WHITE PAPER

The Importance of the Chroma Keyer in a Virtual Studio System

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There are many components or processing elements which go into making a virtual studio, but the final one which brings together the real and virtual environments is the chroma keyer.

This is the process of combining the video signals from the cameras with the virtual, computer-generated backgrounds. Virtual studios are essentially rooms where the wall and often the floors are painted a single green or blue colour. In simple terms the chroma keyer replaces the green (or blue) with the virtual computer generated background.

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The technical challenges of chroma keying

This fundamental concept has been used in film and TV programme production for over 30 years. While the concept seems simple, the reality of implementing the process can be more tricky.

Although the walls and floor may have been painted with a single colour, there is usually a variation in the colour (or hue) seen by the camera (or rather the video processing) due to the lighting variations. The bigger the studio, the more difficult it is to get consistent and even lighting across the back wall.

You can choose to widen the range of colours you consider to be the key colour, but this has to be balanced against keying over the objects in the foreground, such as the presenters, who may be wearing a variety of different-coloured clothes, some of which may be similar to the key colour.

When used for TV programme production there are additional technical problems which arise due to the limited chroma bandwidth of a 4:2:2 video signal. This can produce unwanted artefacts at the edges and limit the amount of fine detail, such as hair strands, that you can have in the final combined output picture.

There is also the dreaded colour spill issue. This is where the blue or green light from the backdrop wall and floor appear on the presenters or other foreground objects – making things look tinted an unnatural hue.

With these sorts of issues it soon becomes apparent that the process of chroma keying is not so straightforward. There are a number of different products or solutions which tackle these issues in different ways, with varying degrees of success.

Are PCs the answer?

You would imagine that the answer today would lie with software – or rather PCs running software processes – but in fact for real-time chroma keying, which is needed for live productions, the PC solution still does not have enough processing power to deal with all those issues mentioned above.

As broadcasters moved from Standard Definition to High Definition, the data rate went up by over a factor of four – from 27Mbs to 150Mbs. So as PCs got faster, the task required got more difficult.

Vision mixers vs dedicated hardware solutions

Maybe in time the PCs will catch up, but right now the dedicated hardware solutions are still producing better results and are more reliable, which is also a key requirement for live TV broadcasts.

Many vision mixers have in-built chroma keyers and some of them are actually quite good, but there are still good reasons to buy a separate stand-alone product.

Presenting a combined image to the vision mixer avoids tying up resources on the mixer, and makes the operator's job of driving the mixer easier if he does not have to worry about setting up the chroma keyer.

In a large virtual studio production with four or five cameras, you might want different settings of the chroma keyer for each camera to get the high quality of image, and this can be done by using a separate external chroma keyer on each camera feed.

Even the largest mixers do not generally have this flexibility. It has to be remembered that the vision mixer is very much a general purpose device and so the manufacturers do not include some of the extra processing that a dedicated chroma keyer can have.

For example, Crystal Vision's Safire 3 is a dedicated chroma keyer with built-in colour correction, lighting compensation and edge filtering – all of which can be used to deal successfully with those technical challenges described above.

Also from an operational point of view, having a dedicated control panel for the chroma keyer makes it so much quicker and easier to make small adjustments during the course of a live programme. This might happen as a presenter moves around, or the camera pans to a different part of the studio where the lighting is darker or brighter.

In conclusion

As consumers begin to understand the difference between Standard Definition and High Definition, broadcasters are using dedicated external chroma keyer products more and more because they have to deliver a high quality output image to meet the growing expectations of the viewer.