

PRIMO 70 SERIES



Sensor Size & Perspective



CONTENTS

FOCAL LENGTH

NATURAL FOCAL LENGTH?

NATURAL FIELD OF VIEW?

NATURAL PERSPECTIVE?

A TASTE OF 70

- Relationship of FOV & Perspective

- Scalable Perspective

- A Taste of 70

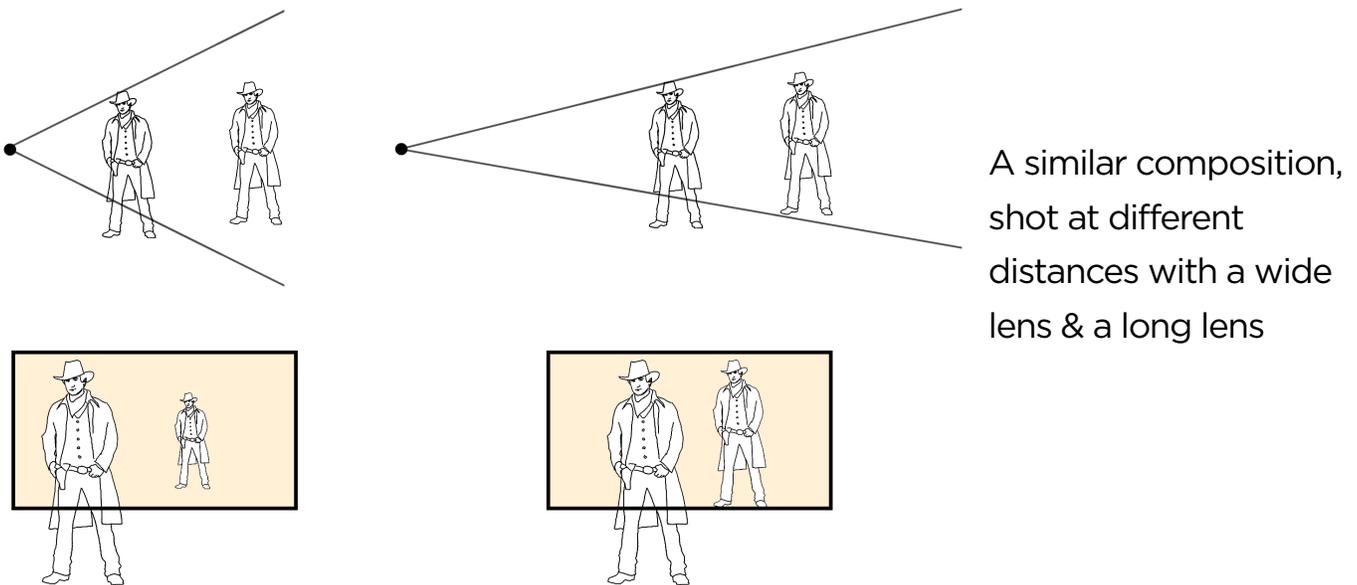
- Anamorphic

1 IMAGE = 1K WORDS

FOCAL LENGTH & PERSPECTIVE

Optical **Perspective** is determined by subject distance, and is defined by how quickly objects **decrease in size with increasing distance**. This is easily seen with parallel lines, like sidewalks, streets or railroad tracks.

With larger sensors and longer focal lengths, filmmakers may use different subject **distances** to frame a Field of View similar to that of Super 35, yielding different perspectives.



With the same Field of View, a wide-angle lens will **exaggerate** Perspective (faraway objects shrink quickly), while a longer lens will **diminish** Perspective (faraway objects are closer in size to foreground objects).

Perspective is key to how the choice of camera distance and focal length describe **space**; a wide-angle lens can make a room seem bigger, a long lens can shorten the apparent distance between two objects.

Perspective is also key to the **photogenic** quality of a face; a wide-angle lens can make an actor's nose appear large in relation to the rest of his or her face, a long lens can make a face look flat. Perspective is also referred to as Optical **Magnification** or **Compression**.

Two images with a similar horizontal Field Of View, shot with 2 different angles of view:

1. A wide-angle lens 2. A long lens

Note the different rendering of the face, and the different magnification of the background house.



NATURAL FOCAL LENGTH?

Some photographers and cinematographers speak of a “natural” focal length, as the focal length that corresponds to what **we perceive** with our eyes. While it’s difficult to give a precise number, 35mm filmmakers mention a range of **40 to 50mm**. (Some scientists tell us that the effective focal length of the eye varies between 22 and 24mm -- depending on accommodation.)

It can also be argued that the “natural” focal length is actually a matter of a changing film culture, and has evolved over the history of cinema. One way to pose the problem is to ask: which lens is used for a **wide shot**?

Master director Alfred Hitchcock shot most often with a **50mm**. Master photographer Henri Cartier-Bresson shot all of his larger-format photographs with a 50mm. The late Gordon Willis, ASC, favored the **40mm**. Many recent filmmakers have gone to shorter focal lengths like the **27mm** or 24mm for their wide shots (and even for their close-ups!).

When discussing the “natural” focal length, we should consider:

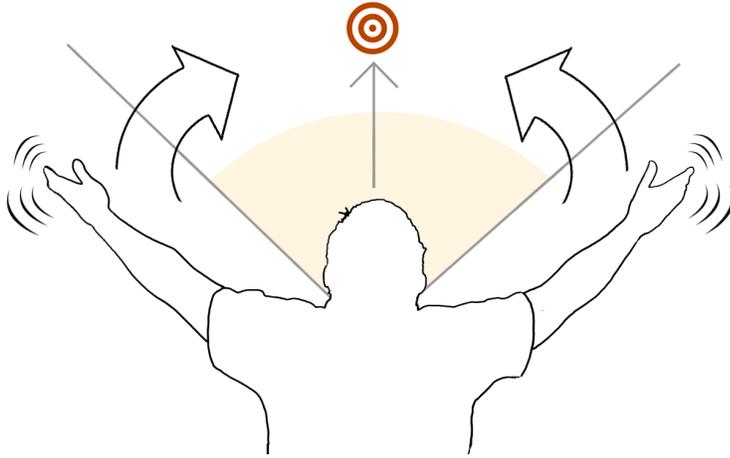
- **Field of View**, which changes with sensor size
- **Perspective**, which doesn’t

NATURAL FIELD OF VIEW?

What is the Field of View of **human vision**? The question is difficult to answer simply, because of the wonderful complexity of human vision. We should distinguish between high-resolution central and low-resolution peripheral vision.

Some scientists say that **Peripheral Vision** has evolved to protect you from fast-moving predators on your sides. To assess your own peripheral vision, keep your eyes focused on something in front of you, stretch out your arms, wiggle your fingers,

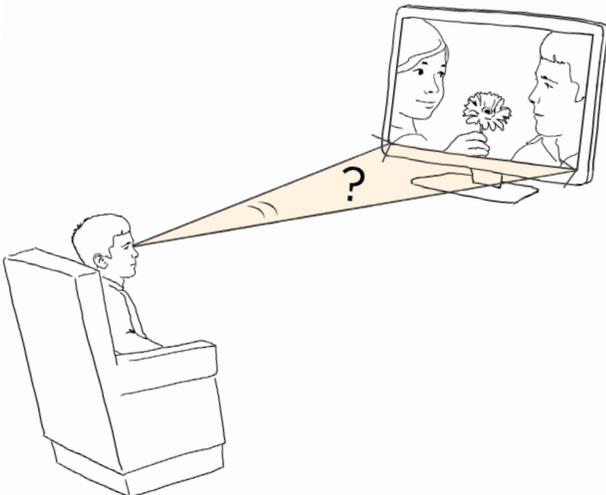
and move your arms and see when you start to distinguish the movement of your fingers. You may end up with an angle close to 105 degrees.



Checking the angle of your Peripheral Vision with arms outstretched & moving fingers

Assessing your sharper **Central Vision** (fovea + parafovea) is more difficult, as your eyes are constantly moving in **saccades** to construct a sharp image, by sweeping the object's image across the highest-resolution fovea area on your retina. Some scientists estimate the central vision an angle of view between 40 and 50 degrees.

One practical way of assessing your own approach to Central Vision is to consider the **Angle of View** that you choose to watch a **movie on TV**. The THX company's theatrical standard suggests 40 degrees for home theaters. This field of view is also partly a personal choice, like where you sit in a movie theater, or more accurately, where you place your laptop screen or the book you are reading.



Your personal Angle of View for watching a movie on TV

NATURAL PERSPECTIVE?

What is the perspective of our **human vision**?

This question is also difficult to answer simply. While it's obvious that a 10mm lens makes a room look bigger than your perception of it, and that a 150mm appears to flatten a landscape, it's more difficult to pinpoint the exact focal length that corresponds to what we see with our eyes.

One practical way to roughly evaluate your **own Perspective** is to put one eye on the viewfinder of a camera mounted with a zoom lens, then keep both eyes open and change the focal length until an object in the image is the **same size** in both eyes. This may happen **around 40 mm**. Once again, perspective is a property of the focal length and is independent of sensor size. The perspective of a 40mm will be the same on a F55 as it is on a Dragon 6K.



Explore your own **Perspective** by looking through a viewfinder and then zooming until the image is the same size in both eyes.

(This assumes that the viewfinder's optical system is not magnifying the image).

A TASTE OF 70

At the beginning of the first paper in this series, we considered the aesthetic characteristics of using 70 lenses on sensors bigger than Super 35, and spoke of “**a taste of 70**”. The Primo 70s offer unmatched optical quality, and the ability to use sensors larger than Super 35, but there is also the subtler question of the **relationship** of Field of View to Perspective.

RELATIONSHIP OF FOV & PERSPECTIVE

Let's assume that the central Field of View of human vision has an angle of about **45 degrees**, with Perspective corresponding to roughly a **40mm** lens. To get the same Field of View in Super 35 you need to shoot with a 27mm lens, or thereabouts, but then the perspective will feel a little **exaggerated**. To get a similar Field of View with a Dragon 6K, you would shoot with a 35mm, which is closer to 40mm and would yield a less exaggerated, **more natural** perspective.

Of course the filmmaker may want to exaggerate the perspective with wider lenses, or flatten it with longer ones, nevertheless the **relationship** of Angle of View to Perspective remains different with bigger sensors than with Super 35.

SCALABLE PERSPECTIVE

Some Panavision engineers, and notably the late Tak Miyagishima, have stated that the “natural” **Perspective** of bigger formats is **scalable**: that shooting larger formats will seem more natural no matter what the focal length. In this view, shooting with a wide- angle lens is simply equivalent to moving closer to the subject, while shooting with a longer focal length is like moving farther away, but in both cases the relationship of Perspective to Field of View retains its “natural” feel.

A TASTE OF 70

By using larger sensors and longer focal lengths with the Primo 70s, film-makers can experiment with images that have a more **natural** relationship between Perspective and Field of View. It is in this sense that shooting with Primo 70s on bigger sensors can offer “a taste of 70”.

It's important to stress that, even if a larger sensor may yield images that appear more natural, there is no right or wrong sensor format. The choice of sensor size, and its accompanying Fields of View and Perspectives, is an **artistic** decision.

ANAMORPHIC

It's interesting to note that the optical anamorphic squeeze creates a strange image that appears to **increase focal length** in one direction. Using longer focal lengths may be part of the appeal of **35mm anamorphic**, which can be seen perhaps to offer a different “taste of 70”.

1 IMAGE = 1K WORDS

An image is worth a thousand words.

After all is said and done, the quality of the Primo 70s on different sensors is best appreciated by watching images shot by our **cinematographer friends**.