Ocular disease and refractive status can affect visual perception. Utilizing the known ocular histories and analyzing their styles, we can apply these basic optical principles to the works of the greatest artists throughout history.

**USE OF COLOR IN ART** - based on the ability to match one color to another-mixes pigments to match subject. Match might be off to convey mood or achieve contrast to another object.

Hard to differentiate color style from necessity- what they see and what expected to see-grass is green. Discussion of complement after-images.

**Pointillism:**
Depending on the number of cones stimulated, determines the softness or boldness of colors. If a splotch of paint stimulates more than one cone at a time, the colors are additive: small dots or far away from subject- soft colors. A splotch that stimulates one cone at a time has relative contrasting components to its neighboring cone and the contrast is depicted more boldly or vibrant: produced with large dots or closer viewing distance.

Seurat “Le Grande Jatte” (1887)

**COLOR VISION DEFICIENCY**
10% of men have some degree of altered sensitivity of reds and greens- only few cannot distinguish red

Painter is at a disadvantage – or viewer may see it as individualism or style.

Sculptor – an advantage not distracted by color, concentrate on form

Military- use this to help recognize difference in brightness/texture from surround
COLOR DEFICIENT PALLETTE
SEVERE RED – GREEN- Palette appears essentially comprising of 2 colors BLUE.

Artists with Congenital Color Deficiencies:
Charles Meryon (1821-1868) (and Paul Manship) – realized as young men so they switched to other art forms.
  Ghost Ship- early pastel that lacks color and diversity-dominated by yellow and overly blue-lacks any green tones to it.
  Able to depict contrasts in light and dark and thus etchings showed great texture.
  Le Petite Pont in B/W Sometimes used red ink

CHANGES IN COLOR PERCEPTION
Due to cataract formation, as the lens yellows, a person progressively sees a more yellow world and looses the brightness of blue since it is absorbed.

If the wavelength cannot reach the retina, it doesn’t contribute to perception therefore not matched. The warmer colors are attenuated and matching will be attenuated by reddish/brownish.

Or a painter might use more blue to compensate from memory of color. The most intriguing example of memory colors is Leonard Davinci: The Virgin and the Rocks painted 20 years apart.

CATARACTS also produce changes in detail:
  Titian: brilliant blue sky and detail in Bacchus and Ariadne (1520) vs. the broadened strokes and browed coloration of Christ Crowned with Thorns (1570) and finally Pieta (1576) “no painter before Titian had ever attempted to convey lack of precision which characterizes the vision of the aged.”.
CONTRAST AND FINE DETAIL

The finer the detail, the greater the contrast needed to render it visible - can’t read in dark but can pick out a tree. As we age, the ability to resolve fine detail diminishes no matter how high the contrast.

Gross detail does not diminish- Rembrandt gave up fine etchings when he reached his 60s- Reduced contrast sensitivity due to:

1. Pupil <3 is optically less efficient
2. loss of receptors
3. Cortical atrophy
4. lens changes.

Claude Monet (1840-1926): Impressionism becomes Abstract Expressionism

Distinct changes in his style – although slow- and it is known he had cataracts. Late paintings depict the world in broad swirls and slashes and up close the forms disappear.

A discussion on the development of his cataracts and how it affected his paintings
Early cataract surgery technique and post-op complications discussed

Water Lily Garden (1900) age 60  Japanese Footbridge (1923) age 80
House of Giverney (1923) - Subject is barely recognizable and painted within 1 year of surgery.
Development of a hypermature cataract and his struggles to consent to surgery. His surgical treatment and post-operative treatment and art-work:
The House Seen from the Rose Garden (1923) post-op
Post Op MRX: +10.00 +4.00 x 090 = 20/30. Never had fellow eye done.
“ If I am condemned to see nature as I see it now, I’d prefer to be blind and keep my memories of the beauties I’ve always seen.”

Mary Cassatt (1844-1926)- Great Impressionist
Suffered from diabetic retinopathy and cataracts with poor surgical outcome
“The Boating Party” (1893)        “Mother, Young Daughter and Son” (1926)
Many themes on family life with increasing broad strokes.
PRESBYOPIA

The development and inappropriate correction of presbyopia can effect the style and media of an artist at any period in history.

**Euphronius (c.540-479 BC)**

“Sleep and Death Lifting Sarpedon” found in a krater c 515 BC.

Developed color reversal techniques with great details requiring a subject and closer working distance. Changed media to sculpture around 500 BC.

ASTIGMATISM

**El Greco - first great Spanish painter**

Elongated and isolated figures which exist in a strange space and appeared to be floating. Very original however it shocked many who some thought he was crazy. He was just an astigmat.

*St Martin and the Beggar  St Andrew*

Arguments in favor of his style attributing to astigmatism:
1. Artists distort in one direction - a circle looks like an ellipse
2. If an astigmatic lens is used to view an *El Greco*, the abnormal elongation disappears.

Arguments against astigmatism
1. Could be stylistic - influenced by Byzantine art
2. Should be in 1 direction - hand shows horizontal 3)
3. Astigmatism does not change over time - his style does 4)
4. One painting shows normal proportion inferior and elongation superior
5. Distortion is a spectacle aberration
6.

ANTERIOR SEGMENT DISORDERS

Recurrent infections can effect the environment they work in and cause blurred vision.
Camille Pisarro (1830-1903) suffered from NLD obstruction

“The Roofs of Old Rouen, Grey Weather 1896

Elevated pressure or corneal edema can cause halos, starbursts

Street drugs and Medications can cause color vision changes

Vincent Van Gogh (1853-1890) ocular etiology is unknown however halos around lights and intermittent use of excessive yellows have been postulated to have some systemic origin: VD, manic-depression, drug use.

“The Night Café” “Portrait of Dr. Paul Gachet” “Starry Nights”

“Oh yes, he loved yellow, this good Vincent, this painter from Holland those glimmers of sunlight rekindled his soul, that abhorred the fog, that need the warmth”

A fine line between crazy and genius

MACULAR DISEASE

Patients with macular disease require great color desaturation to make up for washed out appearance and therefore begin to use intense colors used later in life.

Blue cones are concentrated in the macula and therefore there is an avoidance of blue-predominance of red in latter works.

There is also a loss of form and the cross hatchings (CSF) became broader and more separated.

Edgar Degas (1834-1917) Suffered from some form of chorioretinitis due to the “elements”. He had a progressive, irreversible loss that became severe at the age of 36. Had a cousin with similar problems. He had a blind spot which he could only see around, sensitivity to light, and color difficulties. Treated with occluder lens, stenopaic slit, magnifiers. He must have retained some peripheral VA and fusion since late pictures of him do not show evidence of eccentric fixation.
Discussion of VA changes With respect to art-work and penmanship

“Woman Taking a Bath” 1889

“Women Drying her Hair” 1905  “Madame Alexis and her Children” 1910

“Dancer Looking at Sole of Foot”

Georgia O’Keefe (1887-1986) Suffered from ARMD and CRVO with vision reduced to 20/200. Her art became oversized and disproportionate with hard edges that often gave a 3D effect. This is most likely due to her use of a magnifier that resulted in distortion.

“Black Rock with Blue Sky and White Cloud” 1972

RETINAL AND VITREAL DISEASE

Munch (1863-1944) He suffered a retinal/vitreal hemorrhage that interrupted his work but he made a remarkable series of sketches that showed the debris in his eye and his emotional response. Etiology unknown and lasted 1 year. “Visions from within the Eye” A series of circles as the vitreous hem resolved- colors may represent the sun seen. Image of his branched ocular debris-with blind spot shadow in center and wispy birdlike pattern above- also represents PVD. Intraocular shadow- drawn over a grid perhaps as a means to follow the shape and size of blindspot- Amsler grid developed by Marc Amsler of Switzerland 17 years later “Madonna” and “Scream”

MODERN vs ANTIQUITY

Discussion of the styles of antiquity and the modern diagnostic techniques and artists of today: patient example, Picasso