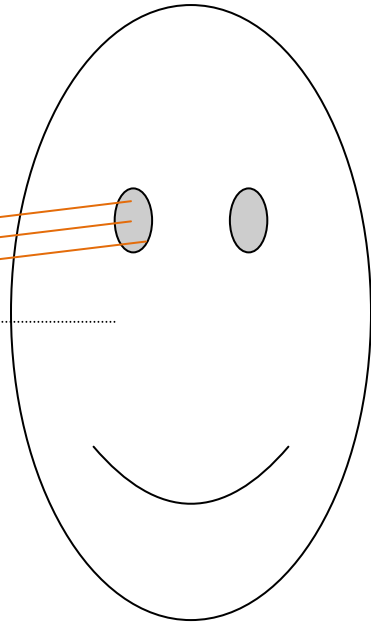
Looking at an object that is far way

Far away object



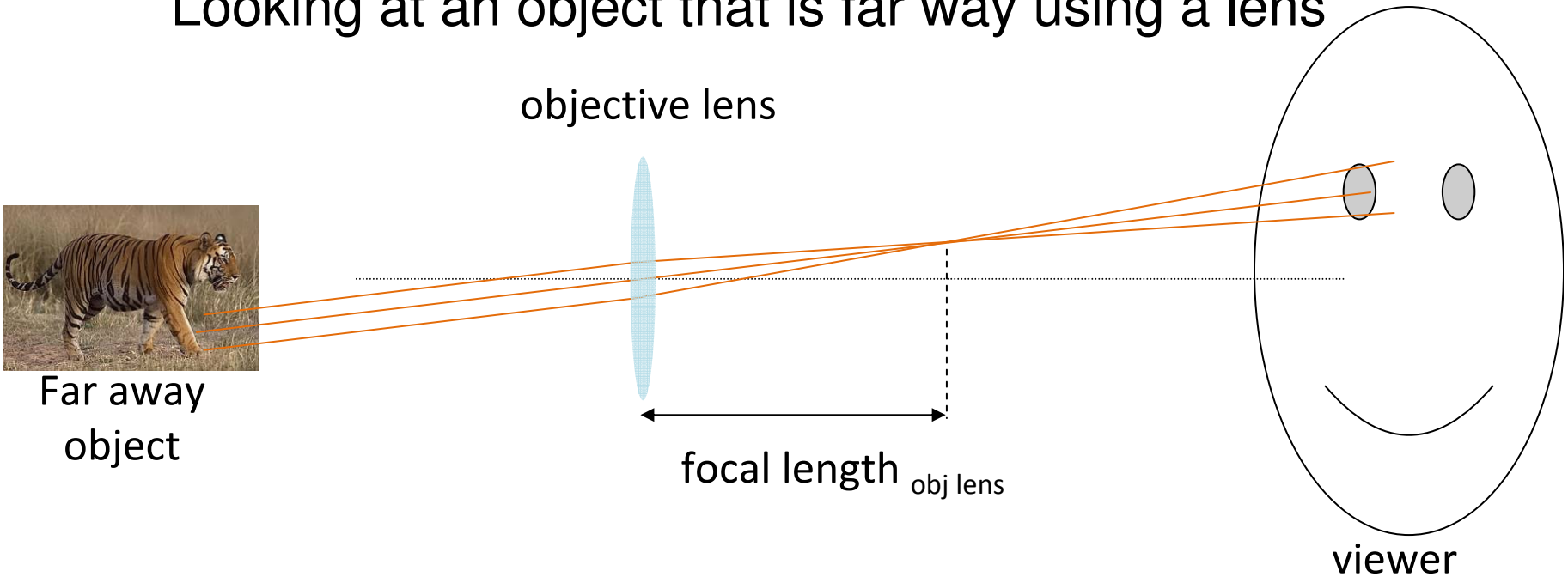
viewer

Let's say you're looking at something that is really far away. In this case, it's a tiger.

Some of the light that from the tiger comes to your eyes, but you cannot see any details on the tiger. It looks tiny.

You can use a telescope to magnify the tiger. We're going to show you how.
(Okay, we don't have a tiger, but let's find something really far away to examine.

Looking at an object that is far way using a lens

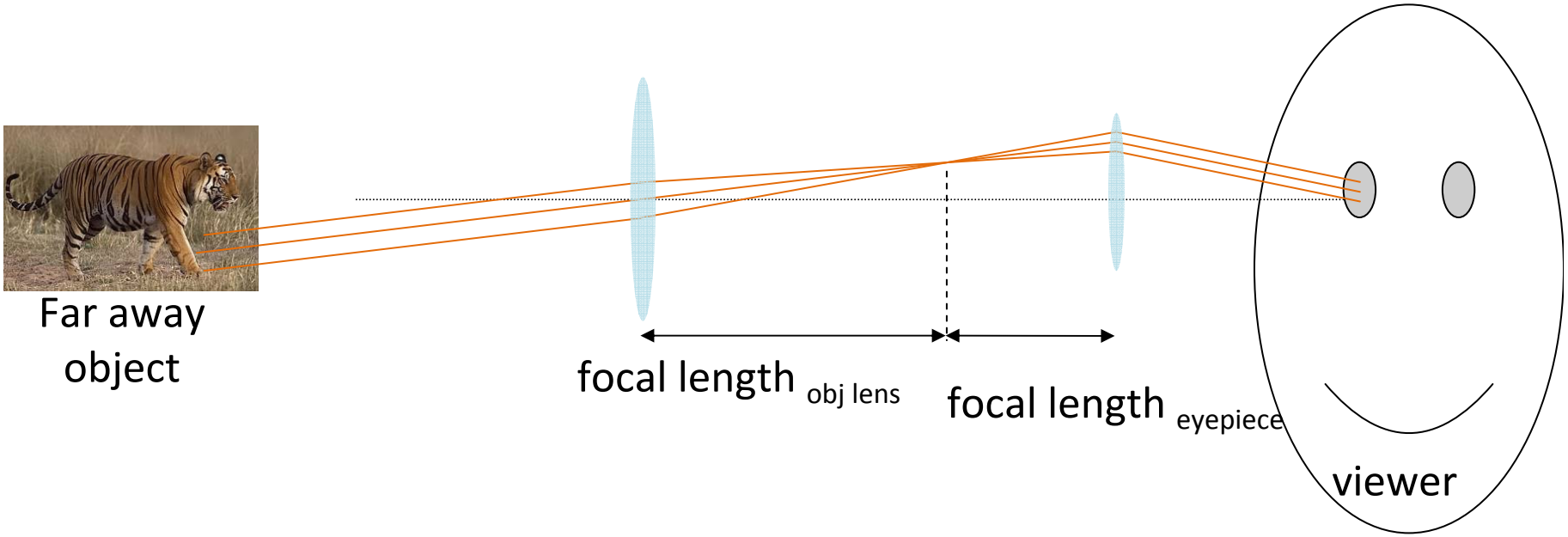


Put a lens between your eye and the distant object (the tiger). This lens is called the objective lens because it is near the object.

If you do this, the tiger looks really blurry, right? All of the light from the tiger is focused by the lens.

That didn't help us see the tiger better. We need to add another lens.

Looking at an object that is far way using 2 lenses



Object is imaged to "infinity" (far away), so you can view it with a relaxed eye

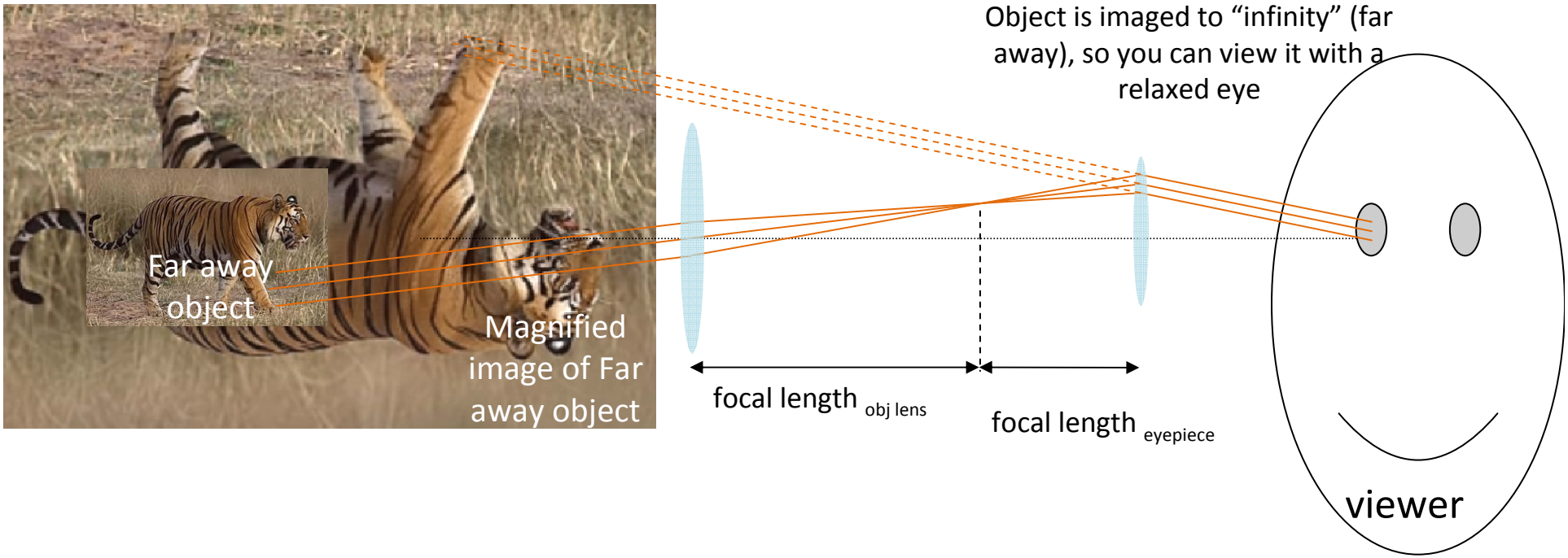
This second lens is called the eyepiece lens.

This lens has a shorter focal length than the objective lens. Position this lens so that the two lenses are separated by the sum of the focal lengths:

separation = focal length of objective + focal length of eyepiece

You will then see a magnified image of the tiger!

Looking at an object that is far way using 2 lenses



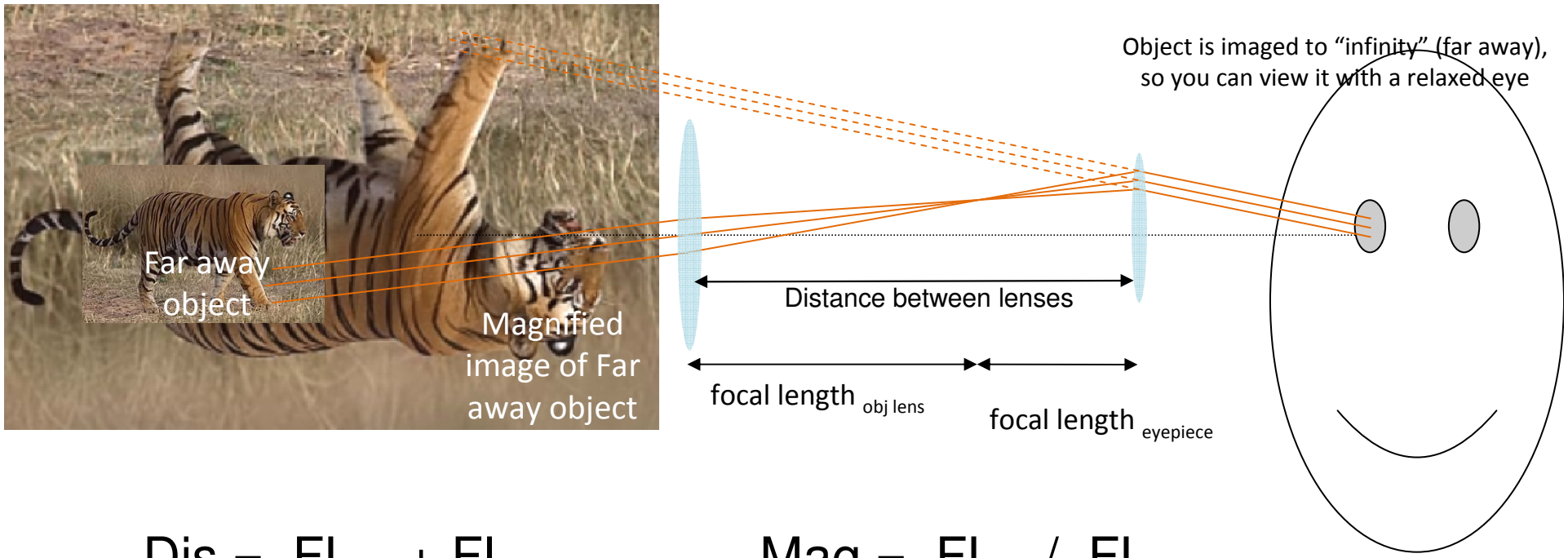
$$Mag = FL_{ob} / FL_{ey}$$

The magnified image appears! You just aligned a telescope.

An important property of a telescope is its magnification. How big is the image compared to the object? Magnification can be calculated by dividing the focal length of the objective by the focal length of the eyepiece:

$$\text{magnification} = \frac{\text{focal length of the objective}}{\text{focal length of the eyepiece}}$$

Looking at an object that is far way using 2 lenses



$$Dis = FL_{ob} + FL_{ey} \qquad Mag = FL_{ob} / FL_{ey}$$

We used just two formulas in this experiment:

separation = focal length of objective + focal length of eyepiece

$$\text{magnification} = \frac{\text{focal length of the objective}}{\text{focal length of the eyepiece}}$$

It is really interesting to look through a telescope with one eye, and look directly at the object with the other eye. You can see the effect of magnification!
If the magnification equals three, the image is three times larger than the distant object!