Is glasses-free 3D ready for industrial/medical applications?

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Harking back to the good-old-days, before social media, before texting, before mobile phones – all the way back to when we (not me literally) received news from the wireless (radio), this new-fangled invention came along called the TV and sat down in living rooms everywhere. Eventually, we could enjoy color TV and in the 1980's the great innovation of stereo sound, and here we are now with all manner of nifty features like flat, connected, apps and in some cases, 3D.

When I ask people about their impression of 3D, I hear the range of responses, from good to bad to "it makes me sick." Further probing will often reveal the amount of experience one has with the technology. Usually, the experience is with wearing glasses in a movie theater, but sometimes with a glasses-free (autostereoscopic or AS-3D) display, such as the one used in 3D-capable gaming consoles. While the AS-3D display in the 3DS performs admirably, it is a hand-held consumer device and not intended for professional applications like Test & Measurement or Medical.

Using the medical industry as an example, they have fantastic imaging technology that allows trained professionals to make accurate diagnosis. Sometimes, the doctor will share the image from a MRI, X-Ray, Ultrasound or other imaging device and ask us to imagine the shape of the body part (say a knee or shoulder) and understand that this grey blob is a problem, but this other grey blob is healthy. Seeing these grey blobs in 3D makes it very clear where they are located and help us to understand what is happening. I am not suggesting that the physicians require this technology to do their jobs, but to us lay people AS-3D images would be quite helpful. That leads to the question; "Is this technology ready to make the move from a 'toy' to a serious medical or industrial use product?" In a word: maybe.

When we look at the technology behind AS-3D, we typically find an LCD with something –like a lenticular lens or a parallax barrier – attached to it to direct a unique image into each eye. There are pros and cons to each approach, but both get the job done just fine. Since the AS-3D display is a modified 2D display, it is

logical to assume that it is connected to the rest of a medical/industrial device just like a 2D display. This is an excellent assumption, since the AS-3D display has the same mechanical and electrical characteristics as a 2D display, the difference is in the formatting of the image. Usually these images are side-by-side (sometimes top-and-bottom), with the display taking the responsibility of getting the proper image to each eye. See – nothing to it, so why isn't everyone taking advantage of AS-3D?

It turns out that making 3D is quite easy. Making good 3D is quite hard. And that is where we are in our story. We have enjoyed a long and robust development time for 2D displays, and of course, the entire ecosystem required for making 2D images. It was only a couple years ago that people bought cameras and camcorders to record their lives, and now we carry HD cameras in our pockets. This same infrastructure does not exist for 3D today. We are still at the beginning stages. You can buy a 3D camera, but it is not standard on your phone. You can buy a 3DTV, 3D movies, 3D games, etc., but these are the exceptions. So expecting that any 3D image is going to look great on any 3D display is a bit premature.

The reality is that making good 3D content for two-view glasses-based 3D is hard and making good 3D content for AS-3D is even harder. That said, it is possible to make great 3D content for AS-3D displays as long as the nuances of the entire display solution are considered. The point here is not to provide a step-by-step guide to making AS-3D content, but rather to make it clear that the technology does exist for the industrial or medical markets. It performs as well as any technology does at this point in its life (very, very early) and can be used well by those that make the effort to understand it. Consider the color display: just because it can show 16.7 million colors, doesn't mean you have to use all 16.7 million colors on every image. The same concept applies to 3D; just because you have 3D displays, doesn't mean every image must be in 3D – just the ones that need it. Ideally, you would want a display that can show both 2D and AS-3D images so as not to add an extra display to the product just for 3D.

We should use AS-3D technology to achieve a specific goal. It seems that a lot of imaging equipment is now able to capture not only the 2D image, but also a 3D image or at least some information about the depth of objects in the image. An AS-3D display used at arm's-length or so from the user should be considered a window into a virtual environment, allowing the user a different perspective on what they are seeing. As much as the "wow" factor of images jumping off the screen may be compelling for a moment, this tends to become tiresome and fatiguing rather quickly. Keeping the image content behind the screen (positive parallax) will help overcome a lot of preconceived ideas the user may have about 3D.

If we consider a small/medium sized AS-3D display in a piece of medical equipment, for example, as being a virtual window inside the human body, we can imagine a 3D ultrasound of a baby in the womb. Although we could show the fetus floating in mid-air, several inches above the screen, perhaps the expectant parents would prefer to see their baby safely represented inside the mother. In this example, having the baby shown behind the screen avoids problems with frame violation – the condition where part of the 3D image floating above the screen is cut-off by the frame of the display. This does not happen in nature, so it looks odd when you see it.

Conversely, it is quite common to look through a window and see only part of a person when the window frame is blocking part of the view. If you are looking at a 3D ultrasound with the AS-3D display being used as a window into the womb, no one will be alarmed if part of the baby is missing since they understand the frame is blocking their view.

The world of 2D displays has enjoyed many decades of development and the current generation, from phones to TVs, look great. AS-3D displays have not had nearly the development time of 2D, so expecting similar performance is not realistic at this stage. What is realistic is to recognize that the actual performance is quite good, and with careful attention to how the images are created and presented to the user, AS-3D displays are, indeed, ready to move beyond games and into serious products.

Bio

Dale Maunu is a senior business planning analyst with the Display Business Unit at Renesas Electronics America, with over 25 years experience in the display industry. He is responsible for business development activities for autostereoscopic 3D displays.