

Ophthalmology and Art: Simulation of Monet's Cataracts and Degas' Retinal Disease

Michael F. Marmor, MD

Much has been written about the failing vision of Edgar Degas and Claude Monet, and theoretical arguments have been made about the extent to which it was or was not a factor in their late style.¹⁻⁷ Contemporaries of both Degas and Monet noted that their late works were strangely coarse or garish and seemed out of character or even unfitting relative to the finer works that these artists had produced over the years.^{8,9} To better understand what Degas and Monet were facing in these late years, it would be helpful to know how they actually saw their world and saw their canvases. This article uses medical knowledge and computer simulation to demonstrate their perceptions and show the relevance of their different diseases and styles of painting.

METHODS

To simulate the effects of disease, an image of a near acuity test card (Lighthouse for the Blind, New York, NY) was modified in Photoshop (Adobe Systems, San Jose, Calif). Gaussian blur was applied first to fog the chart in correspondence with different levels of visual acuity judging by the last line that remained readable. Then, brunescence was simulated (from clinical experience) by removing blue (effectively adding a yellow filter) and darkening the image. **Figure 1** shows the visual acuity chart as it might appear with a brunescient cataract with a visual acuity of 20/200. Finally, blur and filter settings appropriate to different stages of Degas' and Monet's eye disease were applied to photographs of Monet's garden and to works of art.

DEGAS

Degas (1834-1917) probably had a progressive retinal disease that caused central (macular) damage.^{3,10,11} The primary effect of such disease is visual blur (poor visual acuity). Degas remained able to walk around comfortably late in life, which suggests that the damage did not involve the retinal periphery. There was never any indication that he had cataracts, although these would have been easily recognizable and operable during his lifetime.

Degas first talked about "infirmity of sight" in the mid 1880s, although he was still able to read the newspaper. From clinical experience, one may surmise that his visual acuity was in the 20/40 or 20/50 range.¹² By the 1890s, Degas was making frequent reference in his letters to poor eyes and difficulty in reading and writing, and his handwriting enlarged and became less regular. His visual acuity had probably fallen to the range of 20/100 to 20/200. By the turn of the 20th century, he was quite disabled with visual acuity of 20/200 to 20/400. Remarkably, however, he continued to do pastels until he had to move out of his familiar studio in 1912.

Changes in Degas' style correlated rather closely with this progressive loss of vision. His works in the 1870s were drawn quite precisely with facial detail, careful shading, and attention to the folding of ballet costumes and towels. As his visual acuity began to diminish in the 1880s and 1890s, he drew the same subjects, but the shading lines and details of the face, hair, and clothing became progressively less refined (**Figure 2A, B, and C**). One study¹³ showed that the spacing of his shading lines increased in proportion to his failing visual acuity over nearly 3 decades. After 1900, these effects were quite extreme and many pictures seem mere shadows of his customary style (eg, **Figure 2C**). Bodies were outlined irregularly, images were marred by strange blotches of color, and there was virtually no detailing of faces or clothing. Nothing in

Author Affiliation: Department of Ophthalmology, Stanford University, Stanford, Calif.



Figure 1. Visual acuity chart showing the blurring and color effects of a disabling brunescant cataract with a visual acuity of 20/200.

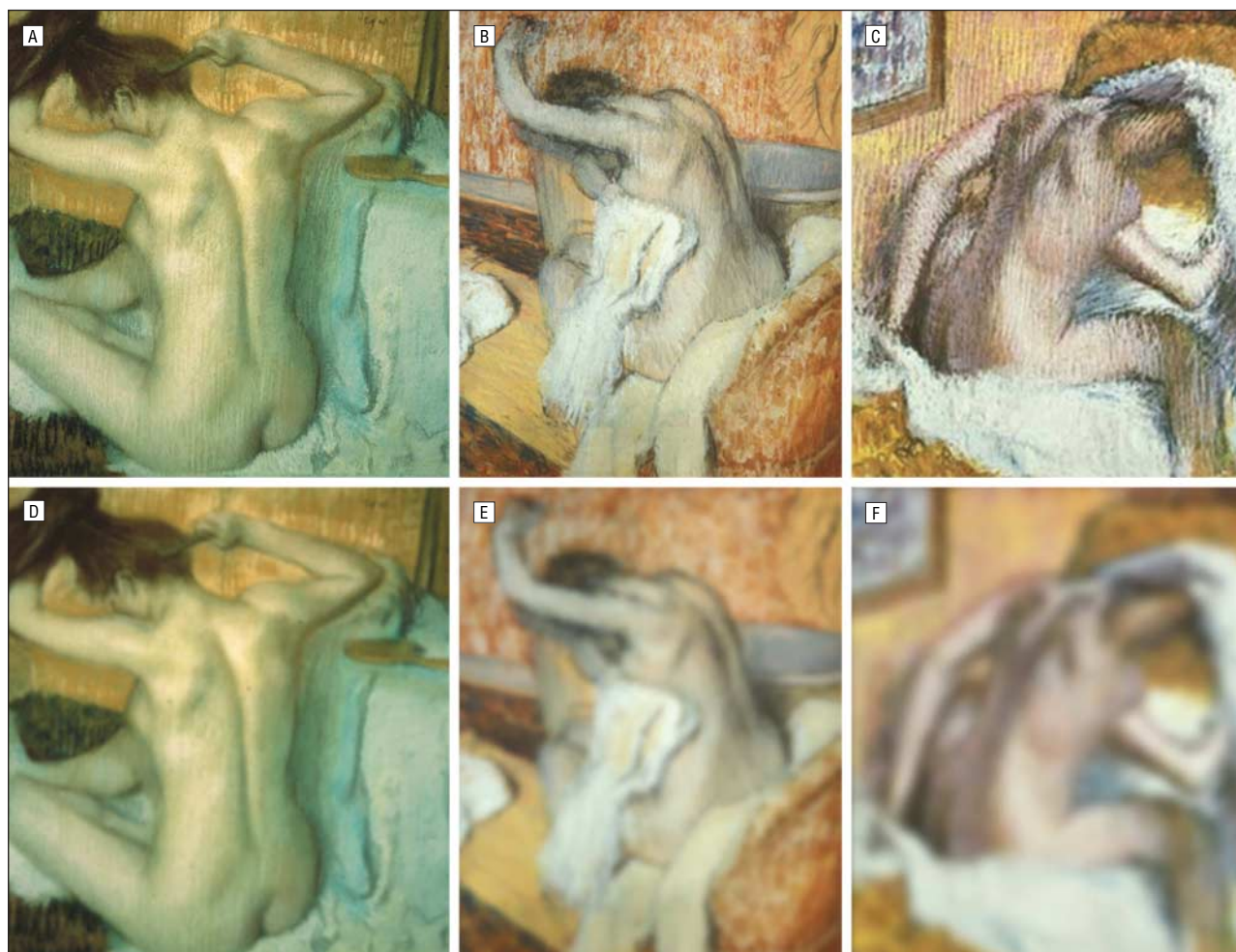


Figure 2. Degas' paintings of nude bathers, showing the change in style (less refinement) over the years from approximately 1885 to 1910. A, *Woman Combing Her Hair* (1886; pastel, 55 × 52 cm); Hermitage Museum, St Petersburg, Russia/Bridgeman Art Library. B, *After the Bath, Woman Drying Herself* (1889-1900; pastel, 68 × 59 cm); Samuel Courtauld Trust, Courtauld Institute of Art Gallery, London, England/Bridgeman Art Library. C, *Woman Drying Her Hair* (1905; pastel on paper, 71.4 × 62.9 cm); Norton Simon Art Foundation, Pasadena. The same paintings were then blurred to the level of Degas' eyesight at the time of the painting. D, *Woman Combing Her Hair* blurred to a visual acuity of 20/50. E, *After the Bath, Woman Drying Herself* blurred to a visual acuity of 20/100. F, *Woman Drying Her Hair* blurred to a visual acuity of 20/300. Note that the shading appears more graded and natural in the blurred images than in the original works.



Figure 3. Monet's lily pond and the Japanese bridge at Giverny, France. A, Photograph of the bridge as it appears today (courtesy of photographer Elizabeth Murray). B, Monet's *Water Lily Pond*, a painting of the pond and bridge before any visual symptoms (1899; oil on canvas, 89 × 92 cm); National Gallery, London, England/Bridgeman Art Library. C, The same photograph of the bridge, blurred as it might appear through a moderate nuclear sclerotic cataract. D, The same photograph of the bridge as seen through a disabling cataract with a visual acuity of 20/200.

Degas' correspondence indicated that he was consciously trying to be more expressionistic or abstract; in fact, his pastels were drawn on larger and larger expanses of paper as he struggled to work. One critic wrote that "these sketches are the tragic witnesses of this battle of the artist against his infirmity."¹⁴ One may reasonably ask whether Degas intended these images to appear to us the way they do and why he continued to work when the product seemed so out of line with his traditional style. Some answers may lie in the recognition of how these works appeared to him.

Figure 2D, E, and F show these same works adjusted (through computer simulation) to the level of Degas' visual acuity at the time that he made them. These simulations do not alter colors since color discrimination loss with maculopathy is usually mild and is not consistent. The striking finding is that Degas' blurred vision smoothed out much of the

graphic coarseness of his shading and outlines. One might even say that the works appear "better" through his abnormal vision than through our normal vision.

How can this be? It reflects, in large measure, the particular style of Degas' work. He was not recording precise landscapes or portraits as were Rembrandt or Cassatt (who stopped painting when cataracts blurred her vision). Degas' main concern was the shape and posture of his subjects and their setting in space, and these characteristics are easily discernible even with poor vision. Although he must have known through tactile feedback (and perhaps by close-up examination) that he was using coarser lines, when he stood back to look at the works, he saw well-shaded nudes and dancers. I suggest that this curiously beneficial effect of visual loss, relative to Degas' style, helps to explain why he continued to work. To him, these late works looked simi-

lar to his earlier ones, and he could not effectively judge or understand the impression these works would make on viewers with normal vision.

MONET

The situation was different for Monet (1840-1926). We know from medical records and correspondence that he had cataracts that worsened steadily over the decade from 1912 to 1922.^{4-6,15} Slowly progressive age-related cataracts (nuclear sclerosis) manifest as yellowing and darkening of the lens that are directly visible to an examining ophthalmologist and have a major effect on color perception as well as visual acuity. The visual simulations of this study are based on estimation of the lens discoloration that is typically associated with differing levels of visual acuity loss from chronic nuclear sclerotic cataracts.

Monet was aware of his failing vision in 1912 and consulted several different ophthalmologists, who diagnosed cataracts.^{4-6,15} Surgery was recommended for the worse eye, but Monet was very resistant even though the operation was well established and relatively safe at this time. Interestingly, he was worried that his color perception would be altered by the surgery (although one might argue that it would become more normal). Since Monet only described slightly reduced vision and was having no major difficulties with his art or his personal life, his visual acuity in 1912 was probably no worse than 20/50.

By 1914 to 1915, Monet's visual difficulties were becoming more serious. He wrote that "colors no longer had the same intensity for me . . . reds had begun to look muddy . . . my painting was getting more and more darkened."⁹ He felt that he could no longer distinguish or choose colors well and was "on the one hand trusting solely to the labels on the tubes of paint and, on the other, to force of habit."⁹ He could still read and write with effort, so I would estimate that his visual acuity in 1918 was near 20/100. However, the yellowing of his lens caused greater difficulty with his art than the blur. **Figure 3A** and **B** compare a photograph of Monet's garden and a painting of the scene from 1899 (when his vision was unimpaired). **Figure 3C** shows the garden as it would have appeared to Monet around 1915. Most colors are still distinguishable, but there is an overriding yellowish cast and a loss of subtle color discriminations. **Figure 4A** and **B** show a water lily painting from 1915 to 1917 as it appears to us and as it would have looked to Monet at that time.

I must digress at this point to note that artists can respond in several different ways to a yellow filter (cataract) in front of their world, and one cannot predict necessarily how it will influence their art. Because cataracts are chronic, a patient may not be aware that the world looks yellowish (as there are no normal colors with which to compare). However, whether an artist recognizes the yellow bias or not, there will be a choice between painting a yellowish world or adding extra blue as compensation (eg, to make the sky



Figure 4. Water lily pond. A, Monet's painting *Waterlilies* done with moderate cataract (1915; oil on canvas, 130 × 153 cm); Musée Marmottan, Paris, France/Bridgeman Art Library. B, The same image blurred as it would have appeared to Monet through the cataract. C, Monet's painting *Morning With Weeping Willows*, detail of left section, done after the cataract was removed (1915-1926; oil on canvas, 200 × 425 cm); Musée de l'Orangerie, Paris/Giraudon/Bridgeman Art Library.

appear "properly" blue). Furthermore, the artist may mix these techniques with Monet's approach of painting by experience and choose colors from habit rather than observation. The idea that the artist will self-correct, ie, choose colors by matching the canvas to the scene, does not hold because certain colors that are different on the palette will look the same through the cataract (eg, yellow and white).

Between 1919 and 1922, Monet was fearful that he might have to stop painting. He would only paint during certain hours when the lighting was optimal, and he was well aware that colors were lost in the yellow blur of his vision that made his garden appear severely monotone (**Figure 3D**). His visual acuity was recorded in 1922 to be 20/200 in the better eye.

As with Degas, we find striking changes in the style of Monet's paint-

ings during the period of progressive visual failure. Compare paintings of the lily pond done in 1899 (**Figure 3B**), in 1915 to 1917 (**Figure 4A**), and around 1922 (**Figure 5A** and **C**). These late paintings are almost abstract in the applications of paint and show a predominant red-orange or green-blue tone that is quite different from the subtle color shading that characterizes Monet's earlier Impressionistic work. As with Degas, there is nothing in Monet's correspondence to suggest that he had any intention of mimicking the abstractions and distortions explored by other painters in the early 20th century.

However, visual failure affected Monet differently than it affected Degas. Monet's mature style was not dependent on the outlining of figures or the subtle shading of figures and clothing, and his applications of paint were larger than those of Degas.

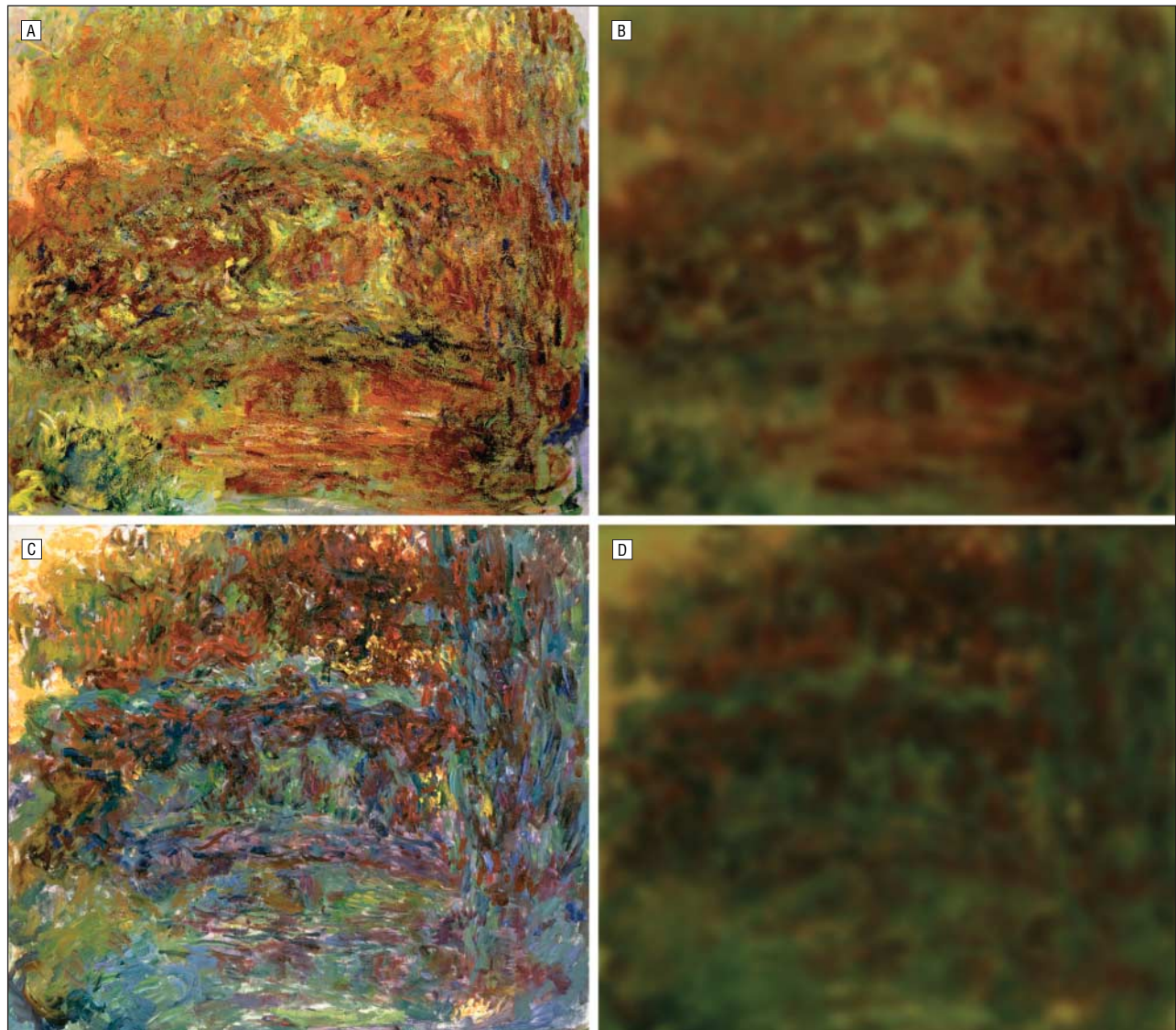


Figure 5. Monet paintings of the pond and Japanese bridge done about the time of his most severe visual disability. A, *The Japanese Bridge at Giverny* (1918-1924; oil on canvas, 89 × 100 cm); Musée Marmottan, Paris, France/Giraudon/Bridgeman Art Library. This version was done with a predominance of orange. B, The image as it would have appeared to Monet through a disabling nuclear sclerotic cataract with a visual acuity of 20/200. C, *The Japanese Bridge at Giverny* (1918-1924; oil on canvas, 89 × 100 cm); Musée Marmottan, Paris/Giraudon/Bridgeman Art Library. This version was done with a predominance of blue. D, The image as it would be seen through a disabling cataract with a visual acuity of 20/200. Note the surprising color constancy of B and D despite the marked differences between A and C.

When we look through Monet's eyes at the late paintings, we see that although he would have recognized the relative coarseness of his brushstrokes, he could not recognize the true colors of his paintings. In 1914 to 1917, his color perceptions were dulled (Figure 4A and B), but toward 1922, images that are strikingly orange (Figure 5A) or strikingly blue (Figure 5C) were to him almost indistinguishable as a murky yellow-green (Figure 5B and D). Even if he painted these works according to habit, he could not judge the effect that he was having on the viewer, nor could he refine the works without risking errors in judgment.

It is very difficult for us a century later to know whether these works appear to us as Monet wanted them to appear. Monet finally acquiesced to cataract surgery, which was performed in 1923. Afterward, he destroyed many of his late canvases. Many of those that remain do so only because they were salvaged by family and friends. Virtually all of his paintings in this late style are undated, but there is a *Japanese Bridge* dated 1919 and a *House and Garden* dated 1922, which leads me to believe that these late-style works were done during his period of severely impaired vision. Of course, we do not know the degree to which

Monet accepted or liked these salvaged works, and we also do not know whether some of these canvases might have been reworked after his cataract surgery.

Monet did very well with cataract surgery and regained acceptable reading vision. He was acutely aware of changes in color perception in the eye that underwent surgery, and he complained vigorously for more than a year that the world appeared either too yellow or too blue.¹⁵ He finally regained confidence in his view of the world in 1924 and worked vigorously to refine the great *Water Lily* canvases now hanging in the Musée de l'Orangerie, Paris, France. It must

be noted that the style of these “grand decorations” clearly harkens back to that of his earlier paintings (compare Figure 4C with Figure 3B and Figure 4A). Thus, it seems unlikely that he had adopted or espoused his broader style from 1919 to 1922 entirely by free choice or that he was entirely pleased with it.

COMMENT

With respect to seeing scenes or subjects, Degas had fewer problems than Monet, even though Degas’ visual acuity fell to lower levels. His main subject was the female form, which was large relative to even poor levels of visual acuity so that his visual loss was not an impediment to planning the organization of his pictures. The situation was more complicated for Monet. The blurring of vision from his cataract was not an impediment to the organization of his pictures either, but the loss of color perception created a major problem. His goal in painting was to highlight variations among times of day, seasons, lighting, and shadows. These judgments became nearly impossible during the several years prior to his cataract surgery. He could use memory from 50 years of experience as a painter to choose colors and to try to create an impressionistic aura. However, we know that he took canvases outdoors when the lighting was favorable, so he must have felt that even distorted observations were still relevant.

With respect to the application of pastel or paint, both Degas and Monet struggled when their visual acuity fell to levels at which it was difficult to paint details. Degas produced coarser shading lines and less refinement in the outlining of his subjects, and Monet began to create his freer style even before he was strictly forced to do so. Degas had for many years used a limited number of colors in his works and these were often rather bright, so that even if his color perception was not entirely normal with his maculopathy, this was not a major impediment to his technique. Monet, in contrast, must have struggled mightily as he looked out into a murky yellow-brown garden and tried to decide what subtle impression to create on the canvas. He recognized

that he could not see colors well on his palette and chose tubes by their labels. However, he could not mix colors by observation or make refinements that had been a major part of his technique. The use of colors directly from the tube may account for some of the curiously intense colors in his late works.

With respect to the impact of visual loss on the artists’ judgment, we again find differences between Degas and Monet. The effect of Degas’ maculopathy was to blur his own view of the coarse shading and poor delineation in his late works so that they would appear smoother and more normal to him than to us. This blurring of the works, given Degas’ particular style, may have encouraged him to continue to paint with failing vision and accounted in part for his acceptance of (or at least willingness to complete) works that seem curiously crude to our unblurred eyes. Monet did not have such luck with respect to his cataracts. The blurring of vision did not seriously alter his basic Impressionistic style, but his cataracts severely changed and challenged the marvelous qualities of color in his works. From his correspondence, we know that he was aware of his altered color perception and that he thought he was compensating. However, it is very difficult to know how well he achieved this since he could not judge for himself the canvases he created. If, in fact, he was pleased with what he saw, then we with normal vision are not seeing what he intended.

It is important to emphasize that I have described the effects of retinal damage and cataract on Degas and Monet because we have good historical documentation of the visual loss that afflicted these 2 great artists. If we did not have such medical records, it would be hazardous and inappropriate to try to recreate their diagnoses from the art itself. Art is created for many reasons, including aesthetics, cultural conditions, and economics, and artists may choose different colors, degrees of representation, and styles. It would be presumptuous, for example, to assume that nonrepresentational painting implies poor visual acuity or that painting with strong colors (or a lack of

color) implies that the artist has cataract or color vision abnormalities.¹⁶ The observations described in this article show how known visual disability would have altered the perceptions of Degas and Monet. By recognizing how the world appeared to them, we can better appreciate their struggles and their accomplishments and place their late art in a proper context.

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Correspondence: Michael F. Marmor, MD, Department of Ophthalmology, Room A-157, Stanford University Medical Center, 300 Pasteur Dr, Stanford, CA 94305-5308 (marmor@stanford.edu).

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