The Resolution Myth

"The higher the resolution, the more detailed the scan results are"

This statement may be correct in a perfect world but it is not true *at all* in the real world. First, we have to make a distinction between the geometric or optical resolution and the spatial resolution http://en.wikipedia.org/wiki/Image_resolution. The optical resolution is a key parameter and major purchasing criteria for most users. In a CCD based scanner, each CCD element is mapped to the scanned original through a magnifying lens. All CIS based scanners map the original directly 1:1 via a Selfoc lens. If one inch of a document´s surface illuminates 600 individual CCD elements, then the optical resolution is 600 dots per inch or 600dpi in the main scanning direction. During one line exposure time, the document is moved through the transport by 1/600dpi in the sub-scanning direction after which the next line is captured. Therefore, the CCD and the lens specify the main scanning resolution or horizontal resolution and the transport speed determines the sub-scanning or vertical resolution.

For example, some scanners claim to have a 600*1200 optical resolution. These scanners cut the transport speed in half and therefore capture a smaller line width. Although this is somewhat incorrect, because the CCD element will also receive some light from the neighboring 1200dpi lines due to its size. Regardless, it is generally accepted to specify an optical resolution of 600*1200dpi although it is only achieved by cutting the transport speed in half.

All resolutions above the optical resolution are interpolated - some vendors even call them enhanced. This is misleading because interpolation adds nothing but redundant data to the scan, just pumping up the file size with little or no benefit to the user. Some scanner vendors are very creative in hiding this fact. Contex for example, invented the term *Contex REAL dpi* for the 600dpi interpolated output on their 508dpi optical scanners. Interesting enough, some of their numerous OEMs (Oce´, Vidar, Calcomp, HP, Ideal), selling the same scanners under different brand names, still specify the resolution (508dpi) correctly, thus creating even more confusion among the large format scanner community.

> **Image Access refuses to take part in misleading the customer with incorrect or improper statements about the real optical resolution. Our WideTEK large format scanners have 600dpi optical, not a dpi more or less.**

We really do not like to mention it, but the optical resolution alone is not worth a lot if the question arises, how much detail can be recovered from a given document. Optical resolution is an indicator of scan quality but NOT a measure of it. No lens is perfect, nor are mirrors, CCDs, glass plates or the illumination. Noise is also a resolution-limiting factor and becomes very significant under certain circumstances. The term for this resolution is spatial resolution and it is always less that the geometric or optical resolution. Read more at http://en.wikipedia.org/wiki/Image_resolution

These effects can be measured accurately by determining the MTF or modular transfer function of a system which is beyond the scope of this article, but we want to give you an illustrative example:

If you are one of the lucky people who do not need glasses to clearly see this screen (or print), please borrow a pair of glasses from someone. For everyone else, the trick is simple: Take your reading glasses off or put your distance glasses on. You will see a big change in the actual resolution of your optical system without there being a change in the geometric resolution (your eye, retina). Adapted to the scanner world, this shows you that two scanners with the identical optical resolution can and will produce different results.
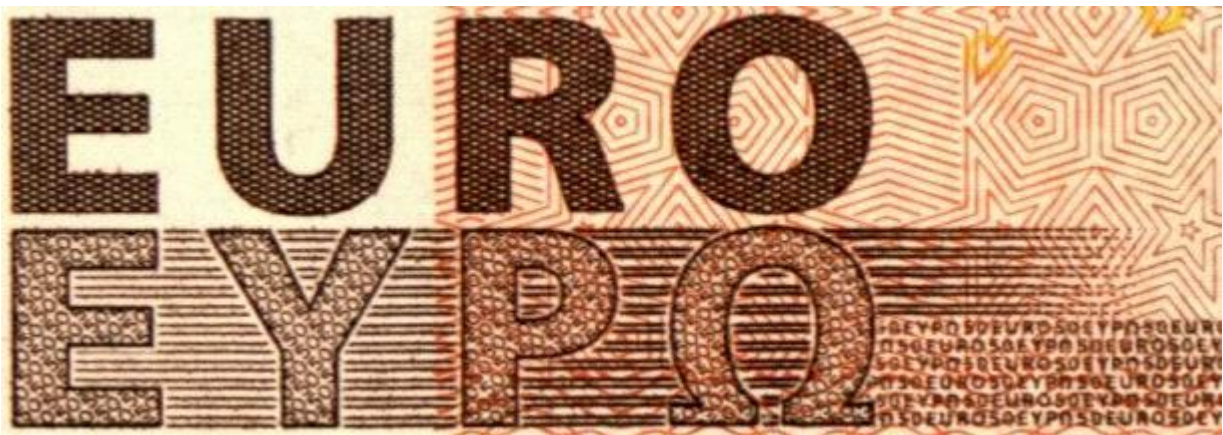

Sample scan from a WideTEK 36 at 600dpi with a JPEG quality factor of 90%. Event the microprint with a character height of 10mils (250µm) is legible due to the high MTF of the optical system. JPEG artifacts do not exist.

Same scan from a competing scanner at 600dpi with a JPEG quality factor of 90%. The print is not legible despite the 600dpi resolution due to a poor optical system.

Our scanners use the best lenses and mirrors available in a self-contained, hermetically sealed optical enclosure, to produce the highest possible spatial resolution at a given optical resolution of 600dpi.

The following two scans of a standard resolution test target are taken from the Contex web site out of the brochure "Understanding Scanning Resolution". The third one is taken with the WideTEK 36 at default settings and are made with JPEG compression inside the scanner.
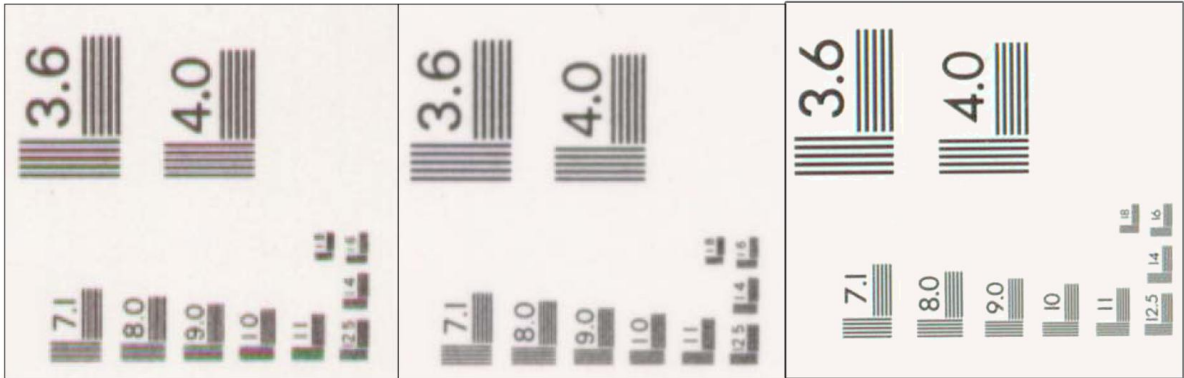
CIS scanner at 600dpi   Contex Crystal G600   WideTEK 36 at 600dpi

CIS based scanners are always a little behind in resolution which comes from their unability to take a red, green and blue pixel from exactly the same position. This is caused by the fact, that today´s CIS sensors are monochrome and simulate color scanning only through sequentially switching between red, green and blue LED illumination.

But it also seems to make a difference, whether you scan with "Contex real 600dpi" at 508dpi optical or with a WideTEK 36 at real optical 600*1200dpi.