Dark adaption and pupil size − an experiment (longish)

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(background)

I've always been interested in astronomy. I still remember
when I was about six years old looking though a neighbors reflector
and seeing a tiny jewel like Saturn. At the time it seemed
like an enormous instrument, though it was probably a 6−8"
reflector. Nothing compares to seeing things 'live'− I decided
that then, I still feel that way.

When I was a little older, 5th grade, I used to go out
observing with a friend − watching the perseid meteor shower,
learning most of the summer constellations.

In my late teens and early twenties I got more serious. I started
out with a pair of 7x35 binocs and an 80mm refractor. I later got
a smallish (5.5") newtonian reflector, and some huge 11x80 binocs
(both from Orion). I looked forward to the family trip to Canada
every year (I live in Wisconsin). My step grandfather owned a small
rocky island on northern lake Huron (Mcgregor bay, Ontario). This
was a good dark sky site, and I can recall finding most of the
messier objects and doing a lot of observing. Memories I hold close
to my heart. The 11x80 bincos were very impressive from a dark
sky site, but they were too difficult to hold steady for any length
of time − the 7x35 bincos were my favorite cuz they were easy to
hold steady.

Well, I kind of drifted out of regular observing. Hard to say
why... probably a combination of living in large city with moderate
light pollution, and the fact that truly clear nights with good
seeing are a rarity where I live (Madison, WI).

However, I've always been a night owl. I like to be out at night,
going for walks or bike rides, working third shift, etc. Lately
I've taken to going hiking at night, no flashlight. I thought
I'd do an interesting experiment to see if increasing my pupil size

would have any effect on my night vision. I did this by making a tea from the datura plant (jimson weed). You see, I also like to experiment with 'legal' drugs. The two primary psychedelic alkaloids in Datura are Atropine and Scopolamine. Atropine is often used in eye drop form by eye doctors to dilate patients pupils during eye exams. Note that I DO NOT recommend ingesting Datura − it's a good way to wind up in the emergency room. I made a tea from two leaves and one 'moon flower' of the plant − I only drank a fraction of the tea (a few sips). For more on Datura see:

http://www.erowid.org/plants/datura/

(experiment)

My goal was to drink enough of the tea to get my pupils dilated, but not enough to incapacitate myself.

I chose a very clear moonless night for my experiemnt. I went for a walk at a nature preserve I'm familiar with − I've gone for many nocturnal walks here over the years. It's a combination of woodland and prairie. So I know how much the brightness can vary from night to night. The brightest nights in the city are the overcast ones − reflected light from those god awful HPS lights creates a diffuse orange gloom, which penetrates even the densest wooded areas effectively. A full moon is brighter, but the directional nature of the light can be very confusing at night −− those moon shadows are tricky. On top of that a full moon is bright enough to prevent complete dark adapation. Generally the more haze or smoke there is in the air, the brighter it will be at night − more backscattering of any light pollution (just the opposite of a truly dark site with no light pollution... there an overcast night can be pitch black).

I also had to establish a baseline for my pupil size, something I'd never done before. Well, I've got pretty big eyes. With the help of a friend I measured my pupil size using a small ruler nearly touching my eye (I used to wear contacts so I'm good at not blinking when something is nearly touching my eye). The room wasn't completely dark − it had to be bright enough to see my pupil and the ruler. Still both my pupils were between 7−8 mm. Not bad considering my advanced age (I'm 36).
It's interesting, because in bright light I tend to squint my right (dominant) eye nearly shut, while keeping my left eye open. There was a slight asymmetry between my two eyes, with my right eye (the one I close in sunlight) dilated very close to 8mm, and the left eye being a little over 7mm. My total iris size is 12−13 mm.

So anyway, feeling the effects of the datura I started my walk on what would normally be a very dark night. The milky was

as visible as it gets from this place − clearly visible running through Cygnus, and then blowing up through Sagittarius. I could see all the stars in the little dipper without using averted vision − again pretty good for the moderately light polluted site I was at.

As mentioned above, I know from experience where the darkest areas on the trails are − some sections in the deep woods are so dark that I normally would have trouble seeing the trail even when my eyes are fully dark adapted, and using averted vision. I swear I could see better. It was subtle, but what I knew from experience to be the darkest areas of the trail were not so dark. In areas where I usually couldn't see the trail, even using averted vision, I could make out the trail. In other very dark areas I could see more detail on the trail than normal − roots and rocks, etc.

When I got home I looked at my pupils in the mirror. They were *huge* − freakish in fact. My right pupil had dilated to well over 9mm, and the room didn't have to be very dark to achieve this − the effects of the atropine.

This surprised me. I had thought the chemical changes in the retina during dark adaption (buildup of 'visual purple', etc.) would far outweigh any slight changes in pupil size. However, because the area of a circle varies with the square of the radius, going from (as an example) a 7mm to a 9mm pupil nearly doubles the amount of light the eye can gather. My experiment seems to bear this out.

Again, I do not recommend ingesting Datura! It's nasty, nasty stuff. Even at the tiny dose I took I experienced a noticable loss of coordination, and a very dry mouth and throat. If you take a larger dose you won't know who you are or where you are. I know this from experience :(. If anyone wanted to duplicate this experient I'd recommend getting a hold of some eyedrops with atropine. Not that I'm going to make a habit of doing this :).

Cheers, Eric

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