# COMMENTARIES

*Readers' comments offering substantial theoretical and practical contributions to issues that have been raised in texts published in* **Leonardo** *are welcomed. The Editors reserve the right to edit and shorten letters. Letters should be written in English and sent to the Main Editorial Office.*

## COMMENT ON "ON THE AESTHETICS OF SIERPINSKI GASKETS FORMED FROM LARGE PASCAL'S TRIANGLES"

*Almost anyone can study the (Pascal's) triangle and discover more properties, but it is unlikely that they will be new.*

—Martin Gardner

Pascal's triangle is almost universally famous, although it should more properly be called Khayyam's triangle after the Persian mathematician-philosopher-poet who, in all probability, was its true discoverer. But such are the vagaries of history that even the Encyclopaedia Britannica does not mention it in the biographies of either Blaise Pascal or Omar Khayyam; I will, with no disrespect to Pascal, call it Khayyam's triangle here.

Contrary to Gardner's assertion, new results keep on being discovered; indeed, a multitude of papers in the *Fibonacci Quarterly* attest to the richness of the morphology of this triangle. This is also amply borne out in Pickover's paper (*Leonardo* **23**, No. 4, 411–417, 1990). Attention in this connection is drawn to a recently published monograph by Bondarenko [1]. This work is as yet available only in the Russian language; it is devoutly wished that arrangements will be made for the publication of an English translation by some appropriate learned society in the near future.

As Pickover has mentioned, computer graphics tools are very well suited for discovering the esthetics of Khayyam's triangle. In particular, he has shown the symmetries of the triangle modulo N, where $N > 1$ is a positive integer. In this respect, it must be mentioned that Khayyam's triangle modulo P, where $P > 1$ is prime, is a deterministic fractal with a well-defined similarity dimension [2]; a paper by Long is highly recommended [3]. Even more interesting are the generalizations [4,5] of Khayyam's triangle, which yield intricate patterns when computed modulo N [6]. As a result of Pickover's paper, it is expected that readers will find exploration of Khayyam's triangle and its generalizations rewarding.

I conclude with the following thought: While Khayyam's triangle modulo 1 contains only zeroes, the triangle modulo $\infty$ contains all numbers except zeroes!

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## COMMENT ON "HOW I CAME TO PAINT THE CRAB NEBULA: THE DEVELOPMENT OF COSMIC THEMES IN MY OIL PAINTINGS"

The underlying theme of Berta Golahny's *Crab Nebula* painting (*Leonardo* **23**, No. 4, 363–365, 1990), and two later paintings on the same subject, is creation—specifically, a modern, twentieth-century understanding of the inception and continuing life of the universe from a scientific point of view. It is particularly appropriate that Golahny's painting of the Crab Nebula grew out of her Genesis series based on the biblical seven days of Creation. In seeking to make the *Fourth Day of Creation,* the creation of the sun, moon and stars, more convincing, the artist consulted photographs of the cosmos and the latest discoveries in space exploration. This led directly to a new, scientific interpretation of creation in the phenomenon of a pulsing, exfoliating nebula, tinged with astral, saturated colors and curling, twisting forms that press against the outer limits of the canvas. The coloring effects of magenta, orange, red, green, blue, purple and black have been made more vivid by the juxtaposition of complementary colors and the skillful manipulation of brush strokes to suggest twisting, turning, often translucent shapes and the flux and energy of endless evolution.

This vision of creation invites comparison with earlier views, such as the anthropocentric interpretations of Michelangelo's Sistine ceiling (1508–1512) or Blake's engraving "And the Morning Stars Sang Together" (c. 1821). Here primal energy is personified in God or the Ancient of Days, complete with flowing white beard, or, as Robert Frost so wittily put it, "It's God," said Eve. "I'd know him from Blake's painting anywhere." Even a modern version of space, Robert Rauschenberg's Stoned Moon series, presents photographs of the astronauts exploring the moon; a cosmic vision shaped by the image of humanity.

Golahny's *Crab Nebula,* although primarily abstract in form, does suggest in some of its embryonic shapes future terrestrial life, but its main thrust is to capture the process of creation, a process that takes place both in the creation of the nebula and in the gestation of the painting it-

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self. Like the unfolding manifestations of the nebula, the artist in her year-long creation of the work found the forms and stages dictated by the central configuration. In comparing *Crab Nebula* to the photographs that inspired the work, it is fascinating to see how much more vivid and complex the artist's interpretation is. The photographs appear static; the painting pulses with energy, embodying an endless universe in creation.

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## COMMENT ON "THE METEOROLOGICAL ODYSSEY OF VINCENT VAN GOGH"

Art historians concerned with determining the precise degree of naturalism in landscape painting, and with the identification of sky motifs, will much welcome articles by meteorologists such as that of Stanley Gedzelman on van Gogh (*Leonardo* **23**, No. 1, 107–116, 1990). To his bibliographical notes, one may add the title of one more meteorological publication relevant in art historical contexts [1].

One hopes that Gedzelman's article will encourage a more direct interdisciplinary cooperation between scientists and art historians on similar issues. What the art historian is evidently most interested in when confronted with a work of art relating to weather is what makes that depiction art rather than a mere illustration. Obviously, the artistic value lies, among other things, in a work's formal structure (which also makes art historians cautious when it comes to the use of statistical methods). As a consequence, any degree of meteorological exaggeration in paintings or other works of art tends to vary dramatically from artist to artist, and one wishes for more art historians to overcome scientific phobias (which the present writer admits sharing) and take on the job of defining such variations.

Gedzelman's comment on the problems of identifying van Gogh's sky motifs (p. 115) also leads one to wish for an intensification of dialogue between art historians and their meteorological colleagues. Such a dialogue should include discussion of which painters' works primarily should undergo meteorological analyses, how central an interest in meteorology is to a given artist's work and intentions, if it is innovative, whether it is characteristic of general cultural trends of the time, or how far it matters for the further development of art, and in what other painters' cases the question looks less crucial. Thus, both historically and artistically, works by Romantic painters like Caspar David Friedrich or Karl Blechen—Turner's meteorology has been dealt with recently—or by some Impressionists, seem to have more meteorological potential than those by post-Impressionist painters, even if, as Gedzelman has shown, these can be of meteorological interest (for works of particular meteorological interest, see [2]).

There are some corrections to make to the article concerning art historical detail. For example, the opinion that Constable was as strongly influenced by Luke Howard as Kurt Badt has suggested is not shared by all writers on that artist [3]. Also, Fig. 4 shows a chalk-and-pen drawing by van Gogh, not an oil painting as is stated in the caption; and for reasons too varied to investigate here, one would not want to call the painter an expressionist. Van Gogh scholars may wish to comment on some further aspects of Gedzelman's text, which is a stimulating and productive example of one discipline applying its methods to another field. As such, it prepares the ground for an interdisciplinary approach that reaches out beyond the scope of this particular subject (but also beyond one individual's research capacity).

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## RESPONSE TO URSULA SEIBOLD'S COMMENT

I concur with Ursula Seibold's comments that meteorological analysis of paintings may prove helpful to art historians. Identification of the naturalistic content of a work should represent a first step in any artistic analysis because it is necessary to know *what* the artist painted before comments on it can be made. If a painting contains a dramatic sky that closely resembles one seen in nature, the probability is virtually 100% that the artist based it closely on an actual observation. In such a case, even if the artist used this sky for some dramatic purpose or invested it with symbolic or iconographic significance, his or her first responsibility was to remain faithful to the observation. The meteorologist here can help the art historian by identifying scenes taken from nature and then describing what the artist saw and the likely conditions under which the phenomenon was observed.

A close photographic analog for a painted sky may provide the best guide to what the artist was doing. The finding that Leonardo da Vinci's late drawings *Deluge* represent astonishingly accurate extrapolations of an actual phenomenon—the thunderstorm downburst and its outflow vortex—casts serious doubt on much of the commentary regarding these works and Leonardo's state of mind while doing them [1]. The aging genius had in fact never lost touch with reality as has sometimes been implied; he had instead found a new way to point out its far reaches to his fair-weather Renaissance contemporaries and to future generations.

Most paintings of the sky represent generalizations of observations in which the artist has exercised certain preferences and employed certain concepts. Sometimes the subtle differences between the natural phenomena and their painted counterparts can be used to identify these preferences. No climatological motive exists for the low visibility of so many eighteenth-century paintings, and the fact that visibility scarcely decreases with distance in these works reveals that the use of obscuration was not primarily meteorological. Optical phenomena such as rainbows can be used to provide an acid test of whether artists reproduce their observations directly or change the vantage points, for rainbows do not decrease in size