DIVERSIFYING VOLUMETRIC CAPTURE WITH POWERFUL PRODUCTION TOOLS AND ACCESSIBLE INTEL®-BASED HARDWARE SOLUTIONS

Versatile and user-friendly Depthkit* software makes volumetric capture technology accessible to video producers and independent filmmakers at last.

Figure 1. Depthkit enables a range of creative expression from photorealistic captures to stylized animations

Volumetric VR: Radically Redefining Movie-Going

With the advancement of volumetric capture techniques, virtual reality (VR) technology is reshaping what's possible with cinematic storytelling. Volumetric films are shot using cameras with depth sensors that capture three-dimensional scans of the environment, resulting in a complete digital recreation of the scene and, crucially, the actors performing therein.

Once the footage has been edited for playback on a headset such as the Oculus Rift* VR system, viewers can participate directly in the drama. The virtual reality documentary *Blackout* from the award-winning volumetric film studio Scatter, for instance, allows audiences to move around freely in the scene of the film. Set aboard a sparse New York City subway train, viewers can walk up to and engage with a diverse array of holographic passengers who share their stories in their own voice.

To put it simply, volumetric film is an experience unlike anything in the history of movie-going. Not surprisingly, this radical new form of immersive storytelling has made a splash among the independent film community. The prospect of telling deeper, original, and more engaging stories through VR is enticing to artistic creators, as are the coveted invitations to prestigious independent film festivals, which have begun to honor volumetric films at their yearly festivities.

Though volumetric films are frequent showstoppers, shooting in three dimensions can be daunting. Volumetric productions are shot on huge capture stages and require big, cumbersome rack-mounted server PCs in order to process the footage. As a result, volumetric shoots are both expensive and difficult to orchestrate,
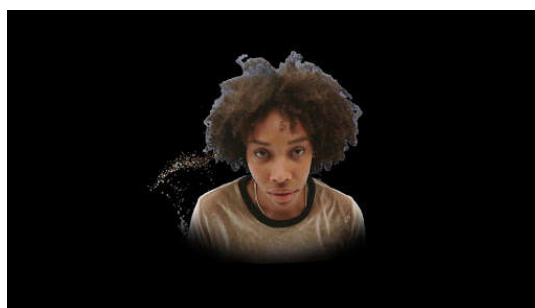
discouraging many would-be pioneers from joining the party. This technological barrier to entry has limited not only the amount of volumetric content being produced, but, ultimately, the emerging medium's potential to revolutionize entertainment.

Democratizing the Future of Three-Dimensional Filmmaking

That is, until now. Over the past five years, Scatter has been building a more approachable alternative to cost-prohibitive volumetric capture stages. On the way to producing some of the best and best-known volumetric films, including the aforementioned *Blackout* experience and the Emmy*-winning *Zero Days VR* documentary, the immersive media studio has invented their own filmmaker-focused tools and techniques.

Scatter's Depthkit* software is the culmination of all their experience and expertise—a complete volumetric capture solution for the Microsoft* Windows® 10 PC operating system (including Intel®-based Macintosh* computers running the Boot Camp* utility). Depthkit upturns the paradigm, providing a nimble alternative for those who don't have access to capture stages and pricey equipment.

"Our mission is to ensure that the future of storytelling is populated by a wide variety of creators with different backgrounds and voices," says James George, CEO and co-founder at Scatter. "Making our software accessible and approachable is how we're fulfilling that mission."

Accessible technology was a luxury he didn't have when he began filming *CLOUDS*, a volumetric virtual reality documentary he co-directed while coding the initial Depthkit prototype. Because the Depthkit application was developed alongside years of production to meet the unique demands of filmmakers, the application is practically custom-built for artists and creative types. The software's tried-and-true "shoot, edit, and publish" workflow lets anyone with a background in video or film adapt their camerawork and production skills to the volumetric experience.

Shoot, Edit, Publish

Shoot: It's easy to start collecting volumetric data. All the user needs are a depth camera, an optional digital camera, and a laptop—a lightweight setup that will fit in a backpack. On the shoot, the software provides a live preview of the depth data as it's being captured so that critical conditions like lighting and camera angle can be adjusted on the fly.

Once the data is captured and post-production is underway, filmmakers will be pleased to find an interface that they are familiar with from their training in video editing. Not to mention, Depthkit assets are easy to export, integrating well into a standard video production workflow.

Publish: For integrating interactive elements, the Depthkit application exports assets to popular VR and augmented reality (AR) creation tools, including the Unity* game engine. With the Depthkit Pro* version, the process yields refined footage with a striking level of detail.

Lowering the Cost of Entry to Volumetric Shoots

Depthkit software is a fantastic way for artists and filmmakers to find a foothold in the highly technical medium, but it's not much help if the gear is still too expensive. Volumetric shoots generate a huge amount of data, which can easily overwhelm an underpowered workstation. Without low-cost hardware options, volumetric capture remains out of reach for many.

Figure 2. Depthkit allows both realistic and expressive performances to be brought into 3D interactive environments

Thankfully, Intel® Core™ processors are readily available in a wide range of reasonably-priced PCs, including portable tablet PCs and Intel® NUC* mini-PCs.

"Intel's powerful processors allow Depthkit to run well on computers users can afford," says George.

In fact, Depthkit software has been optimized for compatibility with them. When installed on a system featuring an Advanced Vector Extensions 2 (AVX2) enabled central processing unit (CPU), such as an Intel® Core™ processor, the capture pipeline takes advantage of optimizations to ensure no frames are dropped, yielding smooth, stutter-free footage. Using an optimization technique known as heterogeneous programming, Depthkit also takes full advantage of CPU hardware for capture and export, yielding lightning-fast workflows that speed up your production timelines.

Depthkit supports both Microsoft Kinect for Windows 2 and Intel® RealSense™ Depth Cameras, with forthcoming integrations for Occipital Structure Core* and Azure Kinect™ at the device's launch. Intel® RealSense™ Depth Cameras are available at a budget price, making them the perfect entry point into three-dimensional filmmaking. That's great news for anyone looking to make the leap.

Empowering a Diverse Community of Volumetric Creators

With Scatter's intuitive software and Intel® hardware that packs a punch, professional volumetric technology is more accessible than ever. Since the Depthkit solution was released in 2018, the paradigm has begun to shift. A vibrant community of artists and independent filmmakers has risen up, with young creators the world over flocking to the medium.

Figure 3. All the user needs are a depth camera, an optional digital camera, and a laptop or tablet (Azure Kinect DK pre-production device shown)

As a result, volumetric filmmaking is already becoming more distinctive and diverse. It seems the discipline allows for so many different voices to be heard. The protest piece *Terminal 3*, for instance, was created by Asad Malik, an undergrad augmented reality artist from Pakistan. *Queerskins: A Love Story*, another Depthkit project, was directed by Illya Szilak, a physician at Rikers Island Correctional Facility.

"It will take many unique and diverse voices to push the medium of volumetric filmmaking forward," says George. "Through making Depthkit accessible, we're empowering those voices to form a tight-knit creative community."
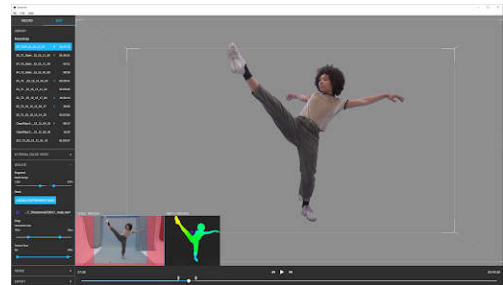

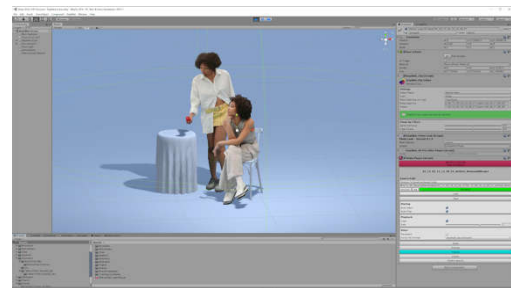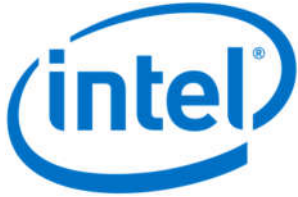**Figure 4.** Depthkit Refinement Interface with data capture.

Figure 5. Adding interactive elements to Depthkit assets in the Unity real-time engine

Captured with Azure Kinect DK pre-production device

Join the Scatter community in inventing the medium:
 https://www.depthkit.tv

Learn more about Depthkit software and volumetric film: https://docs.depthkit.tv

Learn more about the Intel® Core™ processor family:
https://www.intel.com/content/www/us/en/products/processors/core.html

Learn more about Intel® RealSense™ depth cameras:
https://realsense.intel.com

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