PICTURE PROCESSING SEQUENCES IN COLOUR SEPARATION

BRYAN H W SUNDERLAND*

ABSTRACT : The processing sequences currently used in colour scanners are discussed in relation to a structured procedure. A sequence is proposed which would appear to remove some of the constraints presently experienced. Methods for minimising the effect of current sequences are suggested.

In the major world centres of colour reproduction, the greater colour proportion of colour separation is now carried out using the numerous forms of scanning equipment. This has had the effect of sharply increasing productivity. This has been obtained, to a degree, by a reduction in the effective flexibility of equipment and a reliance on 'operator skill' to obtain a desired result. This has led to variability in reproduction quality.

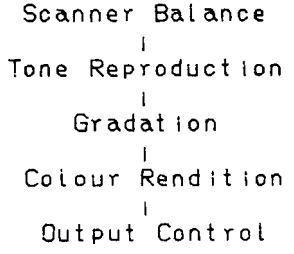
*PIRA, Leatherhead, Surrey, England.

It is also evident from industry studies that different makes of equipment, although using similar operating sequences, yield different results which cannot always be related to the "interpretation" of the original by the operator. This phenomenon has been studied and the discussion which follows is an attempt to characterise the results.

Structured reproduction

An approach to sequencing the operation of colour scanners has been described previously (1). This aimed to minimise the interaction of operations in scanning and is described in Fig. 1.

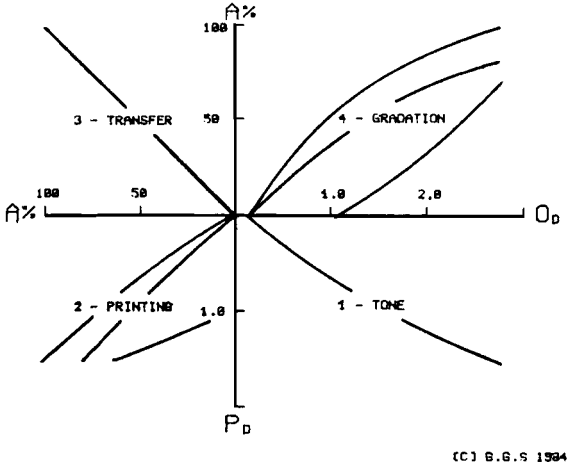
Fig. 1



STRUCTURED REPRODUCTION

A frequent description of the reproduction cycle is provided by the quadrant of Jones diagram (fig. 2). Examination of this diagram indicates the sequence in which the processing of the image must be structured in order to achieve a satisfactory result. Particularly, the relationship between the original and its printed reproduction - marked 'tone' - must be correctly defined prior to the determination of the output gradation from the separation system. Although the gradation is controlled by the printing characteristic, it is also determined from the tone reproduction.

Fig. 2



QUADRANT DIAGRAM

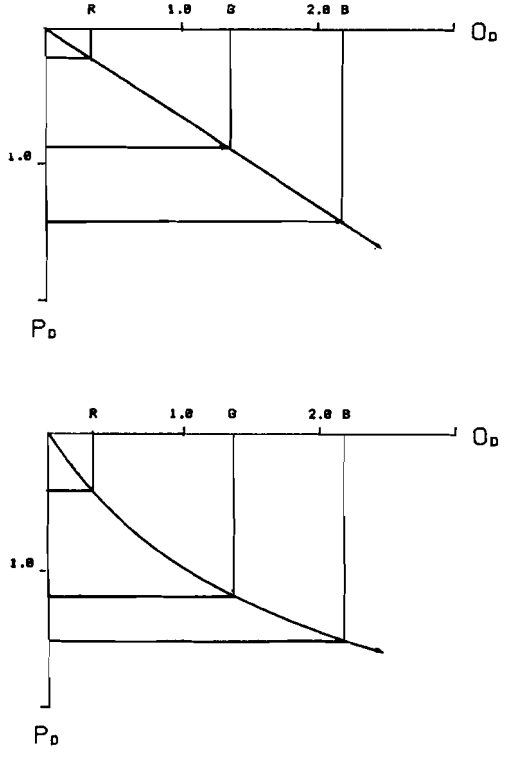
O_D = Original Density

P_D = Print Density

A% = Dot Area

Previous work has also indicated the effect of tone reproduction on colour rendition (2). This is demonstrated in figure 3 where a change in tone reproduction has a significant effect on the necessary colour rendition of an original colour. Previous work has also shown the necessity for a variable tone reproduction in order to correctly reproduce an original (2) and to Accommodate exposure variations (3). Fig. 4.

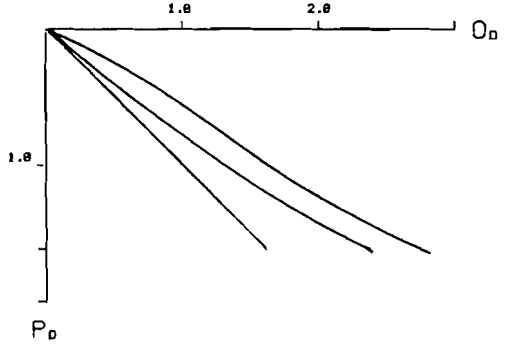
Fig. 3



TONE REPRODUCTION
affects colour rendition

From this previous activity it can readily be seen that the reproduction of colour is very much determined by the overall tone reproduction of the original. In this context it is therefore useful to examine the processing sequence in scanning equipment to determine the ability to adjust colour reproduction in relation to the required tone reproduction.

Fig. 4

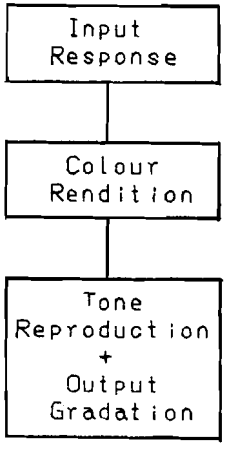


VARIABLE TONE REPRODUCTION

Scanner processing sequence

The processing sequence in many scanners is shown diagramatically in figure 5. This shows that the relationship between the values of a colour is effectively controlled at the input as this is the stage prior to the colour correction circuits. The following circuits of gradation, often combined with tone adjustment, can make only limited changes to the effective colour rendition, without distorting the picture. The overall effect is that input response controls the colour rendition of a scanner. The nominally fixed input in the majority of scanners restricts the ability to adjust tone and/or colour reproduction without distorting the picture, as these functions are largely independent.

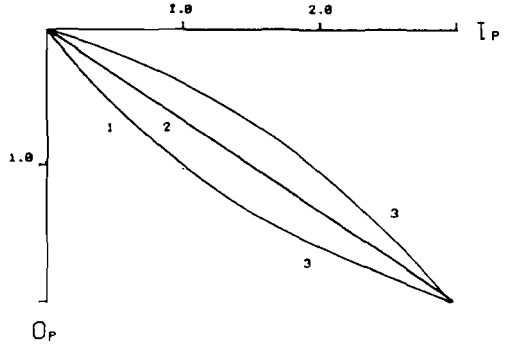
Fig. 5



TYPICAL PROCESSING SEQUENCE

Typical input response curves are shown in figure 6. Items labelled as 1 and 2 show commonly used input response curves. It may be seen that the curves will affect the way a colour is presented to the colour circuits. These are in fact equivalent to figure 3 and represent the effective "tone reproduction" of the scanner. If fixed, they limit the flexibility of the unit. It is this characteristic which tends to "identify" the particular scanner on which a given reproduction is produced.

Fig. 6

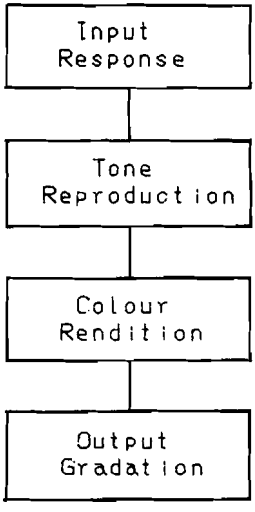


INPUT CHARACTERISTICS

Objective colour reproduction

A computer programme based on previous work (4) enables the processing of neutrals and colours to progress through a tone reproduction calculation prior to the computation of output values. The programme allows for the computation of tone reproduction which is variable. This is followed by the determination of output values taking into account any under colour removal. Colour rendition includes the tone and gradation components plus grey stabilisation if required. The use of this programme has shown the value of a processing sequence in scanners designed to operate as in figure 7.

Fig. 7



PROPOSED PROCESSING SEQUENCE

The illustration shows the rearrangement of the block diagram to apply the tone reproduction component prior to the colour computation. In addition it shows that the output gradation (grey balance) could also be operated independently of earler processing.

One currently available scanner at least appears to operate this sequence (5) and in practice has been found to provide flexibility in tone and colour reproduction. It has a range of input characteristics indicated as 3 in figure 4.

Assessment

The benefits to be gained from equipment which uses this processing sequence are:-

1. Objective operation - this permits a less subjective approach to scanner operation and equipment programming.

2. An enhanced degree of flexibility in the reproduction of different originals.

Although the future benefits of employing the sequence described will be substantial there is at the same time a need to optimise the output of equipment currently in use.

To obtain improved reproduction from existing equipment two opportunities present themselves:-

1. Modify operating procedures taking into account the present input characteristics and processing sequence. Practical methods to achieve this will be reported at a later date.

2. Design input origination to minimise the adverse effects of the operating sequence to be used. Naturally this will not always be possible as the scanner user often has no influence over the origination. In prestige publications, such as Mail Order Catalogue production however, this is perfectly feasible and is the subject of work which will be published at a later date.

Industrial development

The trend in the industry towards a greater degree of standardisation and control of printing operations will produce an increased incentive for accurate separations. This will particularly relevant where the use of electronic page make-up systems could mean that separation data is received from a number of sources. Continued developments in the area of pre-programming and separation accuracy will enable advantage to be taken of the growing number of such systems.

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