Albino Vision Basic Facts

There are FOUR factors that affect the vision of people who have albinism.

1 **Photophobia**
2 **Pixellation**
3 **Astigmatism**
4 **Nystagmus**

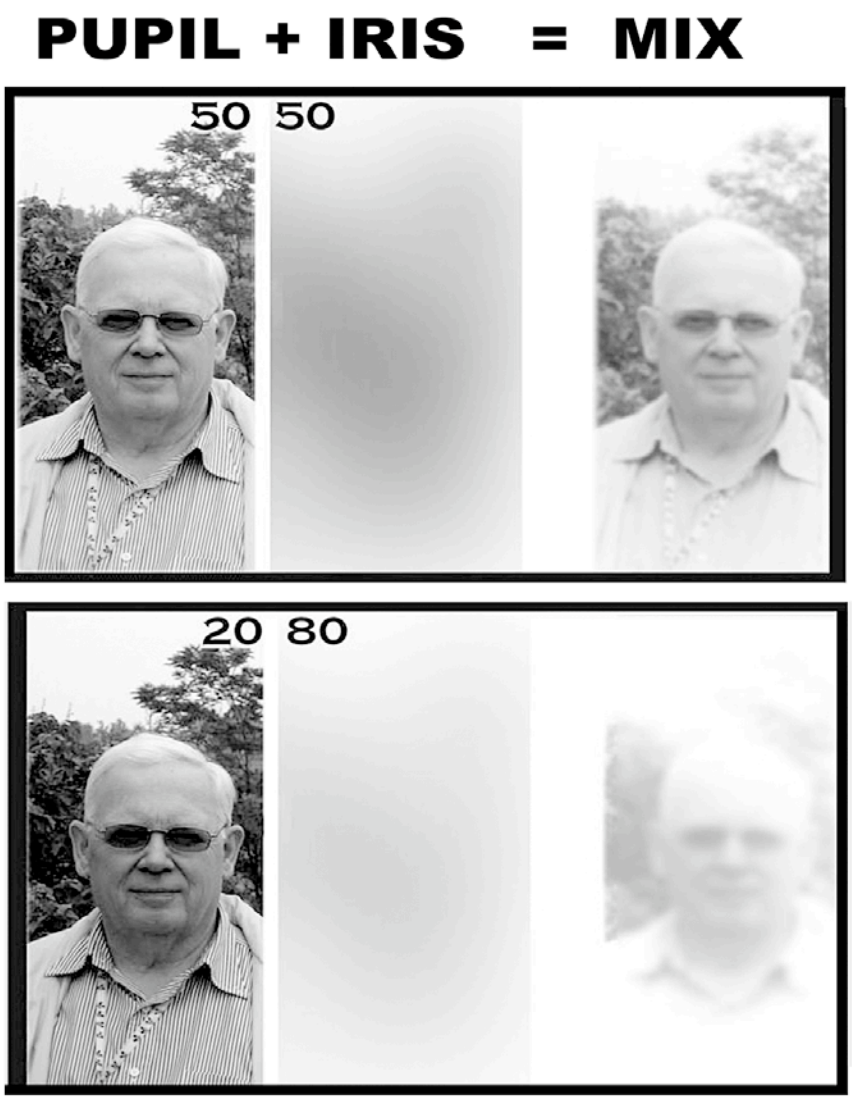
Photophobia - a dislike of light - is primarily caused by a lack of pigment inside the eye. The lack of this dark pigment leads to **Transillumination** of the iris.

Transillumination is the technical term to describe a faulty iris - in which light is able to enter the eye through the coloured part of the front of the eye as well as through the pupil (the black disc in the centre of the eye).

A normal eye reacts to strong light by reducing the size of the pupil thereby increasing the size of the iris. In other words the iris acts like a blind on a window - more blind equals less light getting through the window.

An albino eye tries the same trick - but is not successful. This is because the iris “blind” does not have an internal dark coating which would stop light getting through. It is as though the window blind was made of light white cotton rather than of a darker light-stopping material.

In dull sunlight the albino retina receives light directly through the pupil AND through the iris. The iris light is defocussed because the translucent iris blind distorts the light rays. This results in a blurry picture on the retina.



In bright sunlight the pupil of the albino eye does the same as a regular eye - it gets smaller in order to reduce the amount of light entering the eye. Unfortunately this strategy does not work.

The pupil does get smaller so less light gets into the eye through the pupil **BUT**

The iris gets bigger and lets in more distorted light. (Rather than blocking the light as in the regular eye)

The result is twofold: the retina gets too much light which causes **PAIN**. It also gets a higher proportion of distorted light which makes vision much worse. The result is shown in the photograph.

This is why albino eyes dislike sunshine.

Photophobic transillumination can be substantially reduced if the irs is occluded (covered over) - leaving a clear line of vision only through the pupil. One way to do this is to look through a small hole in your fist. The thumb and first finger block light falling on the iris while allowing light to pass through the gap to the pupil. Another way to achieve the same effect is to make a round 6 mm diameter hole in a piece of black paper or card. If this is held close up to the eyes then light cannot enter the eye through the iris and vision is substantially improved.

A more practical solution is to use a special contact lens that allows light through to the pupil but blocks any light trying to reach the iris. The centre part of the contact lens is clear (not tinted) but the iris area is painted with a coating that stops light. These lenses are not cheap because they have been hand crafted - but they can make a big difference when outside in the sun.

Pixellation

The retina contains rods and cones; rods for rather fuzzy low light vision and cones for higher definition daylight colour vision. It is generally accepted that the albino retina has fewer cones than normal so daylight visual acuity is not as good as it should be.

The difference in regular v. albino vision is much the same as the difference in picture quality between a good 12 Megapixel camera and a cheap cameraphone.

The effect of poor pixel resolution can be easily simulated in a software program such as Photoshop.

The definition of legally blind is someone whose vision is 10 percent or less of normal.

Surprisingly this is nowehere near as bad as it first appears.

This can be easily demonstrated in Photoshop by reducing the number of pixels in a picture (re-sampling) by a factor of 10 times in each direction - then increasing by the same amount in order to get back to the starting point.

The restored picture is now much fuzzier than the original

Does it matter ? Judge for yourself.

You will notice that it is still possible to recognise the face but other parts of the picture have changed.

The handbag has changed its texture and much of the writing on the road sign is now difficult to read. The writing no longer seems so “black”.

Technical note: The left hand picture has 1,600 vertical pixels, the right hand picture has only160 effective v. pixels.

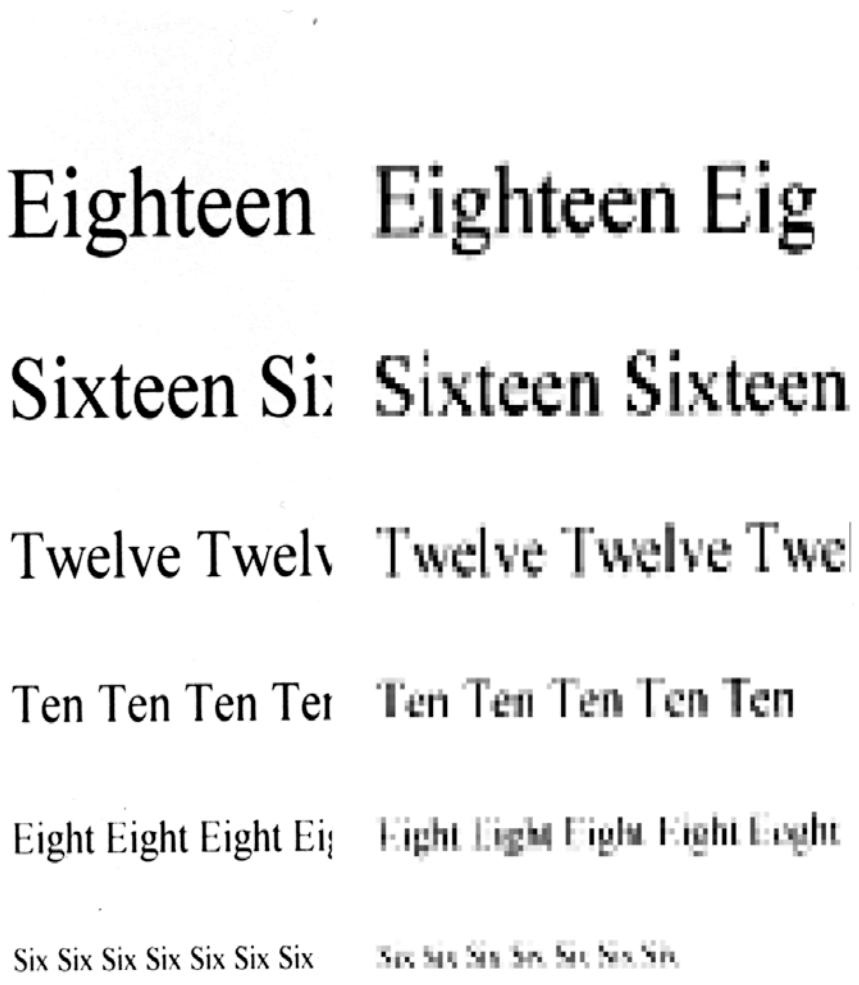
Poor vision is most noticeable when trying to read. The solution is easy - just magnify the text.

The picture shows an oversized simulation of normal and 10% vision at a 15 cm reading distance.

A two times magnification of unreadable pixellated 6 point text turns it into 12 point whereas a three times mag effectively turns it into 18 point text.

Agreed the pixellations is still present (we can't fix that) but the text is now quite readable.

Merely raising the text size from 8 point to 12 point will produce a marked increase in reading speed.



Astigmatism

The two major limitations of albino eyes, namely transillumination and pixellation, are not improved by wearing spectacles. Astigmatism, however, does benefit from the refractive correction that spectacles provide.

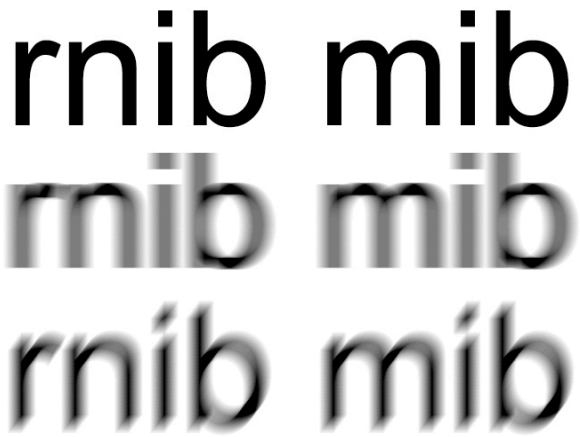
About half the people in the world have perfectly round eyes (soccer ball shape) whereas the remaining half have a slightly distorted eye contour (rugby ball shape). Most albino eyes have a more significant distortion in shape which leads to a noticeable defocus in either vertical or horizontal edges.

Typically the albino eye focusses successfully on horizontals while leaving verticals blurry.

This has two effects on reading.

1 Fuzzy verticals slow reading speed.

2 Fuzzy verticals allow letters to run into one another so that **rn** becomes **m.** (see middle line)



Tipping your head or rotating the text will minimise this effect. (see lower line)

If you find yourself doing this then you need spectacles to fix your astigmatic error.

Nystagmus

Nystagmus is an eye wobble which is "controlled" by the brain - not as the result of something loose inside the eye.

Riding a bicycle is all about balance - which is sensed by the semicicular canals in the ear. At low speed there is a need to wobble the handlebar to keep balance but at high speed the need for the wobble has gone.

Our eyes are also controlled by the balance sensors in our ears through a complicated system of nerves that feed different parts of our brain. This mechanism helps us, for example, to understand that we moved our head rather than the world moved around us

Sometimes, however, our brain can deceive us. If we are sitting in a train at a train station can we be certain that our train has started to move or is it the train on the adjacent track?

Nystagmus is the result of a similar deception - introducing a "handlebar wobble" when it is not needed at high speed.

By changing the balance parameters a different head posture can sometimes reduce the wobble. Altering the springiness of the eye's suspension system (tenotomy surgery) can often reduce resonance and improve vision..

If nystagmus first occurs at an early age the brain is able to partly compensate for the unstable retinal image. It appears that the motion tracking part of the brain (V5 area) gets reassigned to anti-shake duties thereby reducing ability to track fast motion. Fast ball games may therefore prove difficult.

Discussion

Albino vision deteriorates in bright conditions because unwanted transillumination of the non pigmented iris bleaches the retinal image and causes discomfort and pain.

Dark glasses certainly reduce transmission of light through the iris - but they reduce light through the pupil as well. Opaqued contact lenses allow "good" light through the pupil while stopping unwanted light getting through the iris. If contact lenses are worn it is important to heed hygiene directives in order to avoid eye infections.

There is some doubt as to the extent of albino eye pixellation. Is a visual acuity of 6/60 (10 percent vision) entirely due to pixellation or are there other contributing factors - such as the effect of an irregular geometry in the eye?

Astigmatism should be fully corrected as early as possible with spectacles or contact lenses. If the retina of the eye does not receive sharp vertical edges early on then the perception parts of the child's brain never gets to digest and recognise them.

Correcting astigmatism later in life might be too late - as the brain might then experience discomfort from the improved input.

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