly too weak to lift cumulus clouds. In their place, black stratocumulus cloud streets darken the dull sky even further.
But with van Ruisdael there is always some meteorological ambiguity. The smoke plume tilts away from the winter sun to suggest that a south wind has sprung up to combat winter's relentless grip.

Van Ruisdael's *A Winter Scene* (c. 1670, Philadelphia Museum of Art) also contains evidence of warming and was, in fact, the first painting ever subjected to a detailed meteorological analysis. The analyst was none other than the painter John Constable, who greatly admired van Ruisdael and who argued in his *Lectures on Landscape* that *A Winter Scene* represents a faithful transcription of a typical winter weather sequence - the warming we now identify as a warm front passage.

This picture represents an approaching thaw. The ground is covered with snow, and the trees are still white; but there are two windmills near the centre; the one has the sails furled, and is turned in the position from which the wind blew when the mill left off work [toward the east]; the other has the canvas on the poles, and is turned another way, which indicates a change in the wind. The clouds are opening in that direction, which appears by the glow in the sky to the south (the sun's winter habitation in our hemisphere), and this change will produce a thaw before the morning.

Several of van Ruisdael's other winter scenes are also amenable to meteorological analysis. One of these, the Winter Scene with Two Windmills (c. 1675, formerly (?), Richmond, Cook Collection) presents art's first sun pillar. (Constable painted the second!) This beams up from a dim sun penetrating a veil of cirrostratus and a gap in stratocumulus near the horizon. Sun pillars are halo phenomena, produced when light from the sun near the horizon is reflected from ice crystals that tilt slightly as they fall. The sun pillar, the clouds, and the windmills facing the eastern part of the sky all strongly suggest the approach of a winter storm with yet another blanket of snow likely. Despite the pillars of hope and the signs of warming, the dark skies of van Ruisdael's winter scenes do offer testimony that the Little Ice Age had finally become serious business and that the moody darkness of Rembrandt had become a physical presence to snuff out the candle of innovation in Holland.

**Pastoral Restraint and Beauty**

Gloomy thoughts also prevented Don Quixote from rousing himself from his deathbed and leading Sancho Panza to a new life as shepherds.

The Arcadian ideal was all the rage in early seventeenth century Europe. Stories about the love between shepherds and their maidens were second in popularity only to the adventures of knights and their ladies. Renaissance Europe had helped to give form to these romances. It had paid homage to the classical cultures and had begun to unearth ancient Greek and Roman art treasures. The European countryside had also been tamed and no longer housed the terrors of the wilds.

In 1635, toward the end of his full life, Peter Paul Rubens purchased the Het Steen, a country estate near Antwerp. There he could live and work in a pastoral setting, removed from the city's ceaseless clamor. He must have loved that place dearly for it forms the setting of one of the great sky paintings, the Autumn Landscape with a view of Het Steen in the Early Morning (Fig. 7-20).
The near dawn setting is appropriate, for this is when altocumulus and cirrocumulus appear most breathtaking. These high clouds are also most common from late afternoon through the night to early morning because they often form near the top of a humid layer of air that has cooled to the point of condensation by radiating its excess heat to space. When the sun is high in the sky, high clouds, much like fog, tend to get `burned off' by the sun.

So long as there is no wind to provide orientation, altocumulus and cirrocumulus consist of the closely packed but unorganized fields of convection cells considered in Chapter 5. Wind shear orients the cells into series of ranks and rows, or wavelike ripples by creating helical or wavelike motions in the air. When the convective overturning dominates the wind shear, helical motions align the clouds into long rows or bands that tend to parallel the shear (Fig. 7-22a). When the wind shear is dominant, wave motions relocate the cloud elements to the crests. The clouds then line up in rows or ripples perpendicular to the wind shear (Fig. 7-22b).

Sometimes, as in the ocean, the atmosphere supports two trains of waves, due to wind shear at two distinct heights. The air motions at cloud level are then a superposition of the individual motions of the two wave trains (Fig. 7-21c). As a result, if the wave trains cross one another, the cloud elements will assume the checkerboard appearance of Fig. 7-20. The possible variations on this theme are innumerable.
Jan Siberechts, a lesser known Flemish artist also filled the sky with banded altocumulus in his *Ford With Cart* (Museum of Fine Arts, Antwerp) before he moved to England in 1670. The bands higher in the sky show a rippled structure that Turner would later use with some frequency, while near the horizon the oblique viewing angle helped fade the detailed structure.

Despite this successful debut, cellular or banded altocumulus did not become part of the artists' repertoire for another two hundred years. Then, rather suddenly, and shortly after the invention of the camera, altocumulus attained a new pinnacle of popularity. We will meet them again.

Rubens painted a number of other meteorological situations. He was one of the most prolific painters of rainbows, which for the most part were done poorly. Most of these rainbows were grafted to the paintings because of their symbolic associations.

Rainbows are central to the *Rainbow Landscape* (Fig. 7-23). Unfortunately, Rubens made the primary bow considerably wider on the right hand side where it is obviously closer to the viewer. Since the angular width of the bow is not affected by its distance this is an example of an oblique rainbow. It illustrates that Rubens allowed a preconception regarding perspective to overrule the imprecise memory of a fleeting observation. In *Modern Painters*, John Ruskin took several other swipes at this bow before excusing the errors as a sacrifice of a `truth of actuality' to a `truth of feeling'. He noted that the light incorrectly comes from the side. But when he criticized Rubens for making the blue part of the bow too dark, he missed the mark. The dark blue band, as George Siscoe has pointed out, is simply the narrow gap between the primary bow and the supernumerary bow.
Alistair Fraser has shown that the supernumeraries result from the slight vertical flattening of falling raindrops and, as a result, tend to be brightest near the top of the rainbow arc. This is precisely where Rubens located his supernumerary. Thus, despite any other rainbow errors, the *Rainbow Landscape* betrays the eye of a remarkable observer, and is just about the only painting of a supernumerary bow prior to the twentieth century.

Rainbows are often produced by thunderstorms and Rubens has shown one of art's few anvil topped cumulonimbus clouds in his Henry IV in Battle of Arques. The anvil is rather small and no rain falls from the flat base to darken the air below, but Rubens definitely saw such a cloud.

Rubens painted a number of dawn or sunset scenes. Usually it is difficult to distinguish dawn from sunset in paintings but in the *Landscape Within a Forest* (Louvre), but the steam fog rising from a stream strongly suggests a dawn setting. Steam fog forms when the air is much colder than the water and is therefore far more common at dawn than at sunset when the air still retains some of the day's heat. This small work is also extraordinary; European painters have long treated mist and smoke but with few exceptions such as the sylvan fogs of Rubens' Flemish compatriots, Coninxloo, Vinckboons, and Jan Bruegel (*The Way to Market*, Kunsthistorisches Museum, Vienna), have seemed largely oblivious to fog until the nineteenth century.
Virtually no other artist until the 19th century exhibited such a sensitivity to the varied moods of the weather as Rubens. Since only a tantalizing glimpse of the output of many early artists remains, it is possible some portrayed a far wider range of weather situations than we are aware of. But most artists appear to have been content to find some method for treating the sky, which they then stuck to for the remainder of their careers. This holds true for some of the greatest artists, including Titian who painted more or less the same skies over and over. Even Jan van Eyck seemed to grow satisfied with his idealized cumulus and, after a certain point, no longer looked to the sky for further inspiration. Rubens was one of the few who never stopped seeking new aerial discoveries.

Claude Gelee or Lorrain may also never have stopped looking at the sky, but he looked primarily for one thing. No artist has contributed more to picturing the Arcadian ideal than Claude, and he did so with almost inconceivably beautiful atmospheric backgrounds. I have loved Claude’s works from the first moment I saw them, long before I ‘knew’ anything about art. His popularity among the viewing public has never faded. Claude has not always been praised by art critics, but landscape artists seem to have held him in awe. Adulation of his art peaked in the nineteenth century when nature was romanticized. Who could say more on Claude’s behalf than Goethe did?

There for once you see a human being of perfection. His thinking and feeling were concerned with beauty. He saw a world with his inner eyes as is not readily encountered elsewhere outside. His pictures are of the highest truth yet contain no trace of actuality. Claude Lorrain knew the real world by heart, down to its minutest details. He utilized it as a means of expressing the harmonious universe of his soul.

Ruskin chided Lorrain for his repetitiveness and his restriction to tame waves and tame skies but begrudgingly admitted, "his aerial effects are unequalled”. Ruskin was compelled to praise Claude - after all, Ruskin's idol, J. M. W. Turner, admired and competed with Claude.

Claude's *The Disembarkation of Cleopatra at Tarsus* (Fig. 7-24) contains the same general features as many of his other works. The time is sunset (it could also be sunrise), when golden and pink overtones enrich the moisture charged, hazy summer air and tinge the fringes of the clouds. The sun often appears in these works, glowing richly but careful never to glare. Claude’s clouds are almost always the fragmentary dissolving cumulus, stratocumulus or altocumulus of late afternoon whose structured form is purposely deemphasized. After all, isn't it the nature of clouds to be soft? These soft clouds seem to be on the verge of disappearing and so, contribute to the dreamlike mood in many of his works.

The mood of Claude’s works may be termed ‘classical nostalgic’. Most of the landscapes with the exception of his port scenes are sparsely populated with widely spaced structures. Claude and his fellow countryman, Nicolas Poussin, tried to recreate and idealize the classical world in their paintings. Both lived in Rome, never wishing to return to their native France. The city they were familiar with was much smaller than the hectic metropolis it once had been in Roman times. The ruins stood here and there, spaced widely and out of the mainstream of all the 17th century action. Judging from these ruins, one would have thought the classical civilizations were built by societies of enlightened villagers living in benignly ordered countryside settings where nature knew her bounds and rarely, if ever tried to exceed them. What urban prisoner, subjected daily to an atmosphere of coal dust, would not wish to enter these landscapes and live there forever?
So, Claude cheated! And he cheated more than a little. The sky can certainly be every bit as beautiful as Claude has shown it but even his greatest admirers knew somehow that Claude had cheated in his landscapes. That is why it became a fashion among the French nobility to walk around viewing the world with a darkened convex mirror known as `Claude glass'. Edgar Allen Poe, who also knew that Claude had cheated, noted that, "No such paradises are to be found as have glowed on the canvas of Claude".

What is the key to Claude's fraud? In nature the possible range of light intensity is enormous. Direct sunlight is thousands of times brighter than dark soil in the shade of a tree, and the directly illuminated sides of objects are tens of times brighter than their shaded sides. The ability to record such ranges of light intensity has not been granted to painters because of the nature of the materials they must work with. Paintings are seen by reflecting light only. They all appear pitch black in a darkened room. The darkest color paints will reflect nearly 5% of the light that falls on them while the lightest reflects about 95%. Thus the greatest possible range of intensities for a painting is thus about a factor of 20.

So painters work within a restricted world and must make the best of it. But Claude purposely restricted this world even further. If you take a photograph facing the setting sun, all other objects will appear black. The human eye is partially able to adjust by viewing the landscape piecemeal. When we focus on the sunlit sky our pupils contract. An instant later we look at the shaded sides of objects and our pupils quickly dilate to allow more light in. But when we look at a painting, we take it all in at once. Somehow, Claude knew he had to provide his sunset scenes with binocular vision and so he illuminated the shaded sides of the buildings far more than they should have been. They tend to appear rather as the sunlit sides of buildings that reflect the golden and pinkish light of the late afternoon. Claude has not given us the truth, but rather the truths of light. He was not the first to do this – look back at Giovanni Bellini's Agony in the Garden - but no one did it better.

Nicolas Poussin, Claude's fellow expatriate in Rome, cheated even more when it came to the sky yet Poussin has been called one of the greatest landscape painters. According to Bonaventure d'Argonne,

One day I asked him how he had attained this degree of perfection, which had won him so high a rank among the great painters of Italy. He answered modestly: 'I have neglected nothing'.

But Poussin sorely neglected the sky, which routinely refused to conform to his classically ordered world. Only the cloud-dimmed watery sun of his Deluge, the ominous winter scene of his Four Seasons (1662-63, Louvre, Paris) gives a hint of greater atmospheric possibilities. The great contrast between the 'soft' Claude and the 'harsh' Poussin has been stressed for over three centuries, and these differences show up in their skies. Poussin's skies have high visibility but often a leaden blue color. His cumulus look
all too solid (they are often used as platforms for mythological figures) and lack the detailed scalloping and shading that might have made them convincing.

Far more convincing skies and humble human scenes were portrayed by another Frenchman, Louis Le Nain. Louis and his two brothers offer us some of the rare glimpses of peasants before the French Revolution and perhaps the first done without an attempt at mockery. Peasants have been shown at work in the fields from the time of the Tres Riches Heures of the Limbourg brothers, but they were always depicted as ugly, gross caricatures. Breugel constantly moved among the peasants but remained above them, often showing them as crude and even laughable. But the emergence of the Arcadian ideal in the seventeenth century allowed Louis Le Nain to portray his `shepherds' with a human touch amid their sober natural setting.

Louis Le Nain was obviously not carried away by classical idealism. Sunny Italy was not the fount and source of his inspiration, as can be seen from his Landscape With Peasants (Fig. 7-25). The sky is overcast, not with raging storm clouds but with the delicately striated, sobering altostratus that often deck the skies of northwest Europe. Altostratus are seldom dramatic clouds and that may account for why they have been so underrepresented in art. But altostratus illuminated the labors, leisure and lovemaking of real Flemings and Frenchmen, and there is love in the Landscape With Peasants.

The Le Nains came from Laon, near Belgium, where altostratus is a way of life. Only a person brought up where the sky is so frequently gray could have rendered such clouds so lovingly. It is crucial to observe that despite the overcast a rich, suffused light still falls on the fertile countryside which almost seems to emit a luminous green glow. Altostratus is seldom very thick, and a considerable amount of diffuse light usually does filter through them unless the sun is low in the sky. Nevertheless, one ineradicable falsehood has been retained - each boy has been allowed to keep his shadow even though altostratus does not permit enough sunlight through to cast shadows.

Fig. 7-25. Louis Le Nain Landscape With Peasants. c. 1640. Washington, DC, National Gallery of Art, Samuel Kress Collection.

**Misty Undercurrents**

Although it was primarily a century of light and clarity - the unlimited visibility and unmistakable horizon line in

Louis Le Nain's preindustrial, overcast French countryside was typical of the times - not all activities of that very diverse century took place in such unadulterated air. The visibility of Dutch landscape paintings underwent great oscillations and Claude bathed his earth in haze. There was also a significant undercurrent of smoke, steam and obscuration that refused to go away and sporadically surfaced.

Throughout the sixteenth century, background mists used in religious paintings attracted at best a limited following. But shortly before 1600, Caravaggio, apparently a troubled and violent man, developed a striking method for highlighting the main characters and their actions. A brilliant light shines on them while the background is cast into utter
darkness. This technique is particularly suited to indoor settings dimly illuminated by candles or oil lamps. But Caravaggio's chiaroscuro was adapted and modified for some outdoor scenes as well, as in Elsheimer's nocturne, *The Flight into Egypt* (see Fig. 6-43) and Rembrandt's Landscape With a Stone Bridge (see Fig. 7-10).

For a decade or more many artists went through a Caravaggiesque stage. But there were always a few souls that preferred the vagueness of mist and smoke to the finality of darkness. A Genoese artist, Giovachino Asseretto painted a scene of *Moses Striking the Rock* (c. 1630). Moses appears distinctly in the foreground but some of the figures a few feet behind him are paled by mist. Meteorologically the work is suspect, for such thick mist is quite uncommon in the desert of Sinai. But the painting apparently had a great effect on several Spanish artists, including Bartolome Esteban Murillo.

![Fig. 7-26. Bartolomeo Esteban Murillo. The Martyrdom of St. Andrew. c. 1675-1682. El Prado, Madrid.](image)

Murillo was intensely religious and the background sfumato suited him to a tee. He used it repeatedly throughout his career with minor variations to suit the mood of the work. Usually, the air is so misty that figures and buildings on the other side of an open square are barely visible. In a number of his paintings, Murillo utilized the dual view of a universe that includes both the sacred and the profane, and therefore both low and high visibility. The divine figures that appear in the sky are always separated from the terrestrial events around them by a brightly illuminated but dense mist that acts like a curtain, just as our intensely
personal and private mystical visions are worlds apart from our public actions and declarations.

Never had visibility on earth been so restricted as it was in Murillo's *Martyrdom of St. Andrew* (Fig. 7-26), one of the last painted hurrahs of revealed religion. The *Martyrdom* is one of Murillo's later and most dramatic paintings. The saint is being tied to an x-shaped cross. An angelic vision appears within a golden aureole in an otherwise gray and misty sky to distract him from his physical agony. All foreground figures are rendered distinctly and are colored brightly with red and gold highlights so as to stand out all the more sharply from the barely visible, fogbound people and classical buildings a few feet behind the main action.

Religious painters were not granted a monopoly on atmospheric obscuration. There are other ways for us to intoxicate ourselves. We can get drunk or fall passionately in a consuming love. When all else fails, we can even engage in a little magic and sorcery. The diffusion of wealth to a larger fraction of society in the 1600's gave more time for such 'leisure' activities and inspired paintings of drunken revelries, heartrending romances or even witchcraft. All of these activities require a bit of obscuration and must take place in an environment completely removed from the setting of our daily affairs. At such times we cannot be allowed to see too clearly.

Fig. 7-27. David Teniers the Younger. The Temptation of St. Anthony. c. 1635. Museum Mayer van den Bergh, Antwerp.
David Teniers the Younger was a Flemish landscape and genre painter of some stature. His *Scene with Bocci Players* (National Gallery, London) contains some of the most convincing painted crepuscular rays. His smoky witchcraft scene, *The Witch* is even more convincing. It shows a woman who has apparently conjured a few more ugly little beasties than she can manage. She fears that the situation is getting out of hand and seems to sense that she may become the victim of her own witchcraft. The scene is set indoors and some of the brown beasts faintly emerge from the dull brown background. Although there is no smoke, the visibility is barely ten feet. As long as the monsters were quiet, no one standing outside the room could possibly be aware of what was going on within. Teniers used the same approach in the *Temptation of St. Anthony* (Fig. 7-27), where brown monsters emerge indistinctly from the brown rock of the cave walls.

Many of the seventeenth century's misty scenes involved more pleasurable pastimes. In 1593, Cornelis Cornelius helped inaugurate a Dutch tradition by painting *The Marriage of Peleus and Thetis: The Banquet of the Gods* (Frans Hals Museum, Haarlem), a Dionysiac revelry in which the distant horizon virtually disappeared. Even Rembrandt got into the act with his *Rape of Prosperine* (1632).

![Fig 7-28. Jacques Blanchard. Angelica and Medoro. 1629 Louvre, Paris.](image_url)

In France, Jacques Blanchard lived long enough to paint some lyrical love scenes such as his *Angelica and Medoro* (Fig. 7-28). Never before in painting had lovers been so
safely hidden from the rest of the world. The two lovers carve their names in the trunk of a tree in a misty forest that cuts off a view of the horizon. Blanchard's *Angelica and Medoro* and Rembrandt's *Rape of Prosperine* both prefigure the great misty love scenes of 18th century French art.

Under Louis XIV, French painters avoided such smoke. Their job was to keep the beloved monarch clearly in the limelight and make monarchy appear as God's choice of government. Henry IV, Cardinal Richelieu and Mazarin had paved the path for the Sun King, whose long reign began in a stew of uprisings but lasted until 1715. When Louis finally took over the affairs of state he became one of history's greatest and most ardent patrons of all the arts.

But while it was a highly creative era for most of the arts, the specific task assigned the painters of the French court narrowed their focus and suppressed independent creativity. Painters took care to conform to the 'classical' style Louis favored because he had plenty of work for them. Distrusting Paris ever since he had been forced to flee during the second Fronde, Louis decided to build a countryside palace at Versailles that would serve as a fitting symbol of the apotheosis of the French Monarchy. Work began in 1661 and from that secure and magnificent vantage point Louis oversaw a revolution that placed France at the forefront of the world's culture.

The painters hired to decorate Versailles were men of remarkable talent but they initiated no revolution in the way we see the world. Their job had been set before them and they carried it out to a tee. But toward the end of his reign, Louis XIV no longer did his job well. After consolidating France, he entertained expansionist notions in the east that only succeeded in winning enemies and troubles. For forty years his armies labored through a desert wilderness of battles in search of a promised land of conquests. Yet, when the dust finally settled, France was bankrupt and its population had dwindled by over 20%. Louis' extravagance in Versailles, his expenditures on the battlefield, and especially the failed harvests during the brutal Little Ice Age weather of the 1690's exacted an immense toll on France. Thenceforth France would be a little less martial. With its guard relaxed, the classical spirit waned and a variety of subversive elements such as the lure of the life of pleasure reared their seductive heads once again. This freed French art for new discoveries.