Input resolution and its effect of the printed image quality on digital toner printing systems (case study – Sinai, Egypt)

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Abstract The resolution is considered as one of the most important factors which controls the quality of the printed image, whether input resolution (digital camera–scanner) or output resolution (printer–computer to film, plate or paper).

The research discusses the accuracy of the input resolution of image processing equipment for digital files through using two different sets of resolution, one low (72 dpi) and another high (300 dpi) and to print the files by using a digital toner printer. Which produce with a high output resolution up 2400 × 2400 dpi and use the same type of paper for printing these files. Then quality measurements (characteristic curve–dot gain–density) are performed to determine the accuracy effect of input resolution on the quality of the printed images.

In this research the researchers used scientific and practical analysis methods to analysis this problem and to determine the accuracy effect of input resolution on the quality of printed images. It has been concluded that the differences of the input resolution do not obviously affect the quality measurements that the results are largely close, despite the quality difference of the two cases (low resolution–high resolution) are easily noticed to the naked eye while zooming images at appropriate level.

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1. Introduction

The input resolution accuracy is considered as one of the key factors of the preparation of digital files in order to print it digitally. Determining the input resolution accuracy is one of the most important technical preparation steps of a digital file by using one of the following input devices: digital cameras, scanners (flat–drum) and digital images libraries. Those devices often contain two digital images degrees one with low resolution degree for speed navigation and other with high resolution degree for printing process or the designer determines the input resolution degree of files, but the designer may specify for example, high resolution file nearly 300 dpi and attaches to
some low resolution satellite images, such as the satellite images of the Internet may need to be enlarged because of the small size when placed in the high resolution files and this will lead to the roughness of the details that appear in the printed images. So, some digital printers try to overcome this problem by using high output resolution by increase the number of pixels in the scanning pattern of the screen cell for the production of halftone dots trying to reduce this roughness effect. Case study – Sinai, Egypt. Sinai area is characterized by the different nature of the rocks. This led to the difference in the tones of images this serves the search in easily determine the impact of the accuracy of recording the input on the quality of the printed Sinai image.

2. Problem

- Change the degree of resolution of the satellite images, to digital printing or web images.
- The lack of digital images required to be able to choose from.
- The lack of digital image libraries in the provision of more diverse images of the designs of the various degrees of resolution suitable for printing.
- Deceive the low resolutions of the images on the surface of the screen.

3. Importance of research

The input resolution to be one of the most important factors quality affecting the appearance of the printed image and regarding the lack of pictures have high resolution so the designer used images have low resolution, therefore the search study the effect of different resolution degrees on the quality of printed image.

4. Theoretical study

4.1. Resolution definition

It is the number of image elements (dots, pixels) per unit length that can be reproduced on a monitor, film, an image carrier (printing plate, etc.) or on paper. Normally expressed in units (dots) per cm (dpcm) or inch (dots per inch).

Defined in photography by the number of separate lines per millimeter that can be reproduced with a tone value of 50% (dark and light lines with the same width) (Habil, 2001).

4.2. The resolution of the human eye

It is known as resolving power and means the ability of the eye to distinguish between two lines and is determined by the distance between the light receptors and the retina. This creates a viewing angle, which the eye can still just barely differentiate between two lines. This minimum viewing angle comes to about 1.5°. In order for the human eye to be able to differentiate between two lines, there needs to be a gap between the lines, that is, a pair of lines consisting of one black and one white line. The resolution of the eye is therefore not given in lines/cm but more precisely in pairs of lines/cm (Erickson and Romano, 1999).

4.3. Input resolution

One of obvious quality feature of an image definition can be determined at a limited by the resolution device when scanning the original data and transferring it to the film, plate, or substrate (Schmitt, 1999).

The original image is scanned by either a digital camera or an input scanner. The image information is not transferred entirely, but only in accordance with a scanning pattern of a specified resolution and number of tone value levels or gray levels. The pattern consists of the smallest image elements resolved by the scanning device, pixels word is created from picture and element.

The resolution of the pixel pattern can be specified by its resolution (spatial frequency), that is, the number of pixels per centimeter or inch. This is the scanning frequency (spatial frequency), also known as scanning resolution (Green, 1995).

4.4. Screen resolution

Screen resolution refers to the number of pixels a screen can display within a given area. Screen resolution is usually expressed in...
pixels per linear inch of screen. Most personal computer displays have resolutions that vary from 72 to 96 pixels per inch (Ppi). The resolution of the display screen is dependent on how the monitor and display card are configured, but it is safe to assume that most users fall into the lower end of the range, or about 72–80 Ppi (Eschbach, 1999). Images destined for print can be created at various resolutions, but images for Web pages are always limited by the resolution of the computer screen. Thus a square GIF graphic of 72 by 72 pixels will be approximately one inch square on a 72-Ppi display monitor. When you are creating graphics for Web pages you should always use the 1:1 display ratio (one pixel in the image equals one pixel on the screen), because this is how big the image will display on the Web page. Images that are too large should be reduced in size with a sophisticated image editor like Adobe’s Photoshop to display at proper size at a resolution of 72 dpi (Thomas, 2001).

4.5. Sharpness

Sharpness refers to reproduction quality of images and different from particularly lines or black and white line art original (Romano, 1998).

5. Practical experiences and applied

5.1. Programs, devices and materials used

5.1.1. Programs used

– The Photoshop cs2 for processing digital files of standard patches, two different sets of resolution and prepared for printing.
– FreeFlow DocuSP v5.1.

5.1.2. Devices used

– Computer IBM Pentium 4, Samsung 17-inch screen
– DocuColor™ 5000 Digital Press
– Measuring spectral reflectance device SpectroEye.

5.1.3. Materials used

– Xerox printing color tonner (Cyan–Magenta–Yellow–Black).
– Paper Cochah, gloss 150 gem.

5.2. Preparation of test files and printing

5.2.1. Test files

Use some measured patches and photos of Heidelberg’s color chart PCS – ECI 2002:

– Dot area patches (characteristic curve–dot gain).
– Density patches (density curve).
– Photos (sharpness).

Figure 2 The effect of different resolution on characteristic curve of cyan.

Figure 3 The effect of different resolution on characteristic curve of magenta.

Figure 4 The effect of different resolution on characteristic curve of yellow.

Figure 5 The effect of different resolution on characteristic curve of black.
5.2.2. Prepress

- Use Photoshop cs2 and open A3 file its mode CMYK with resolution 300 dpi.
- Open PCS – ECI 2002 color chart (PDF file) with resolution 300 dpi.
- Copy measured patches and photo from color chart and paste in test file.
- Repeated the same steps but with resolution 72 dpi.

5.2.3. Press

- Use electrophotography printer (Xerox DocuColor™ 5000 Digital Press).
- Sent two files (high resolution–low resolution) as PDF files with the same specification to the RIP situation of printer.
- Select type of paper (Cochah, gloss 150 g) and the size (A3) and order print.

5.2.4. Measuring test files

- Measuring by spectral reflectance device SpectroEye.
- Measure standard color in terms of density, dot area, and dot gain.
- The resulting measurements of the different resolution were plotted as graph (Figs. 2–10).

6. Analysis of the results

- The difference between characteristic curve of 72 and 300 dpi resolution (Figs. 2–7) very often slightly whereas in the case of 72 dpi shows an increase from 1% to 3% than 300 dpi resolution.
- There is a marked dot gain in both cases high (300 dpi) and low (72 dpi) resolution (Figs. 8 and 9).
- Yellow is the highest values for dot gain in all gray levels except for high-light (Figs. 8 and 9).
– Cyan is the highest values for dot gain in the areas of high light only (Figs. 8 and 9).
– Magenta and black the least values for dot gain in all gray levels (Figs. 8 and 9).
– In the case of density (Fig. 10), also found that differences in resolution did not affect significantly the values of CMYK density.
– The density values in the low resolution 72 dpi increased slightly than high resolution 300 dpi at all gray levels (highlight–middle tone–shadow) nearly 1 to only 3 density.
– For the density cyan was the highest values, but yellow was the least recorded (Fig. 10).

### 7. Conclusion

– Disparities, differences and diversity in the input resolution does not affect the measurements of print quality such as density, characteristic curve and dot gain despite the fact that the printed quality difference between the high and low resolution seem clear to the naked eye (Figs. 11 and 12), at many of the reproduction.
– Images of low resolution should not be manifested order to prepare for printing, but on the contrary, if allowed minimization, this is better in terms of print quality.
– Should not be used high screen ruling with low input resolution files must be in proportion 1 screen ruling to 1.5:2 input resolution.

### References


