ACCOMMODATION OF THE ORIGINAL COLOUR BALANCE IN REPRODUCTION

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ABSTRACT

The influence of visual and effective grey balance in coloured originals is discussed. This is related to the need for an effective means of obtaining good reproduction of individual subjects, while at the same time maintaining a visual consistency between them. A method, which has been used to achieve this aim, is described.

THE INDUSTRIAL CONTEXT

The evolution of an engineered solution to the colour reproduction process from original to final copy has developed steadily-from the platemaking and press performance specification to the control of proofing and hence the improved design of colour separation software. Pre scan analysis including the visual perception of the original is a further step in this evolution (Sunderland 85) and in the last year this has been formalised in the development of a Graphic Analyser which materially assists communication of an assessment or perception to a reproduction facility.

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In spite of these major improvements there are still occasions when results are disappointing particularly when a number of original subjects appear in close proximity, when areas which are visually neutral grey on the original appear with colour castes. The aim of this submission is to extend the quality assurance approach to accommodate the neutral balance characteristics of originals for reproduction.

OPERATIONAL CONSIDERATIONS

The commissioning and operational integration of scanning equipment with printing grey balance is achieved by using a neutral transmission or reflection step wedge. The aim is to ensure that a known grey is reproduced as a visual grey when printed. In practice, many techniques exist - and are used - to "balance" the colour separation device either directly or indirectly using the original subject itself. This often leads to anomalies in the reproduction leading to inaccuracies in the reproduction of neutrals and/or colours. The justification for this approach is often quoted as "taking out the colour cast". In fact although it removes an imbalance at one point it may well introduce problems in other parts of the tone scales.

This effective imbalance in colour materials is the result of several effects.

- dye sets which are metameric (Hunt '70)
- processing variations
- lighting colour balance in the original scene
- viewing adaptation and peruption.

In practice these effects lead to different interpretations of the way in which the process of colour reproduction is understood. For instance, whereas the grey balance of a printing condition may be given, a scanner operator will examine the reproduction of an original, produced by separation equipment, and question the printing grey balance condition when in fact the effects described above are influencing the result obtained.

AN EXAMINATION OF ORIGINAL MATERIALS

Colour transparencies and prints were obtained from a number of manufacturers. They were selected to include the reproduction of a grey scale.

Measurements of the grey scale were made using wide band densitometry through red green and blue filters. The resulting density measurements were plotted to compare the green and blue filter measurements with that of the red filter.

The results are shown in diagram (1). Given a neutral tone, all three measurements would plot on the 45^{o} line. In the case of a grey scale used for setting a colour scanner this was achieved with a tolerance of $\pm$ 0.03. Examination of the diagram will show that this is approached only rarely. In the majority the deviation from neutral is significant. The illustration represents materials from a number of manufacturers. Although there were broad similarities between materials from any one manufacturer, it would appear that the effects described are typical of the variation experienced.

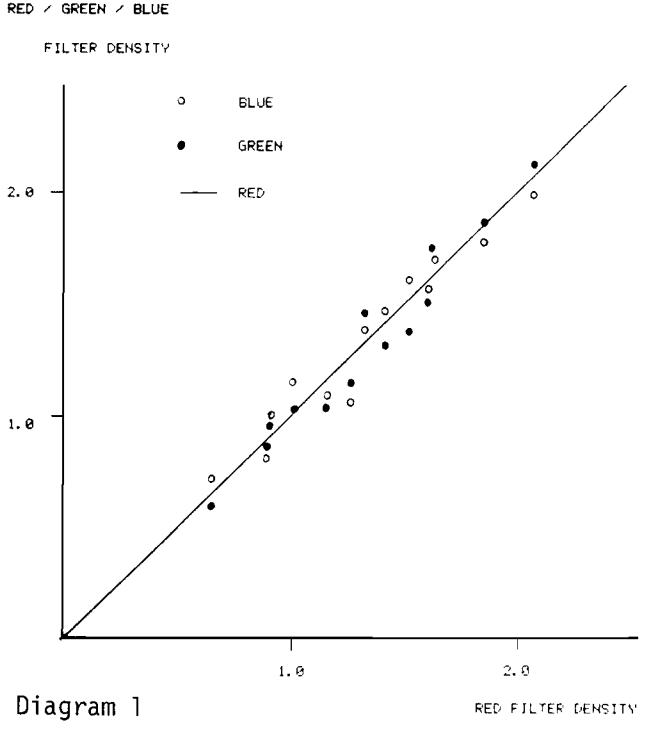

Diagram 1

AN INDUSTRIAL SOLUTION

Previous work (Sunderland 1985) has described a computer programme which takes into account

- the printing conditions
- the viewing conditions
- the perception of the original
- grey component requirements
- grey stabilisation
- colour reproduction

The programme is based on the use of a neutral grey scale to "balance" the scanner. The programme is further refined in the "perception" area of the programme, to accommodate the colour deviations in visually neutral extreme highlight and shadow areas.

In addition the programme requests a measured definition of a visual neutral in a significant area. This information is used to normalise inputs for the calculation of neutral, colour and GCR requirements. The calculations define the output required to accommodate the defined balance of the original.

Examples of the programme output are shown in diagrams (2) and (3). Diagram (2) illustrates output for a neutral scale. Diagram (3) describes the output required, also from a neutral scale, for an original which is visually neutral but which provides differing filter densities.

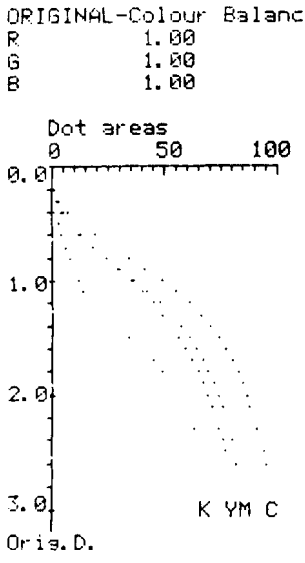

Diagram 2

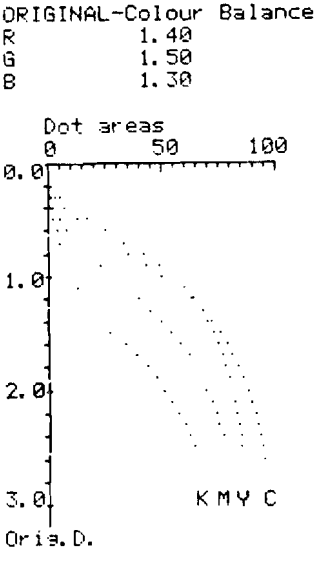

Diagram 3

Examination of the two diagrams will show that, although the printing system used was identical, the dot area gradation for individual colours which should be achieved on a neutral grey scale has changed the relative position of magenta and yellow printers for the two originals.

This is certainly one explanation why in practice there are different interpretations on what constitutes a "neutral". In this case the "printing grey balance" has been combined with an "original grey balance" and the result is to require a gradation change on the scanner, which could, incorrectly, be seen as a "printing grey balance" change.

INDUSTRIAL BENEFITS

The use of this procedure has been shown to accurately reflect the perceived appearance of an original. It further assists an objective assessment of originals from different sources and their effective integration into a controlled proofing and printing system.

The aim is to minimize manual intervention, either optically, post output, or electronically, prior to scanning. This will materially assist the cost effective operation of systems.

FUTURE DEVELOPMENT

The present method employs wide band densitometry. This has yielded excellent results which have provided the benefits described. In the future it is expected that the use of colorimetric principles (Maurer '75, Masia '84 Mason '85) will enhance the approach.

REFERENCES

Hunt, R W G 1970
Objectives in Colour Reproduction
J. Photo. Sci. 18, p 205

Maurer, R E 1975
The effect of dye absorbtions in colour
transparencies on graphic arts processes
TAGA Proc. p 276

Masia, A 1984
A digital colour separating system based on Principles
of Colorimetry
TAGA p 346

Mason, R 1985
Specification and control of Process Colour Images by
Direct Colorimetric Measurement
TAGA p 256

Sunderland, B 1985
An engineered assessment of Originals for Graphic
Reproduction.
TAGA p 520