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*Technical guide*

# *Measuring Screen and Display Resolution*

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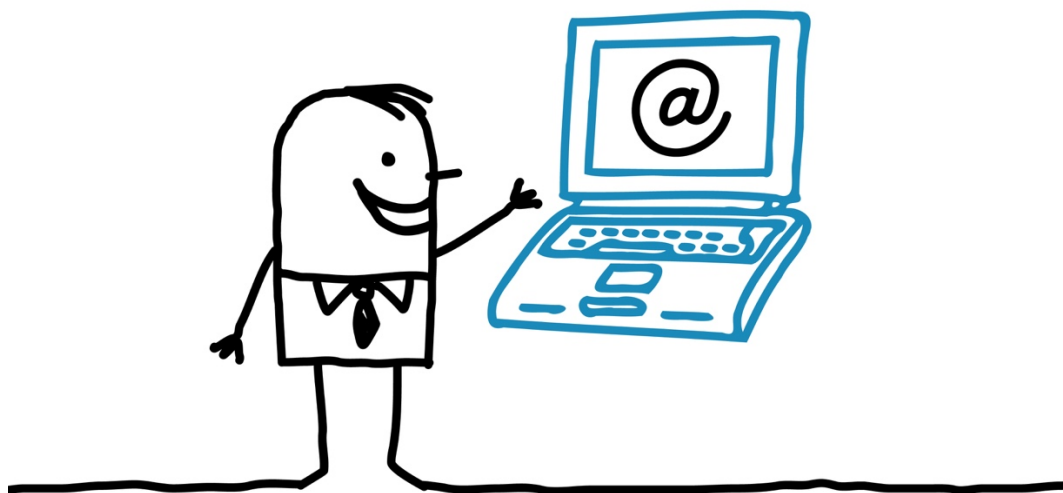
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The below image shows two high definition displays. Kauffman Stadium, home to the major league baseball team, Kansas City Royals, and an iPad retina display.

Both displays have a similar number of pixels, however the pixels at Kauffman Stadium are about 170 times larger.



Figure 0-1: Kauffman Stadium, Kansas, USA (left), Apple iPad retina display (right)  
(Photos: informationdisplay.org and apple.com).

An obvious question is; how is pixel size and high definition resolution related? The answer actually depends on how far away the display is viewed. If you view the Kauffman Stadium display from 10 feet, your eyes will see the individual pixels, but beyond 225 feet (Kauffman Stadium is 387 feet by 410 feet) the perceived resolution will actually surpass that of an iPad retina display!

*So the reason why this is important, is that the number of pixels, in isolation, does not define a high definition video experience.*

The magic metric for determining perceived resolution is Pixel Per Degree (PPD). The below diagram illustrates this concept.

PPD is the number of pixels viewed within a degree. As the viewing distance is decreased the number of pixels per degree is decreased, and thus the resolution that our eye perceives is decreased. This is why, for an equivalent resolution, the pixels in an inch needs to increase when viewed from a shorter distance.

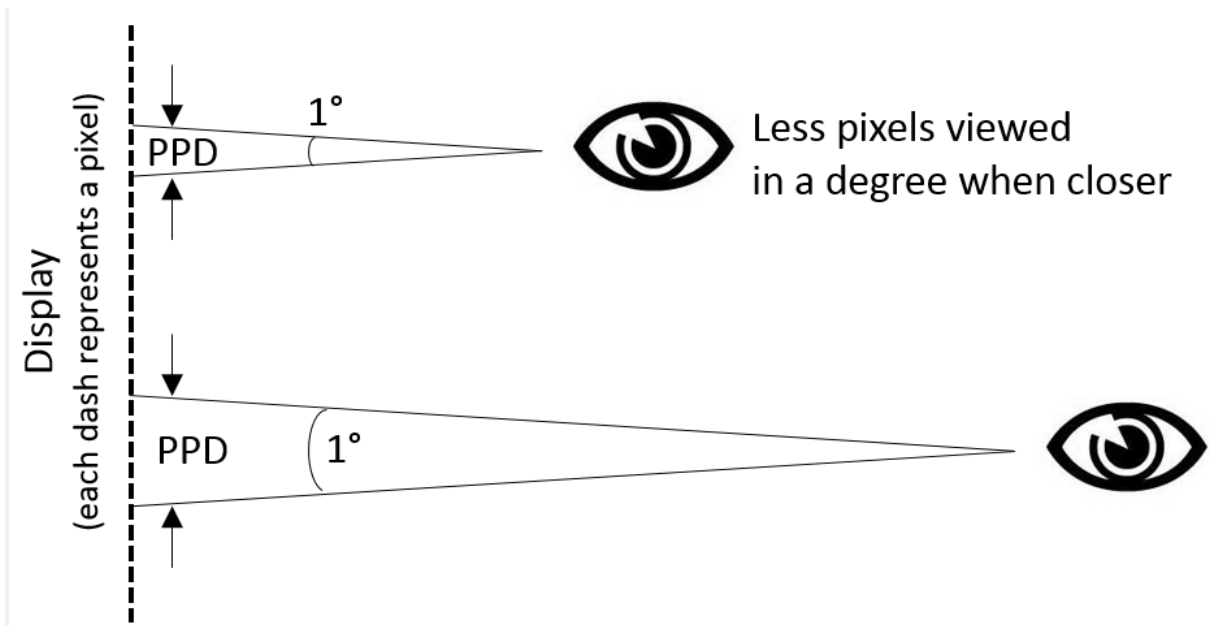


Figure 0-2: Pixels Per Degree (PPD) (Source: deBaffle.net).

It is generally accepted that the naked eye cannot appreciate additional resolution above 70 pixels per degree.

The below table summarises the key specifications for both the Kauffman Stadium display and the iPad retina display. As you can see, based on their respective viewing distances, the resulting resolutions, in pixels per degree, are equivalent, while the pixels per inch are vastly different.

Display	Pixels	Display diagonal length	Pixels per inch	Viewing distance	Pixels per degree
Kauffman stadium	1,800 x 1,584 (2400 diagonal)	1620 inches (135 ft.)	1.48	2700 inches (225 ft.)	69
iPad with Retina display	2048 by 1536 (2560 diagonal)	9.7 inches	264	15 inches	69

Table 0-1: Pixels Per Degree (PPD) for Kauffman Stadium and Apple iPad retina display.

For those interested in the math, pixels per degree is calculated using the formula  $2dr \times \tan(0.5^\circ)$ , where “d” is the distance from viewer to display, and “r” is the number of pixels on the display per unit length, or just use the online calculator here: <http://phrogz.net/tmp/ScreenDens2In.html>.

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## About the author

Richard is the founder of deBaffle.net. He has over 13 years' experience in the information and communications technology industry and has held senior management roles in both government and the private sectors. Richard has extensive experience working with organisations to deliver technologies that meet business objectives. This includes strategy development, procurement and implementation.

Richard has an honors degree in engineering and a degree in economics from the Australian National University.

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