

LIGHTING FOR TELEVISION

BASIC CONSIDERATIONS

Introduction

This information sheet introduces the technical and artistic requirements which have to be considered when lighting for television.

Technical Requirements

1. Incident Light Level

In general the incident light level is governed by the sensitivity of the camera tube, taking into account the working aperture of the camera lens.

The working lens aperture is determined from depth-of-field considerations; it is usually that aperture which gives acceptable depth of field from a production point of view.

2. Contrast Ratio

Contrast Ratio is the ratio between the luminance of the lightest and darkest part of the subject or image. The scene contrast cut-off doors is on average 160:1 although it may be as high as 1000:1.

Television camera tubes have a restricted contrast range over which it is possible to accurately reproduce the tonal gradation of the original scene. This is known as the acceptable contrast range (A.C.R.) of the camera tube and is affected by the amount of δ correction applied to the signal from the tube.

Camera Type	Incident Light	Reflected Light Apostilbs		F/No	Approx A.C.R. (small areas)
		Peak White	Face		
4½" I.O. Camera	500	300	150	f8	40:1
Vidicon Camera	1600	1000	500	T:2.8	50:1
3 tube Colour Camera	1600	1000	500	f 4.0	30:1
4 tube Colour Camera	1600	1000	500	f3.5	30:1

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Note The mean apertures quoted above give the same depth of field for a given angle of view.

Light Units

1 lux = 1 lumen/m²
(illumination)

1 Apostilb = 1 lumen/m²
(reflected light)

1 lumen/ft² = 1 foot candle = 10.76 lux (Incident light)

1 foot lambert = 1 lumen/ft² = 10.76 Apostilb (Reflected light)

Inherent Contrast Ratio is the contrast inherent in a scene by virtue of the reflectance or reflectivity of the different surfaces in the scene. In order that lighting may be used to 'model' a set successfully the scenery inherent contrast should be restricted to about 20:1. In order to ensure this the colours used by Scenic Designers are selected from a range of colours which have reflectances between 3% and 60% i.e. a contrast ratio of 20:1.

A television White is a surface which has a reflectance of 60% and the average European face is approximately half this value i.e. 30%.

3. Colour Temperature

In monochrome television, variations in Colour Temperature (unless excessive) are not a problem. However, in colour television the colour temperature of the light sources should be within 150°k of the 'line up' colour temperature i.e. $2950^{\circ}\text{k} \pm 150^{\circ}\text{k}$. This applies to lighting of faces where accurate colour rendition is important. When lighting scenery, the colours of which are unknown to the viewer, variations in colour temperature are less important.

Artistic Requirements

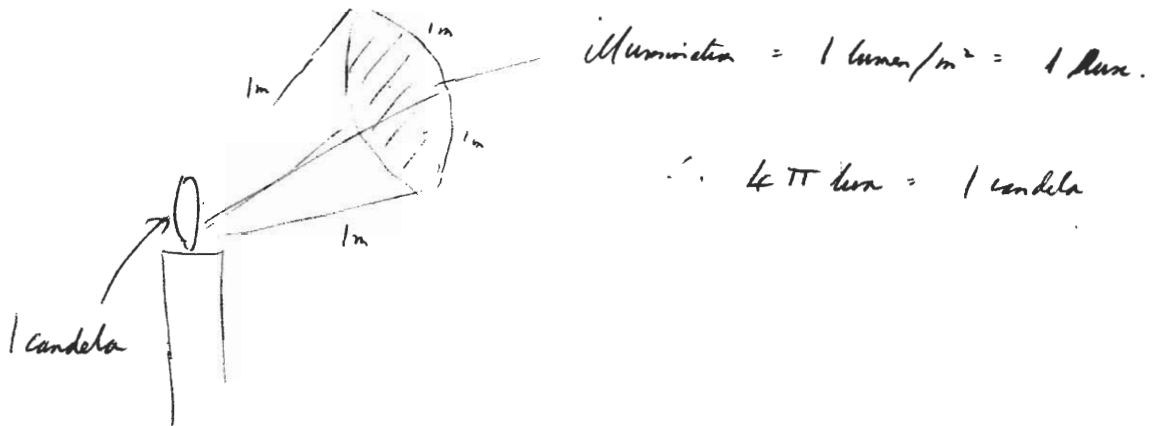
1. Illusion of Depth is the first artistic consideration, otherwise pictures will tend to look flat and uninspiring. Monochrome reproduction takes away the interest normally created by contrasting areas of colour and it is necessary to light for shape, form, tonal contrast and surface texture. In general the lighting can be divided into two parts, the first being modelling of artists and the second scenery lighting. However, the set lighting should not distract from the centre of interest, usually the human face. Subjects (artists and sets) are modelled by light, using shadows to reveal the shape, form and texture. The greater the shadow areas the more solid and three dimensional will the subject appear. Texture is revealed to a maximum when the surface is edge lit. Tonal contrast can be used to create the illusion of depth by arranging a recession of tones from the background (light) to foreground (dark). In order to achieve control over the scenic contrast the scenery should, whenever possible, be lit separately from the artists.
2. Script requirements have to be satisfied in such a way as to maintain a balanced picture content which has a fairly constant mean brightness and so minimising effects at the receiver due to the absence of d.c. restoration. Additionally, this reduces the amount of vision control required.

The script requirements are basically two-fold:-

- (a) Explicit - Day, Night, Interior, Exterior, etc.
- (b) Implicit - Mood or Artistic Impression visualised by Director and Lighting Supervisor.

3. Compatibility

A vast majority of receivers are monochrome; and a further constraint is added to the transmitted picture, namely that the compatible picture (monochrome) is not degraded. To assist the "realisation team" (lighting, scenic design, costume and make-up) in this respect, most of the studio control room monitors are monochrome. Only the monitors used for final assessment are colour.



$$\text{Tube Illumination} = \frac{\text{Scene Luminance} \times \text{Transmission Factor (loss)}}{4 \left(\frac{f}{d}\right)^2 (1+m)^2}$$

$$m = \frac{v}{u} \quad \frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

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