

The Gordon Project



Dr John Emmett examines a little known side effect of TV watching, and explains how the broadcasters are working to overcome problems with photosensitive epilepsy.

Virtually anyone can have a photosensitive epileptic (PSE) seizure under the right circumstances. Everyone has a seizure threshold that makes us all more or less resistant to flashing light sequences and sometimes even susceptible to intense patterns.

Under normal living conditions, however, PSE occurs in approximately 1 in 4000 of the population, with an incidence of 1 in 100,000 per annum. In addition there is an unknown number of photosensitive people who have as yet not had a convulsion, and unless an attack is triggered by an outside influence such as a television programme, many of these persons will lose or reduce their photosensitive tendencies with age.

Seventy-six per cent of PSE patients have their first convulsion between the ages of 8 and 20, whilst only 11 per cent have their first photosensitive convulsion above the age of 20. The condition is more prevalent amongst girls, to a ratio of nearly 2 to 1.

These statistics point firmly towards the need for the careful checking of television material before it is broadcast, because a significant number of vulnerable viewers (typically a teenage girl) may well not be aware of their vulnerability, and therefore will be vulnerable to all visual material beyond their control, i.e. the programme material itself.

The dangers of not checking all the programme material that is actually broadcast

were recently highlighted by an item transmitted by NHK. This cartoon is estimated to have resulted in the Hospitalisation of 700 viewers.

At present the method of screening used in many UK Broadcasters is described in an ITC Code of Practice Document, and that increasingly relies on a laborious and subjective frame by frame analysis of videotaped material. This recent increase of work effort comes about, at least partially, because non-linear video editing has made

be turned into analogues of the brightness elements that are viewed under typical home viewing conditions. Fortunately, the peak brightness of home TV displays seems to be constrained to between 100 and 250 candelas per square metre. Oddly, looking to the future, it is quite possible that this brightness value may not increase greatly under home viewing conditions, even if the display technology allows it. This is because subjective tests have shown that pictures with higher peak values, are perceived as less sharp (and less desir-

reaction to brightness that is almost the inverse of this value, and this results in the visibility of video noise being fairly even across the grey scale of a television picture. In effect, this means that we would have had to invent gamma for analogue television transmission, if it did not exist as a result of the display Physics.

If you doubt this non-linear response of your vision, take a look at a grey scale and choose a value that you think represents mid-grey. If you then measure the light reflection or screen brightness of this selected strip, (and BPR produce a range of affordable photometers for video and projector set-up!) you may be surprised to find that it is in fact nearer 20% of the white value, rather than the 50% that you might have expected³.

Inside Gordon, the component video signals Red Green and Blue are each individually un-gamma corrected into a linear form, and then matrixed to produce a perceptual brightness equivalent signal. This signal is integrated over the visible picture area, and displayed on the horizontal front panel meter. The electrical signals are made available to each of the four plug in module sites. The principal module processes the signal to extract cyclic changes in the brightness, normally from 3Hz, up to half the field frequency.

Other modules are frequently fitted, especially one for detecting similar flashing in the Red channel, which may not be detected in the matrixed luminance channel because the Red may flash to another colour which is of a similar luminance value. Yet



the unintended creation of offending material so easy. In view of these increasing problems, Channel 4 Television commissioned the development of the (Flash) Gordon monitor equipment with the specific aim of providing an effective tool to detect likely video sequences which could trigger attacks of photo-stimulated epilepsy.

This system monitors video signals for flashing sequences or intense patterns, and when a suspect video sequence is detected, local and remote alarms are activated, and the timecode display is frozen at the time of detection.

In order to do this, the electrical video signals first need to

able) than identical pictures with lower peak brightness values.

Peak brightness is an important element in the potential epileptogenic effect of television pictures, and as a result, flashing or patterns below 20 cd/m² will affect very few viewers statistically.

Video signal voltages follow a power law version of brightness, and are said to be "gamma" corrected¹. The gamma power law was arrived at accidentally in the 1930's as a result of the grid voltage to brightness characteristic of cathode ray tubes, which theoretically follows a 5/2 power law. As luck would have it, the eye has a gamma

another module can detect highly modulated patterns on the screen, simply by looking closely at the frequency components present in the video signal, and weighting these according to the visual response of an average viewer.

Currently, Gordon is available from BPR Ltd in versions for component or composite 625 or 525 line systems. It includes options for plug-in card modules which can be supplied to detect Red flashing (component inputs must be used) and Pattern detection, as well as the standard module which detects 10% brightness flashing. Details are on the Broadcast Project Research Web site at www.bpr.org.uk

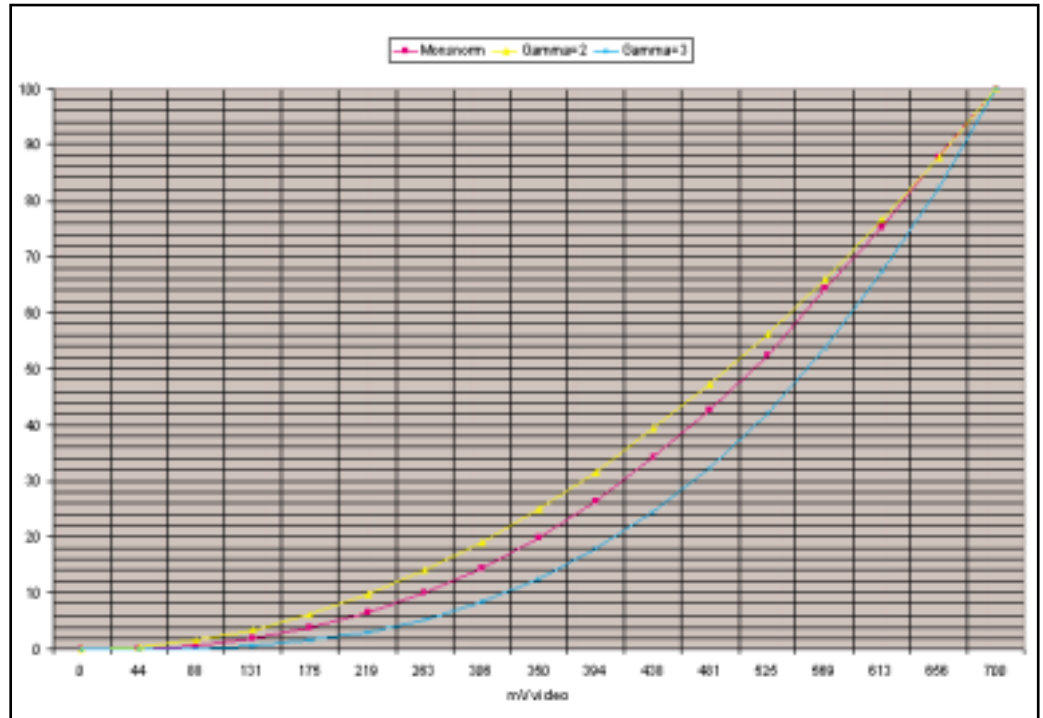
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From the editor:

Interestingly, the ITC has recently amended its Programme Code on the use of flashing images. The revised section of the Code now reads: "Flashing lights and certain types of regular visual patterns can cause problems for some viewers who have photosensitive epilepsy. People below the age of 20 years are the most susceptible group and many are unaware of their susceptibility. Care must be taken to minimise these risks in all programmes, but especially those where young people are likely to be watching in significant numbers. This might mean cutting or amending



Graph of voltage against brightness to illustrate Gamma. Vertical scale represents screen brightness percentage, typically equivalent to 0 to 200 candelas per sq. m in the average home. "Monnorm" is the averaged measured brightness of several Studio monitors at 80 cd peak brightness. Notice that brightness tapers off at high levels, even at this low peak brightness, so the gamma law is not precise for CRT's, and the match gets much worse for flat panel displays.

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certain scenes or sequences or rejecting entirely some material, such as a pop video. At times difficulties in minimising the effects may be encountered, for example with some types of live coverage, such as a news report. Where there is likely to be significant risk, viewers should be given an appropriate warning at the start of the programme or programme item. Licensees should refer to ITC Guidance Note Flashing Images and Regular Patterns in Television which outlines the technical parameters for minimising risk levels." See www.itc.org.uk