Binocular considerations

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Binoculars are a great way to obtain deeper views of the heavens. They're easy for beginners to use, usually offer richer fields of view than telescopes, and can be much cheaper! However, some are better for astronomy than others.

Magnification & aperture

Binoculars are specified with two sets of numbers, such as 7×50 or 8×40. The first number is the magnifying power, while the second is the aperture of the objective lenses in millimetres.

Personally, I think of all binoculars under 40 mm aperture as daytime-only. Nevertheless, you can see a surprising amount of astronomical detail with the 8× or 10× pocket-sized models. Just avoid the ones with garish anti-glare coatings and/or highly coloured lenses. Both do weird things to star colours and magnitudes. If you have dark skies then you can still see a lot with 40 mm binoculars. For example the old 8×40's I use can see every star plotted in Sky Atlas 2000.

Higher magnification binoculars are harder to hand-hold steadily, resulting in a shaking image from the wobbling of their hands. The same goes for large aperture binoculars; especially if they are metal bodied instead of plastic or fibreglass. Regular arm exercises can help a lot. I find my 15×70's really easy nowadays, after resuming archery—but most people will prefer to use a tripod. Big binoculars are usually sold with a tripod adapter.

Exit pupil

Exit pupil is the diameter of the light cone coming out the eyepiece. Lots of references claim that the human eye's pupil will dilate to about 7 mm when fully dark-adapted, which means that it will get the full benefit of any binoculars or a telescope that produces an exit pupil 7 mm or less in diameter. For binoculars, the exit pupil is simply the aperture divided by the magnification.

This 7 mm dilation is the basis for all those recommendations to get 7×50 binoculars; because 50 mm binoculars collect enough starlight to be astronomically useful (even in suburbia), and 7× is a low enough magnification to hand-hold. Their exit pupil would be 50 ÷ 7, or about 7.1 mm.

The 7 mm exit pupil dogma is fine if you're young, but the eye's ability to dilate slowly decreases after your thirties. By your 70th birthday, the pupil dilation is typically down to about 4 mm. If your telescope or binocular's exit pupil is bigger than your dilation, then a lot of the gathered light is simply wasted against your iris.

We had an interesting demo of this during a public night a few years ago. A 7×50 and a 10×50, both on tripods, were aimed at the Pleiades and the publics were asked to describe the views. Without exception all of the older folks reported many more faint stars in the 10×50. The kids and Generation X'ers saw no difference apart from the magnification. Of course, both pairs of binoculars gathered exactly the same amount of light, but the 10×50's produced a 5 mm exit pupil. Similarly on a telescope, a higher magnification makes a dramatic difference for the senior observers.

So if you're old enough to remember the moon landings I would be recommending 10×50 or 12×50—not 7×50 unless you're buying for a kid. If you're old enough to remember the Korean War then preferably the 12×50; perhaps even 15×50 or 16×50.

If you can afford bigger aperture binoculars then get ones which produce an appropriate exit pupil for you for the next couple of decades. For example, 13×70 would produce a 5.4 mm exit pupil, 15×70 produce 4.7 mm, 11×80 produce 7.2 mm and 20×80 produce 4 mm.

Eye relief

Eye relief is the distance between the eyeball and the lens of an eyepiece at which you can clearly see the full field of view.

Binoculars with a short eye relief may be a problem if you wear glasses full-time, because they will keep your eye further back from the eyepiece. If your eyesight isn't too bad then, removing your glasses and re-focusing the binoculars will work fine for you. Blurry views for everyone else, of course.

If you go with this option then get a neck strap for your glasses, so that you don't drop them in the dark! If your eyes are severely different from each other and/or astigmatic, then you could only use these particular binoculars while wearing contact lenses, otherwise you probably won't get your eyeballs close enough to get the full view.

Incidentally, both of my Saxon binos (10×60 and 15×70) have good eye relief and can be used while wearing glasses. Just fold back the rubber eyecups. The 10×60's can be hand-held by most people but don't seem to be sold anymore. The nearest equivalent model 12×60's are selling for $190-240 from several Australian retailers. My 15×70's are selling for $250-300.

Other considerations

A problem common to the entire 'Big Cheap Binoculars' category is a less-than-perfect-view of things at the edge of the field of view. Typically, this exhibits as either spherical aberration (edge and centre have slightly different focus points) or as coma (stars on the edge have little 'tails' or 'fans'). Most of us won't care, because our attention will be in the central 90 percent of the view that looks great. Brands such as Leica, Swarovski and Fujinon put a lot of effort into eliminating all such optical defects—and it's reflected in their retail price. ★