

AN ENGINEERED ASSESSMENT OF ORIGINALS FOR GRAPHIC REPRODUCTION

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Abstract : The subjective interpretation of originals for reproduction is considered. The need to relate this to a definitive brief for production is discussed. A method is described which achieves an engineered assessment of originals thus enabling effective communication between origination and pre-press facilities.

Current Industrial Consideration

Rapid industrialisation has taken place in graphic reproduction. We are now familiar with the use of scanners, electronic image assembly, facsimile transmission, machine processing of film and plates and the production of proofs and prints which conform to an agreed specification. These developments have highlighted areas for improvement in the communication between the originators of material and production facilities.

Excellent results are certainly achieved after "Editorial changes". These incur the cost of down time, materials and in some cases an acceptance by the customer of results which have not the appearance of the subject matter when the originals were assessed for reproduction. The objective of this paper is to suggest a means of more effective communication between the Provider and Producer of the image.

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Assessment Procedures

Industrial standards such as:-

BS 950 II
ISO 3664

define viewing conditions for use in the graphic industries. These define colour temperature, light intensity and the surrounding area of, in particular, transparency materials. This is vital as the overall perception of an original varies with surround conditions. (Birkenshaw 1976).

Recognising the need to reproduce a transparency "as seen", separation equipment may be organised to provide 'standardised' reproduction. This is the ideal situation when the customer's perception of the transparency is that seen under the prescribed conditions. In practice, originals are viewed in a variety of conditions and their representation of the subject matter is perceived and assessed subjectively prior to separation and reproduction.

This action is not carried out with the aim of confusing those involved in reproduction but to visualise the final result. This is achieved by using the numerous reproduction facilities available until satisfaction is achieved. An ultimate objective of the reproduction system is to accommodate and interpret this perception of the original and to arrive at a Pre-Scan Analysis which will enable the required results to be achieved by prediction programming of the separation equipment.

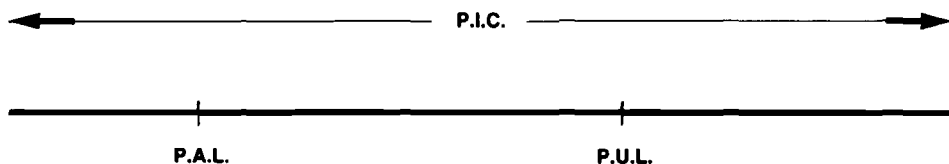
Previous developments towards this objective have used the transparency characteristic (Sunderland 1971) and the exposure level of the transparency (Maurer 1972). The present extension of these approaches is to describe the subjective interpretation of an original in terms which can be readily related to, objective methods of reproduction.

Perceptual References

The approach taken is to consider the original as part of a P.I.C.

P ictorial I mage C ontinuum

a scale running from absolute white to extreme shadow. Within this scale the eye effectively adapts to an upper and a lower level within which it 'sees' the scene. The remaining values of the P.I.C. are appreciated as a continuation of the scale but at a decreased contrast.



The most significant point is described as the P.A.L.

P erceived A daptation L evel

There is a precedent for this approach in the illumination field where the adaption level is described as "the level to which the eye will become adjusted in the steady state in a given visual environment".

In the case of reproduction the level is that visualized when looking at the original scene displayed.

The second point is that at which detail becomes invisible to the viewer or is perceived as black. This is described as the P.U.L.

P erceived
U mbra
L evel

These levels are either 'moved' or perceived by using different illumination levels and/or environments for assessing originals. They may be determined by discussion or by calibrating variable viewing conditions. The subsequent density measurements of the appropriate areas are used to calculate the required reproduction.

Production Considerations

The selected levels described above are measured and used in the approaches described previously (Sunderland 1971, 1982) which define a tone reproduction shape between selected points. It is then necessary to accommodate the remainder of the P.I.C. This is achieved by the use of a function incorporating the following form.

$$D_2 = D_m(1 - e^{-kD_1^n})$$

- Where D_1 = Calculated Density of Reproduction
- D_2 = Final Density of Reproduction
- D_m = Maximum reproduction Density

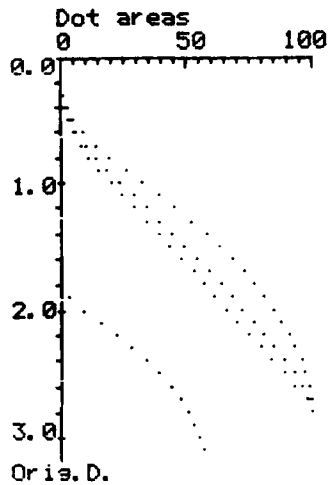
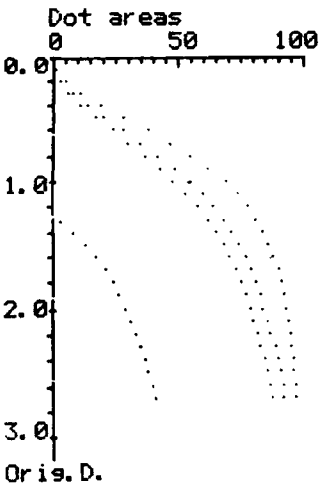
This typically describes the response of photographic materials and has the effect, with suitable coefficients 'k' and 'n' of adding a defined 'toe' and 'shoulder' to the reproduction.

Accurate tone reproduction is the prime requirement of a reproduction process before the application of printing factors such as grey balance, colour rendition and undercolour removal with its derivatives.

The following diagrams show the effect, on final output gradation, of P.A.L. and P.U.L. appropriate to different perceptions of an original.

P. A. L. 0.30
P. U. L. 2.20

P. A. L. 0.65
P. U. L. 2.70



This objective interpretation of the subjective perception of an original has been incorporated into a computer programme previously described (Sunderland 1982). It has been effectively employed to define the required reproduction of both colour and black and white reproductions for numerous processes. It defines the tone reproduction followed by the other factors and defines output in the graphical form shown or as numerical output.

The data is employed to preset reproduction equipment or to pre-program graphics subsystems. This enables the assessment of originals off-line leading to more effective production.

It is encouraging to note that the preferred tone reproduction and conclusions of Jorgensen (1975) are closely followed by the programme. It would therefore appear that there is now an opportunity to combine aesthetic and engineering aspects of reproduction to increase both confidence and quality in the final outcome leading to an effective G.F.E. (Graphics Front End) for the reproduction industry.

System Integration

This means of assessing originals has already been used in graphic subsystems enabling the effective off line assessment of originals in addition to providing higher quality and productivity.

This holistic approach is also expected to find application in other forms of imaging and reproduction such as video and computer graphics displays where a defined perception is required.

References

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Sunderland, B H	1971	ISCC Proceedings
Maurer, R	1972	TAGA Proceedings
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Jorgensen, G W	1975	IARIGAI Proceedings