Van Gogh, Turbulence and Llamas

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Arguably Van Gogh's "Starry Night" is the most instantly recognizable painting in the world. It was painted towards the end of Van Gogh's life, in 1889, roughly a year before his suicide. He was already suffering from severe mental health problems, probably bipolar syndrome, exacerbated by his consumption of absinthe. He was living in poverty, having sold exactly one of his paintings[1] and had quarrelled with his friend, Paul Gauguin. It is easy to dismiss the paining as a fever-dream of someone spiralling into madness.

An interesting technical analysis of the painting by Ma et al has gained a remarkable amount of publicity. At least ten popular versions of the article have been published; in particular it has been summarized with admirable succinctness by Katie Hunt from CNN. The article suggests, via an analysis of the brush-strokes in the painting, that Van Gogh had a profound insight into turbulent flow in liquids, that was not realized in physics until the discovery of Kolmogorov scaling in the 1940's. If

[1] The current record for a Van Gogh painting is M$117 for "Verger avec cyprès"

correct, this would be truly remarkable, since turbulent flow is a notoriously hard problem, and there is even doubt as to whether solutions exist in general.

When we look at this issue, there are really two problems. The first is “What was Van Gogh trying to represent in ‘Starry Night’?”. But there is a more general question: “Can we trust a modern interpretation of a painting done many years ago?”. We will look at some examples.

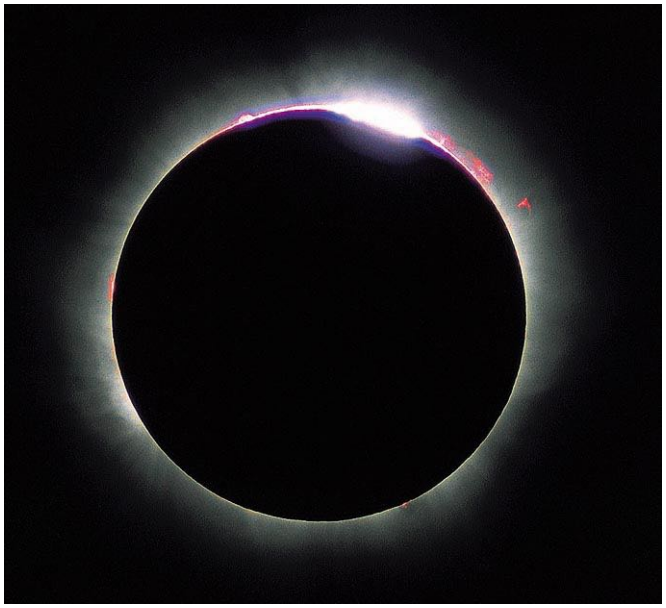
The Scrovegni chapel in Padua is an undistinguished building on the outside, but the murals on the inside show the life of Christ in luminous detail. Perhaps the best known is the “Adoration of the Magi” (c 1305), where Giotto has painted the classic scene, central to the Christian faith.

There are two features to be examined in detail. He has painted the star of Bethlehem, mentioned in the Gospel according to St Matthew, above the manger as a comet. Almost certainly this is based on Halley’s comet, which returns every 75 years, and Giotto would have seen it in 1301 when it was prominent for an extended period. It is a good rendition of the comet before perihelion, with a bright coma and short tail. Not surprisingly, it has been speculated that Halley’s comet WAS in fact the star mentioned in Matthew’s gospel, but the closest return was in 12 BC, which does not gybe with the date of the

birth of Christ.

However the animals in the paining are a little more problematic. With a long straight neck, pointed ears and a smooth coat, they closely resemble llamas, which would be truly remarkable since they could not have become familiar to Europeans until two centuries later! Obviously no one would seriously believe that Giotto was sufficiently prescient to predict this. They are not horses, since Giotto lived in medieval Italy and there are perfectly acceptable paintings of horses elsewhere in the Scrovegni. Hence the only conclusion is that they are intended to be camels, but painted by someone who has never seen one!

A later painting by Cosmas Damian Asam (1735) celebrates the life of St Benedict. He was a wandering monk, who founded the Benedictine order[2] and the monastery in Monte Cassino in 529 AD. He was rewarded by an eclipse a few years later, and over a thousand years later, Adam celebrated this event with a painting, which is now in Weltenburg, in Germany.



Asam would have witnessed a total eclipse in 1733, visible in Northern Italy., and his work is notable for two reasons. Firstly he shows the solar corona: a ring of faint light round the sun. It can be thought of as the solar atmosphere, and is so faint that it can only be seen with the naked eye during an eclipse. Secondly you can see the so-called “diamond ring effect” or “Bailly’s beads”. At the end of totality, the sun shines through valleys on the edge of the moon while most of the light is blocked by lunar mountains.

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[2] The order is responsible for the liqueur, Benedictine, but not, as far as I know, Eggs Benedict.

Ippolito Caffi, *View of Venice with the Eclipse of 8 July 1842,* oil on canvas, c.1842)

Obviously Asam could not have understood either effect but it is notable that he reproduces both of them correctly, even though the diamond ring is only visible for a few seconds at the end of totality.

By contrast, another painting of an eclipse by Ippolito Caffi is wretchedly bad. The view of the city of Venice with the spectators is correct, but the lighting produced by the mostly eclipsed sun is totally wrong. Perhaps the oddest aspect is that as an artist, Caffi must have understood the behaviour of light, but he nevertheless managed to produce a painting of something he could not possibly have seen.

The year 1858 was notable for a particularly bright comet, known as Donati's comet.

Donati's Comet over St. Paul's, London

Donati's Comet over Paris

There are a number of paintings of the comet. The painting of the comet over London, by an unknown artist, and Paris, published in a book by Guillemen, must have been done almost simultaneously. Both show Arcturus, in addition to part of Ursa Major. What is impressive, in addition to the consistency between the two paintings, is that they show three tails. which we would now interpret as a dust tail (heavy particles), a gas tail and an ion or plasma tail. Needless to say, these were not understood at the time.

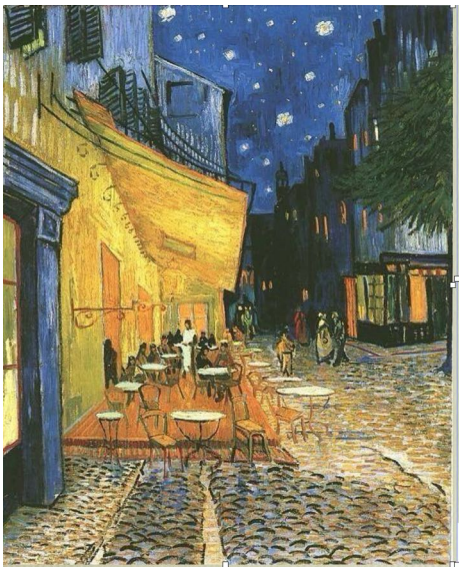
Van Gogh, *Starry Night over the Rhone,* 1888, Musée d'Orsay

"Starry Night" obviously leads to difficulties of interpretation. Quite simply, Van Gogh has filled the sky with swirls of light that do not resemble stars. However he was genuinely interested in astronomy. This is most obviously shown in a slightly earlier painting, "Starry Night over the Rhone", which shows an easily recognizable Ursa Major. An 1890 painting "Venus over the White House at Night" shows less detail but does allow the identification of the house and hence, from the position of Venus, the approximate date and time the picture was painted.

Venus in ***White House at Night*** 16 June 1890 Hermitage Museum, St. Petersburg.

Undoubtedly his second best known painting is "Cafe at Night". This is a well-known cafe in Arles, now known as the Van Gogh café! The trial sketch he made for this, available in his notebooks, does not show any stars. In a letter to his brother, he comments that he wanted to find a realistic

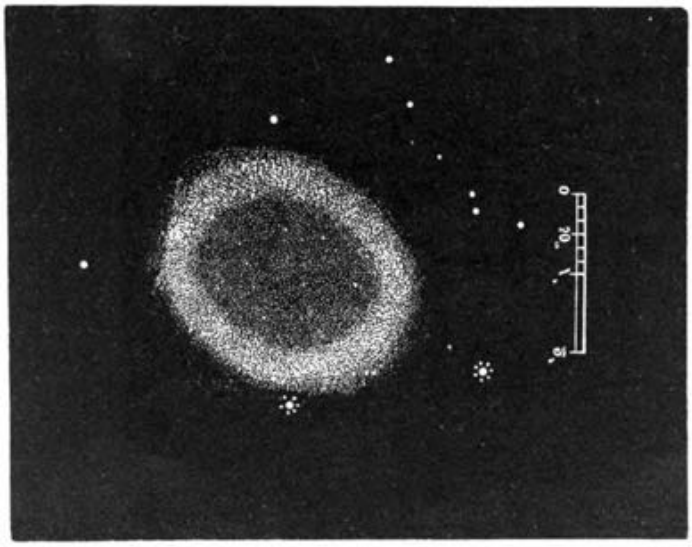
picture of the heavens, not just a random assortment of stars. Thanks to the work of Paul Luminet, the stars can be identified as the constellation Aquarius, and again the stars are placed correctly. Note that all of the paintings show stars with halos: it is possible that Van Gogh suffered from visual problems.



Preparatory study for the painting, September 1888. Dallas Museum of Art, The Wendy Emery Reves Collection.

The end of the 19th century was a time when people were becoming fascinated by astronomy. The French astronomer, Camille Flammarion, had published “Astronomie” in 1880. This was probably the first really popular book on Astronomy written by a professional. It was a best seller, and would undoubtedly have been available in bookstores in Arles. Again we know from his journals that he frequented these and spent money that he could not afford on books. The state of knowledge at the time is well summarized in a textbook, General Astronomy, by Charles Young, of Princeton, published in 1890. [3] Allowing for obvious gaps in knowledge, both books are remarkably accurate about the solar system and many features of stars, but are totally wrong when discussing the universe on the largest scale.

Camille Flammarion, “Spiral Nebula,” *Astronomie populaire,1889*



The first big telescopes had been constructed, and in particular the Earle of

[3] Both the Flammarion (in translation) and Young texts are available on Gutenberg

Rosse's drawing of the "nebula" M51 (the Whirlpool) was well know: both Flammarion and Young reproduce it in their books. At the time we did not know what M51 was, but Young in particular has an extended discussion of what nebulae are. He states, quite correctly, that there is a central star in the Ring nebula (M57) and his sketch shows this. We now know M57 is a so-called planetary nebula, the dying remnant of a sun-sized star which has become a dim white dwarf in the process.

It is then quite reasonable to extrapolate this idea to other nebulae, without realizing that they are fundamentally different objects on a totally different scale. In particular we can look at the sketch of M51 and see it as a central star, a dimmer star in orbit round it and a swirling gaseous 'nebula' filling up the space between them. It was not until the 1920's, when Edwin Hubble was able to observe individual stars in M51, that we realized that it is a spiral galaxy like our own Milky Way. Armed with this knowledge, we realize that Flammarion and Young were more or less correct in talking about the distance to some nebulae, such as M57, as being a few hundred light years. They were wrong, by a factor of around a billion, in talking about the scale of those that we now know are galaxies.

So it is safe to assume that Van Gogh knew the night sky well, and it is likely that he would have at least browsed through Flammarion's book or something similar in Arles. It is not unreasonable that he carried the images home in his (now fevered) brain and imagined what it would be like if he could see one of these extraordinary "stars" above the landscape around Arles.

He painted "Starry Night" in 1889. I have taken the Flammarion drawing and superimposed it. The match is obviously not perfect. A recent NASA image of M51 fits

even better, but Van Gogh did not have the Hubble telescope as a source!

So, given that we know Van Gogh had a lifetime interest in astronomy, it is overwhelmingly probable that a picture entitled “Starry Night” shows pictures of (imagined) stars, not turbulent flow in viscous liquids! The moral is clear: we should not superimpose 21st century knowledge on 19th century impressions.

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