



Moffat used virtual production to simulate realistic vehicle environments, blending physical lighting with immersive LED backdrops for dynamic motorcycle and car commercial scenes (Credit: Sarah Thomas Moffat)

MOTION WITHOUT MOVING

Virtual production is transforming car chases, in-space simulation scenes and more, offering filmmakers greater control, safety and efficiency while creating immersive, dynamic environments with cutting-edge technology.

High-risk action scenes in films have historically posed significant challenges for filmmakers, often requiring extensive time, complex logistics and a high degree of risk for the crew. Traditional methods involved real-world stunts, dangerous driving and intricate choreography, sometimes taking weeks to shoot. However, with the rise of virtual production during the pandemic—when physical limitations restricted on-location shoots—filmmakers quickly turned to digital environments and the volume. This innovation allowed for greater control, safety, and efficiency, reducing shooting time significantly.

PUMP UP THE VOLUME

In the intense finale of *Happy Valley* season three, viewers saw a violent struggle inside a car as Tommy Lee Royce (James Norton) fought off a group of attackers with a beet knife.

The sequence was filmed three years ago, when virtual production was still emerging, says cinematographer Johann Perry. It was his first time using the volume, working with VFX provider Driving Plates and consultant Ian Sharples. Filming took place in Wainstalls near Halifax, with volume scenes captured at a studio in Manchester.

"I was suddenly part of the script and it was about three pages long," Perry adds. "If we tried to do this 'in real life,' it would be a matter of starting the scene when everyone's fully clothed in a regular situation. Over the course of the scene, you'd have a knife to the stomach, a knife to the neck, and blood everywhere — all over the inside of the car, all over the costumes. It would be a complete mess. The car would go from travelling down the road to leaving the road and careening through a field."

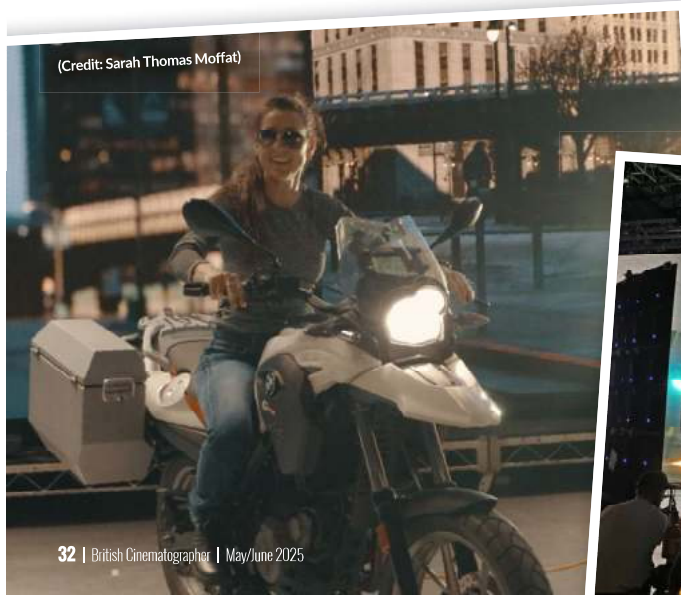
The scene continues in the field, so there were multiple elements that would need to be redressed every time Perry shot a different version of that scene if the volume hadn't been adopted. "We had four people in the car and we needed to capture all their reactions and points of view, meaning each time, we would have had to reset the car, reposition the camera, change everyone's clothes, mop up the blood and reset the scene. It would take weeks in the real world. This took us a day."

More recently Mark Patten BSC embraced the volume for car chases and car scenes in Netflix hit *Black Doves*.

"It just allows the director to work the scene in a much more controlled environment, because previously, with low loaders or driving around town, you'd always have the technicalities of stopping and starting," he explains. "Now, you can invest the time you gain by shooting in a volume and really focus on the details of the scene without having to worry about the technicalities of driving around town."

The key, Patten says, is breaking down the scenes and shooting the plates. In *Black Doves*, for example, the plate work was done at 20 miles an hour due to the restrictions in London.

"There's a lot more control once you've got that background plate and you're working within that environment," he adds. "Another thing to consider is lensing—if you go too wide and step out of the car, it starts to fall apart. I think it always works better if you use



(Credit: Sarah Thomas Moffat)



Mark Patten BSC embraced the volume for car chases and car scenes in Netflix hit *Black Doves* (Credit: MARS Volume)

a slightly longer lens. That helps make the scene feel more real, and the viewer won't feel like they're in a virtual world."

Patten says the biggest challenge with using virtual production as a cinematographer is the prep, because one must understand the entire pipeline before the shooting day. "The more time you spend with the specialists who run the volumes, understanding how you'll grade the background plates and work with them, the better," he adds. "By the time you get to the shoot, all the technicalities should be ironed out."

Rowan Pitts, founder of MARS Volume, says partnering with Patten and his team on its car process work "was a perfect example of how in-camera VFX and virtual production" can elevate storytelling.

"The Black Doves team was able to capture multiple locations, times of day, and lighting setups — all within a single controlled studio environment," he explains. "It streamlined both time and cost, while also giving the director and DP the freedom to experiment, refine scenes and make creative choices in real time." More on costs later.

COMMERCIAL SUCCESS

The volume is also prominent in the world of advertising and Sarah Thomas Moffat adopted the practice when she was filming *Matrix City*, which included a motorcycle sequence shot in the ARRI Creative Space in Burbank, California. She describes the space as a testing ground for the early days of virtual production (VP), "with all the best camera and lighting equipment available next door" in the ARRI Rentals department.

"We were looking to replicate the vibe of the original *Top Gun* meets Sarah Connor in *Terminator*," she says. "I rode my motorcycle into the ARRI space and lit it from the floor, as I would in a real location, to blend real-world and virtual light motivation."

Furthermore, Moffat also used VP for a car commercial, filmed in the FUSE Technical Group virtual production studio, which is specifically designed for vehicle processes.



The Schweppes commercial shot by John Mathieson BSC blends sci-fi spectacle with a brand (Credit: TBWA)



The space commercial was shot at 10-Dots Studio in Bulgaria (Credit: TBWA)

"We ran a virtual scene of driving through a bridge, like one of many in New York City," Moffat explains. "The virtual bridge reflected all around the car and onto the driver in virtual daylight. The car was on wheel dollies and easy to manoeuvre, so we could align the composition and scale of the vehicle in relation to the scene. We shifted the floating walls to land in the camera frame and reflection without seeing seams. From there, we aligned the UE scene's running speed, blur effect, exposure, height, and scale. On the floor, I used a Kino Mimik IBL (Image Based Light) off the driver's side with the window rolled down to create the same pattern of reflection onto the driver. I also used a rotating polariser on the lens for added in-camera control over how much reflection I wanted to see on the windshield."

Quentin Jorquera, virtual production supervisor and consultant, oversaw the making of a Schweppes drink commercial with John Mathieson BSC. The advert, which blends sci-fi spectacle with branding—from Martian vistas to NASA control rooms—was realised at 10-Dots Studio in Bulgaria.

"One of the good things about using virtual production here was that we could literally shoot three completely different environments in two days," he explains. "The sets were built in a way that they were quickly interchangeable. You could move them around

— especially the NASA set, which in the end was limited to just a few rows of stairs and desks on

wheels. We could roll them in front of the LED wall, shoot the NASA scene, roll them out, and bring in the props and set design for the other scenes. That limited the amount of physical set that needed to be built, and allowed us to shoot in environments that were either semi-indoor/outdoor or indoor with extremely faraway views — environments that were literally out of this earth — without having to bring the whole crew somewhere like Namibia or any other remote place in the world."

IN REAL-TIME

Virtual production enables real-time shooting by seamlessly blending live-action footage with virtual environments, providing instant visual feedback and allowing for on-the-spot adjustments—something Jorquera considers invaluable.

"It turns the shoot into a normal shoot — like you're working on a physical set," he explains. "The director isn't going to move a chair, they are going to ask their assistant who's then going to ask the props team. Same thing here, except that the VP supervisor is in charge of everything inside the wall. We took the time before the shoot — even before the physical pre-light — with the DP, the director and the production designer to look at everything on the LED wall, tweak what we wanted, change the lighting, add fog, move people, add characters, adjust stairs, lighting direction — all of it. >>



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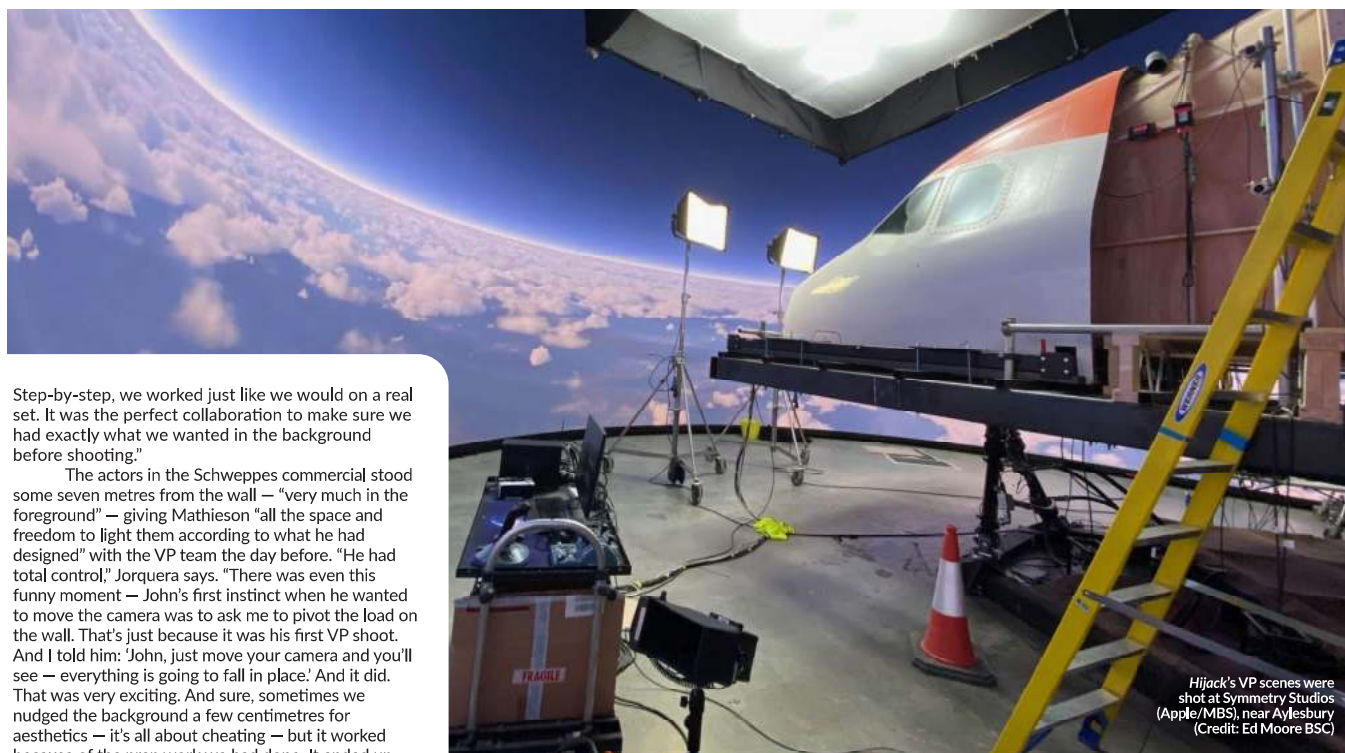
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DISCOVER EXTRAORDINARY



Hijack's VP scenes were shot at Symmetry Studios (Apple/MBS), near Aylesbury (Credit: Ed Moore BSC)

» Step-by-step, we worked just like we would on a real set. It was the perfect collaboration to make sure we had exactly what we wanted in the background before shooting."

The actors in the Schweppes commercial stood some seven metres from the wall — "very much in the foreground" — giving Mathieson "all the space and freedom to light them according to what he had designed" with the VP team the day before. "He had total control," Jorquera says. "There was even this funny moment — John's first instinct when he wanted to move the camera was to ask me to pivot the load on the wall. That's just because it was his first VP shoot. And I told him: 'John, just move your camera and you'll see — everything is going to fall in place.' And it did. That was very exciting. And sure, sometimes we nudged the background a few centimetres for aesthetics — it's all about cheating — but it worked because of the prep work we had done. It ended up feeling like a normal shoot on a normal set. And I think this is what virtual production should be like."

TIME AND MONEY

Jorquera says the 10-Dots in Bulgaria mentioned at the end of the shoot that this was the smoothest shoot it had ever had, which he says was probably thanks to the preparation the team did.

"There are obvious cost savings in shooting three sets in a single day and a single place. Especially since two of those environments are extremely different," he continues. "The NASA Space Center — the room we created virtually was as big as the studio itself, which is huge. We would have had to find a real location that matched our exact design, because building such a huge set wasn't possible. And the Martian set — we had one, actually two sets, where you could see people in the distance, hundreds of metres away. We had that sensation of depth. Recreating that in real life would've cost millions. And doing it on green screen? Sure, it's possible. But the post-production and the artistic control — that's where VP shines."

PLANE, SAILING

Ravi Varman ASC ISC embraced the use of the volume for a key yacht scene in *Indian 2*. The visuals on the LED panels—supplied by JDH Event Gears and fashioned in Unreal Engine through a collaboration between Varman, production designer T. Muthuraj and VFX supervisor V. Srinivas Mohan—were essential for achieving lighting consistency.

"It's a long scene involving action, and we had to shoot it over multiple days," he says. "The sequence begins before sunset and continues until the sun sets, with light cracking through the clouds—a look that's very hard to sustain naturally for such a long period. That's why we chose this approach. Also, the crew was large, and the cast included one of India's biggest stars, Kamal Haasan. Shooting in the volume was a safer and more comfortable option than filming on a real yacht at sea."

Ed Moore BSC (*Hijack*) is behind *My Fault: London* (Amazon Prime Video), which he says "is a \$20 million movie and has tons of car chase stuff in it—it's a young adult romance set against the backdrop of illegal car racing".

The film's high-octane action demanded the skills of British racing driver Ben Collins — the white-suited Stig from *Top Gear* — who led the stunt driving team.

"Because of the type of driving we were doing, we had a lot of high-speed chase sequences at night through central London, which was really restrictive," Moore continues. "Finding areas to shoot that kind of thing was a challenge. We did have some locations where we could close off streets, but it was impossible to do that with the cast, who were all stunt drivers. So, the schedule worked out where, at the end of the shoot, we spent a week in the volume and did all the interior cast shots, while the second unit had already filmed the driving sequences and the environmental shots. Brownian Motion did an amazing job with the plate photography, so when we got to the ARRI virtual production stage in Uxbridge, we were ready. The chase sequences were already edited, and the cast could look at the virtual environment and react to it. It was incredibly efficient."

Moore says that without the volume, the team would have had to build driver pods on top of the cars, "which would have been

a nightmare". The volume allowed him to shoot everything in one place, "at normal hours", even though sequences took place at day and night in different locations.

"Being able to do that in one location was a massive help," he continues. "As for continuity—when we were shooting inside the car, outside the car, and even on top of it, the exteriors were mostly done by the brilliant second unit DP, David Mackie."

Some sequences were shot with the cast outside, not driving, but in those environments at the right times Moore knew exactly how the sequence looked. "Then, when we were in the volume, we had the plates to match, and the lighting was all done using those plates," he adds. "We'd use the exact same scene lighting in the volume, supplementing with a few extra LED tiles to fill in shadows. The result was this incredibly dynamic lighting that would be impossible to fake any other way. There was lots of urban lighting rushing by to give the sense of speed, and that would reflect off the car and onto the cast. It was all in-camera, with minimal VFX work to sweeten things."

Moore recently wrapped on *Hijack* series two and says "as much as we would have loved to shoot the whole thing at 30,000 feet, even Apple wouldn't have paid for the jet fuel". The solution was to use the volume to simulate being in the air, particularly on the airliner set. LED walls along the aircraft created changing clouds, while a larger volume around the flight deck combined Unreal Engine clouds and plate photography of London.

"It really helped to have the cast feel like they were actually flying, especially in the flight deck scenes where they were landing the plane," Moore says. "It's much easier for them to react to what's going on if they can actually see the world outside the window. Without the volume, we'd have been relying on green screen, matching all the environments in post-production. And sure, that's possible, but you don't get the same sense of immediacy. In the volume, the reflections, the lighting, everything

feels real, and that's so important for getting the right shots. Of course, the volume has its limits—if you throw focus to it, it can fall apart. But as long as the focus stays on the cast, and the volume serves as the environment, it's incredibly effective. It's a cost upfront, but it's worth it when you have so much material to work with in one set." >>



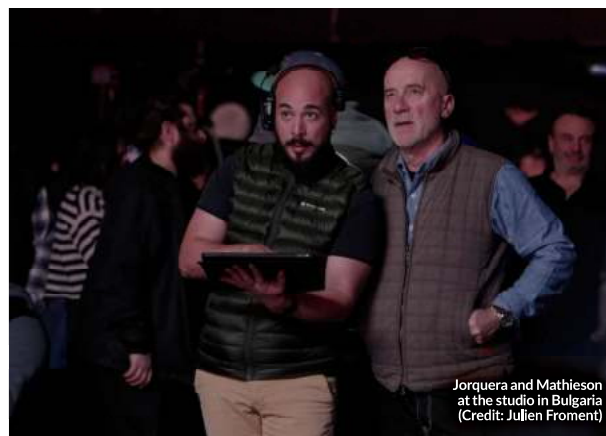
Moore shooting *Hijack* series one (Credit: Aidan Monaghan/Apple TV+)



Moore shot *Hijack* series one in a vast 270-degree volume (Credit: Aidan Monaghan/Apple TV+)



(Credit: Julien Froment)



Jorquera and Mathieson at the studio in Bulgaria (Credit: Julien Froment)



Schweppes embraced cutting-edge virtual production at TenDots studio in Sofia, Bulgaria (Credit: Julien Froment)

SHOULD BLUE AND GREEN NOT BE SEEN?

There are alternatives to VP and the volume, such as blue and green screens, but Perry says, "The beauty of using a volume is that the actors are in a controlled space," which allowed the team to see the car leave the road and travel across the field to continue filming.

"They have visual cues for each element of the action, so it made perfect sense to film the plates on the road, film the car leaving the road and then capture all the plates for that," he adds. "Once that's done, you can put the actors in that space, and because you're in the volume, you can do much more interesting camera movements around the car while the action happens."

Perry believes anyone who thinks the volume and VP will make blue and green screens redundant should think again.

"If you're doing something much simpler, like a basic scene in a carriage or a car with two shots—close-ups of people talking—green screen can work fine," he says. "But the beauty of the volume is that all the lighting cues are already there in the plates you've shot, which you can't easily replicate with green screen. With the volume, you can create a much more realistic environment, whereas with green screen, there's more guesswork involved, and you have to create a different environment."

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Jorquera says the team built the virtual set with a flight of stairs inside the design to perfectly match the curvature of the LED wall, which created a line that allowed him and the crew to perfectly blend the virtual floor with the real one. "Once we had colour-graded the virtual floor to match perfectly, you couldn't see the difference," he explains. "It was seamless—even on set—and it also allowed the reflections coming from the virtual world to perfectly match the real floor

without us having to do anything. That was a bonus — free work that we didn't have to do in post-production, which would've cost a lot of time and money and never reached that same level of quality or precision. We were shooting bottles and glass and the reflections were perfect. The backgrounds through the bottles on set were matching reality. It was quite amazing."

Moffat says it's not always a deliberate decision to avoid blue or green screens; rather, a clear choice to use virtual production (VP) for its specific benefits.

"Green/blue/grey etc screening is still a useful tool and still needed," she says. "The two can be incorporated through Unreal Engine in real time movement tracked to a specific subject on camera, while also having the display of the full scene on the wall. There is a lot you can do with both together now. One of the things I enjoy about using a scene on an LED wall is the ability of ICFX — in-camera VFX. When filming in a virtual environment, especially with vehicles like cars and motorcycles, I can create and control shots that might otherwise be more challenging in real world locations."

At the end of the day, it's a matter of choice. Patten says, "Some directors may say, 'No, I don't want to be in a volume because it's too controlled.' For instance, one director—(David) Fincher—uses volumes for car shots because it's completely controlled. Others want more of a messy, loose feeling. You just have to see what the tone and mood of the show is and make those decisions early on. Are you going to do everything in the volume? Will you do all your car work in the volume? The issue with splitting it is that you can definitely see the difference. So, you've got to decide. You should always try to persuade production: if you're going to go in the wall, stay in the wall." ■



"Shooting in the volume was a safer and more comfortable option than filming on a real yacht at sea" (Credit: Ravi Varman ASC ISC)



The volume was deployed to recreate the environment for yacht sequences in Indian 2 (Credit: Ravi Varman ASC ISC)

VIRTUAL REALITY



Meanwhile...Film Soho recently opened V Studio, a new volume stage in central London equipped with a 1.5mm pixel pitch LED wall, in-house Mimik image-based lighting and a revolving stage designed for vehicle process work. The studio's virtual production setup supports a wide range of workflows.

