COLOUR REPRODUCTION SPECIFICATION AND OPERATION

Bryan Sunderland, Senior Consultant*

Abstract : Data flow needs in a colour reproduction cycle are examined. Production areas are discussed with the aim of achieving an effective system. Industrial application is described and the implications of emerging technologies are considered.

Introduction : Although improvements have taken place in individual processes the number of departments through which a colour reproduction passes between "concept and copy" has not, at the present time changed significantly. This is described in Fig. 1 which shows typical production flow.

Also shown is the necessary flow of data to achieve efficient production. This will produce:-

Optimum quality
Low wastage
Consistency of output
Reliable delivery
Minimum costs

This is achieved by arranging that most operational stages may concentrate on control to a predetermined characteristic rather than adjustment to accommodate variable input requirements.

*PIRA - UK

This is the significance of the data flow direction indicated. The elements of the process need to be related in the manner shown. Output data is fed back. The input requirements are defined and the two operations integrated during reproduction. This procedure represents an integrated approach to the colour reproduction process and encourages communication between all those involved. Research has provided the knowledge which is employed to communicate between departments and the sections which follow describe the material used in production applications.

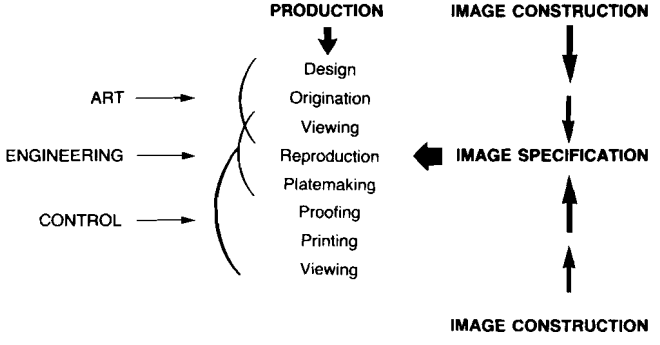

Fig. 1

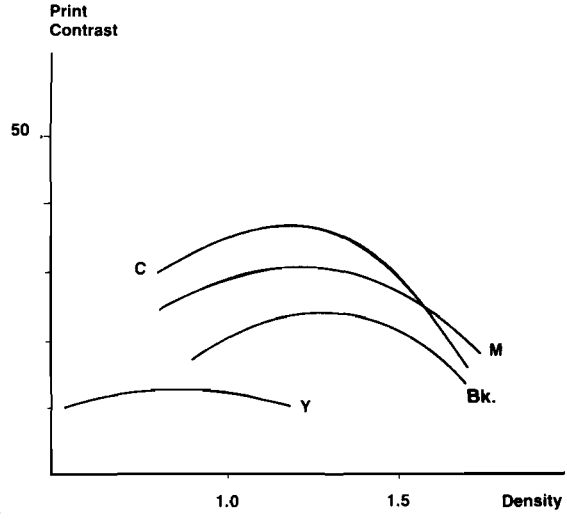

Fig. 2

PRESS OPERATION

The objective in this area is to specify optimum

Screen ruling
Ink weights
Grey balance
Gamut information
together with control data

Optimum screen rulings and ink weights are found using a combination of normal colour intensity (1) and colour brightness (2) calculations. Examples of the variety of printing characteristics encountered is shown in Fig. 2 which shows the mechanical transfer characteristics of inks under a given set of conditions and Fig. 3 which shows the colour values at different ink weights. The objective would be to print at the peak of the characteristic for each colour. Unequal optimum peak values are treated by priority needs of printability, colour and grey balance stability.

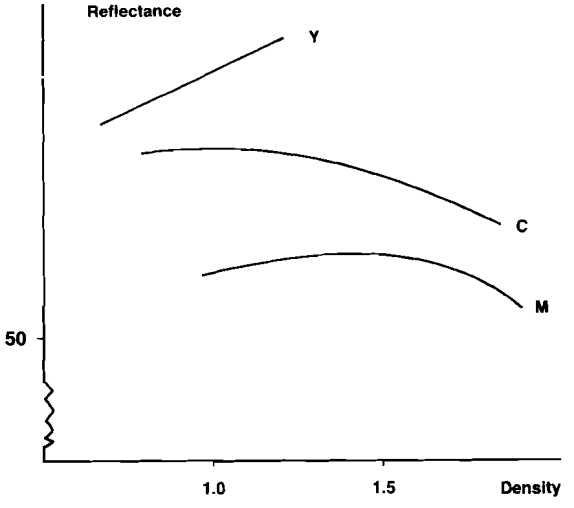

Fig. 3

Optimum ink weights may be defined for each set of printing conditions and the variability between sets of conditions is considerable. While this can be justified for some categories of production, the practical needs of the industry for interchange of material are leading towards a rationalization of standards. It should be pointed out that if external standards are applied it is necessary to modify production conditions to meet the standards otherwise control will be lost (5).

Once optimum density standards are established grey balance and gamut charts (3) are printed at the densities defined and provide the necessary information to be communicated to preceding operations. Once the defined standard has been established it is only necessary to provide densitometric values of solid densities and tint values as a quality control. These may be applied as Print Contrast or Dot Gain (4). It has been found that production may be very closely maintained by visual means and achieve many of the elements of efficiency listed.

PROOFING

The specification defined for the production press is used as the control for proofing. The objectives of the proof are to

1. simulate the printing condition and
2. provide the required reproduction.

It has been shown that the tone transfer of this operation can be adjusted (6). In operation proofs are required to produce an equivalent tone transfer to the production press. Pre-press systems in some cases can and should be adapted to simulate the defined production press operation.

PLATEMAKING

In this context the platemaking operation together with the film contact operation is considered as a tone transfer stage in the reproduction cycle. Since this process is the mechanical link between separation and final reproduction it should be optimised and controlled (7).

Having established an output specification it is now necessary to consider the objectives of the designer and their interpretation.

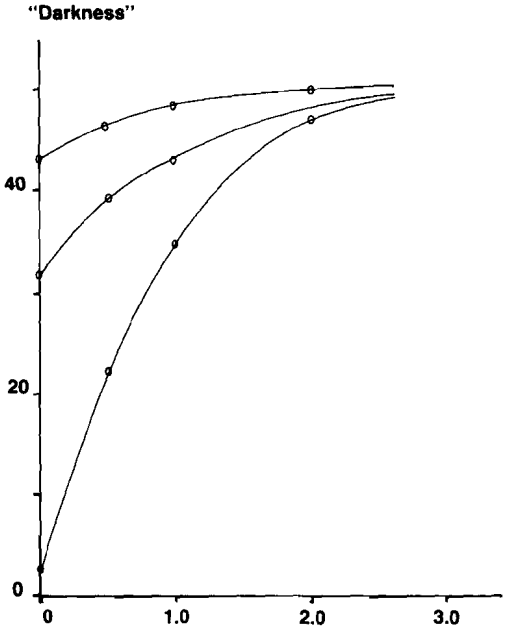

Fig. 4

VIEWING CONDITIONS

It is essential that the interpretation of the design is correctly communicated to the originator of the artwork and/or photographs. To achieve this it is necessary to establish an agreed viewing condition so that the content of the subject to be reproduced can be accurately defined. This subject has been extensively reviewed (8). An indication of variable tone interpretation is shown in Fig. 4 which describes the variation in tone perception for different lighting intensities.

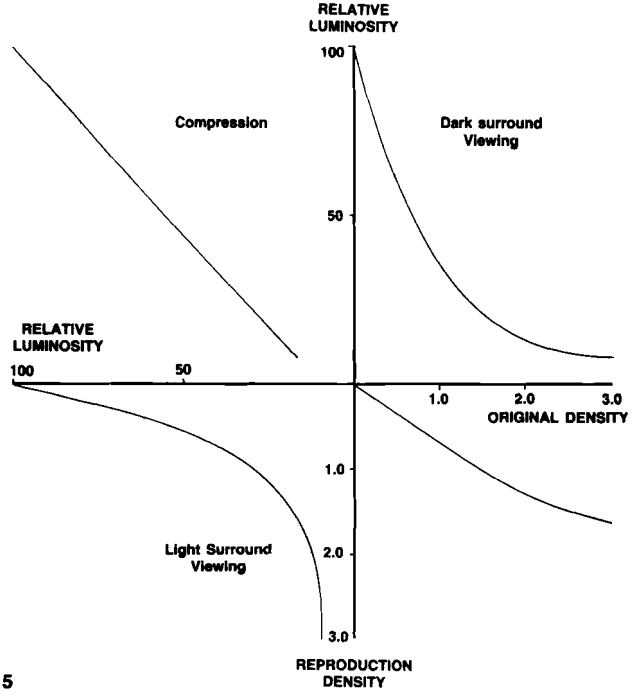

Fig. 5

TONE REPRODUCTION

The relationship between the tone values of the originals supplied and the final printed reproduction is a major factor in the acceptability of reproductions. This subject has been discussed and developed (9). This work describes a means of relating the visual perception of an original to the printing process and Fig. 5 shows the determination of final output tone needs for original, printing and viewing conditions.

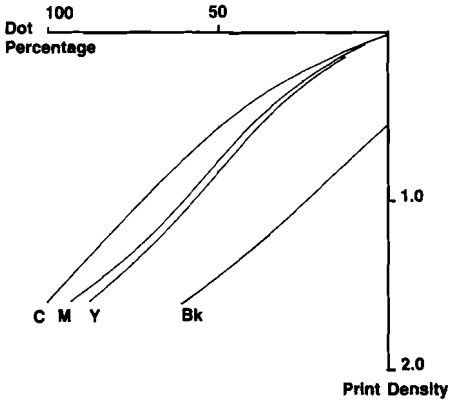

Fig. 6

SEPARATION IMAGING

As discussed in the introduction the separation imaging is considered as the engineering function between artistic interpretation and controlled production. It is necessary to relate the viewing and tone requirements to the defined production press characteristics.

The need for variable tone reproduction has been described previously (10, 11) and separation imaging has been adapted to accommodate variable requirements (12). For convenience in the determination of separation image requirements the grey balance condition has been determined for four colours (Fig. 6) taking into account viewing, proportionality and additivity. This means of illustrating the grey balance and output printing performance has been found useful in defining the operating requirements for colour scanning equipment. This is determined by graphical analysis using manual or computer based means. Colour values are determined using the same parameters. This area will be considered further in a later paper.

SYSTEM APPLICATION

The principles are not entirely novel but have been integrated into production operations and the commercial benefits have been achieved from efficient production.

Future developments in the industry will progress to the further integration of operational stages i.e., copy to plate through either soft or hard copy proofs. It is essential that the principles of integrated communication and operation are applied as part of the operational control of the process. The capital cost of the equipment systems which are now becoming available will require this approach to achieve efficiency.

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