

Making Digital Facsimiles of Documents

Part 3: Types of Printed Material

Many methods have been used to apply ink to paper, especially for producing pictures. For the purpose of making digital facsimiles of documents, what is important is the result, not the method used to produce the original.

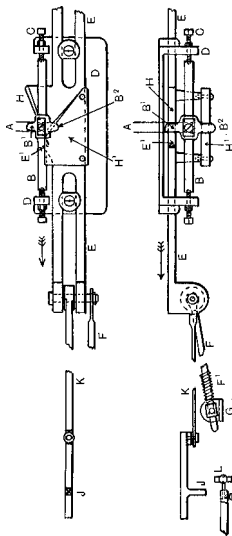
For this purpose, there are four major kinds of printed material: text, line art, "black-and-white" pictures, and color pictures.

Text

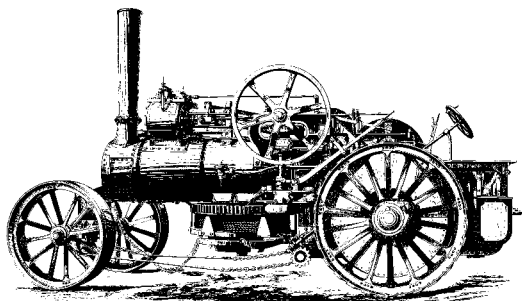
Text is familiar and little needs to be said about it. There are many different type faces that can occur in a variety of sizes. This document contains examples.

Line Art

The term line art refers to illustrations in which a single color of ink is applied to paper by means of lines, stipples, and other means. Engineering drawings illustrate the simplest form of line art, as in this example:



In older printed material, engraved line art was used to approximate realistic rendering of more complicated material, as in this example:



In both these examples, only one color of ink is used, and the result is referred to as *monotone*. The appearance of shading is achieved by very fine detail.

"Black-and-White" Pictures

With the advent of photography, printing methods were developed that produced the appearance of photographs. (Actual photographs rarely appear in printed works because of the expense.)

When color photography was introduced, the term "black-and-white" was used to distinguish photographs without color. Although "black-and-white" implies only two colors, "black-and-white" photographs actually have shades of gray — they are termed *continuous tone*, as opposed to monotone line art. Here is an example of a "black-and-white" photograph:



Although there are printing methods for producing continuous-tone pictures, they generally yield inferior results.

Instead, a *halftone* process, which produces the appearance of continuous tone, is commonly used. In a halftone, an array of tiny dots of various sizes is integrated by the human visual system to provide the illusion of shades of gray. Here is a (crude) example taken from a newspaper:



If a portion of this image is magnified, the underlying array of dots becomes evident:

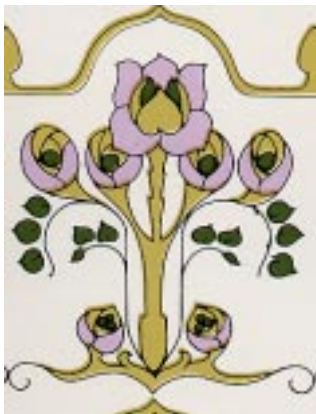


How realistic halftones look depend on the *screen* used to produce them. Fine screens, as used in art magazines, produce results that are indistinguishable from photographs to the naked eye.

Color Pictures

The situation for color pictures is similar to that for “black-and-white” pictures, except that there are not just shades of gray but also shades of colors.

Some printing methods use several colors of ink to produce multi-tone color pictures which, although not photorealistic, nevertheless can provide a range of rich colors. Here is an example:



Various degrees of photorealism are produced by color halftones, in which arrays of dots in four different colors (cyan, magenta, yellow, and black) are overlaid. Here is an example from a newspaper:



Enlarging a small portion of this picture reveals the dots:



As with “black-and-white” halftones, the fineness of the screen determines the visual quality.

The distinction between monotone, multi-tone, continuous tone, and halftone printing is important because it affects the way scanning should be done.

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