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Efficient police virtual training environment in VR by V-Armed

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By Sébastien Lozé

Virtual reality has seen many implementations in the Training & Simulation sector, from brain surgery (https://www.unrealengine.com/spotlights/helping-brain-surgeons-practice-with-real-time-simulation) to military operations (https://www.unrealengine.com/en-US/spotlights/offworld-industries-brings-realistic-infantry-training-to-the-simulation-community). Now, VR-based law enforcement training is available to police officers to quickly and safely train them for a variety of situations.

One of the most exciting emerging players behind this surge is V-Armed (https://www.v-armed.com/), creators of VR simulations for large-scale multi-participant training. Participants move around in a large, mostly empty space and, with the help of head-mounted displays, body sensors, proxy weapons, and strategically placed doorways, experience tactical scenarios as if they and their fellow officers were actually there.

Image courtesy of V-Armed

The VR experiences, developed using Unreal Engine, feature realistic visuals of the environment and people, sound effects, and other sensory cues designed to induce the same mental and physical challenges as the real thing, down to the adrenaline rush the participants feel as the scenario unfolds. As with a real-world situation, participants are free to call out and gesture to one another. Command personnel can view the session from any angle as it's happening and can also replay the session later for review.

“The vision of V-Armed is to help people train better,” says Elad Dabush, Chief Technology Innovation Officer at V-Armed. “For law enforcement, training at real-life locations can be very limiting. For example, in some training environments you can’t shoot above a certain height or in certain directions because the bullet might land outside the safety boundary. In VR, it doesn’t matter. It’s a complete 360/6DOF environment, and the bullets are virtual.”

Making a believable virtual environment

Before starting V-Armed three years ago, the team had worked for many years in film and video production, creating numerous TV commercials. This experience shows through in the visceral response from participants. “After telling stories on TV, we instinctively know the right kinds of elements to include, the ones that will create the stress and tension that would be present in the real-life scenario,” says Rotem Shiffman, Head of Development at V-Armed. “That tension is absolutely necessary for an effective training experience.”

Shiffman explains that when a user can forget that he’s in VR, his body starts to react as it does in real life. The VR scenario has to be realistic enough on several levels—visually, emotionally, physically—to fool the trainee’s brain into thinking he or she is actually there. Real-world physics and lighting, realistic weapons and uniforms, and true-to-life sound effects are just a few of the tools they use to accomplish this goal.

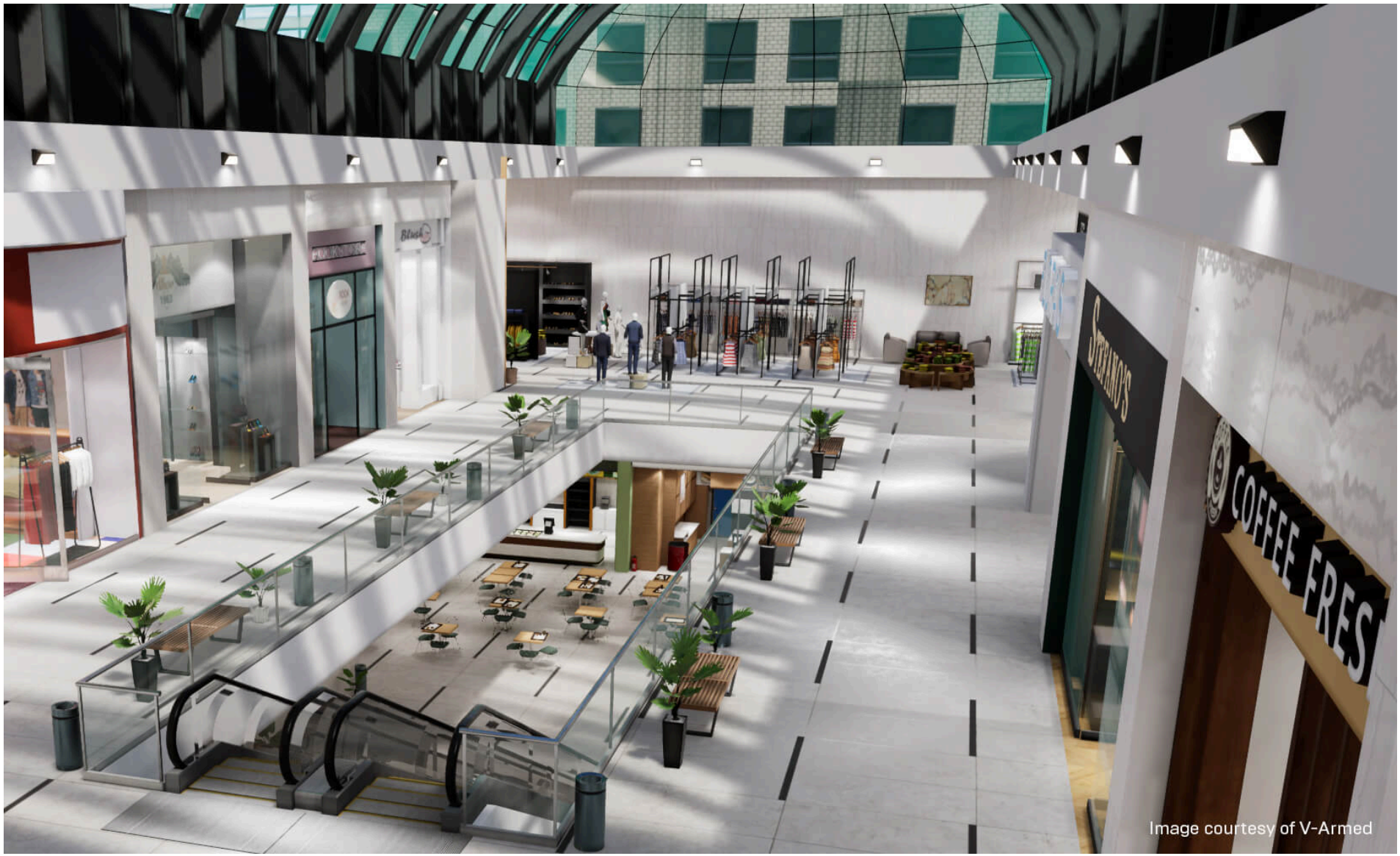


Image courtesy of V-Armed

Creating such experiences isn't simply a matter of recreating an environment down to the tiniest detail with high-resolution 3D models—in fact, doing so would be a hindrance to VR playback speed. With virtual reality, a vital part of making it real is keeping the frame rate high enough for fast updates and smooth motion, which means picking your

battles with regard to levels of detail.

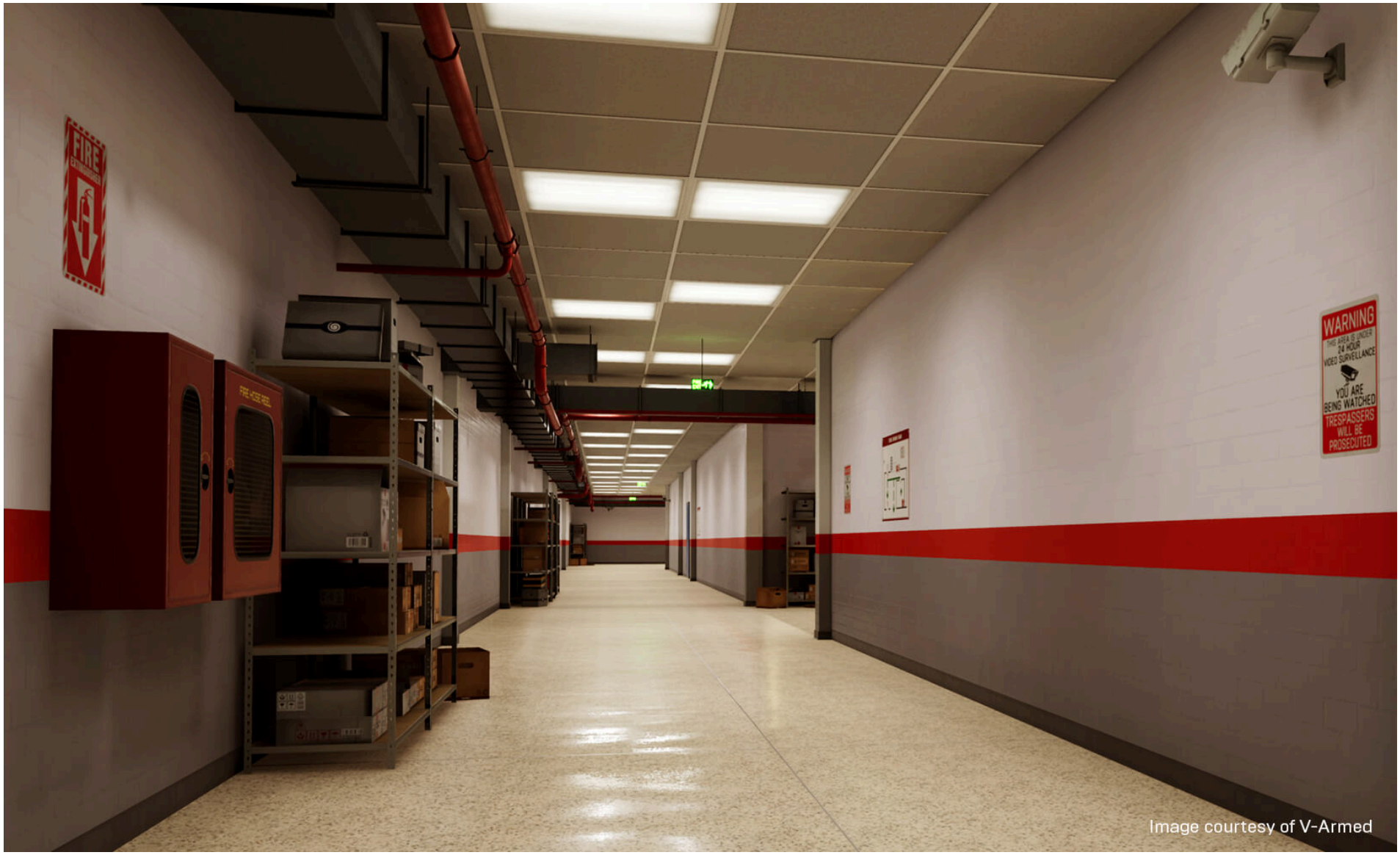


Image courtesy of V-Armed

“It's not just visual fidelity and realism, it's authenticity,” says Dabush. “We found that texturing, lighting, shading, and overall mood has much higher importance than poly count, especially with our target audience. If a wall or piece of furniture

isn't 100% realistic, this won't register with most trainees. But it's important that the gun they're holding be exactly right, and that their uniforms be accurate. These are the kinds of things that make it real to them."

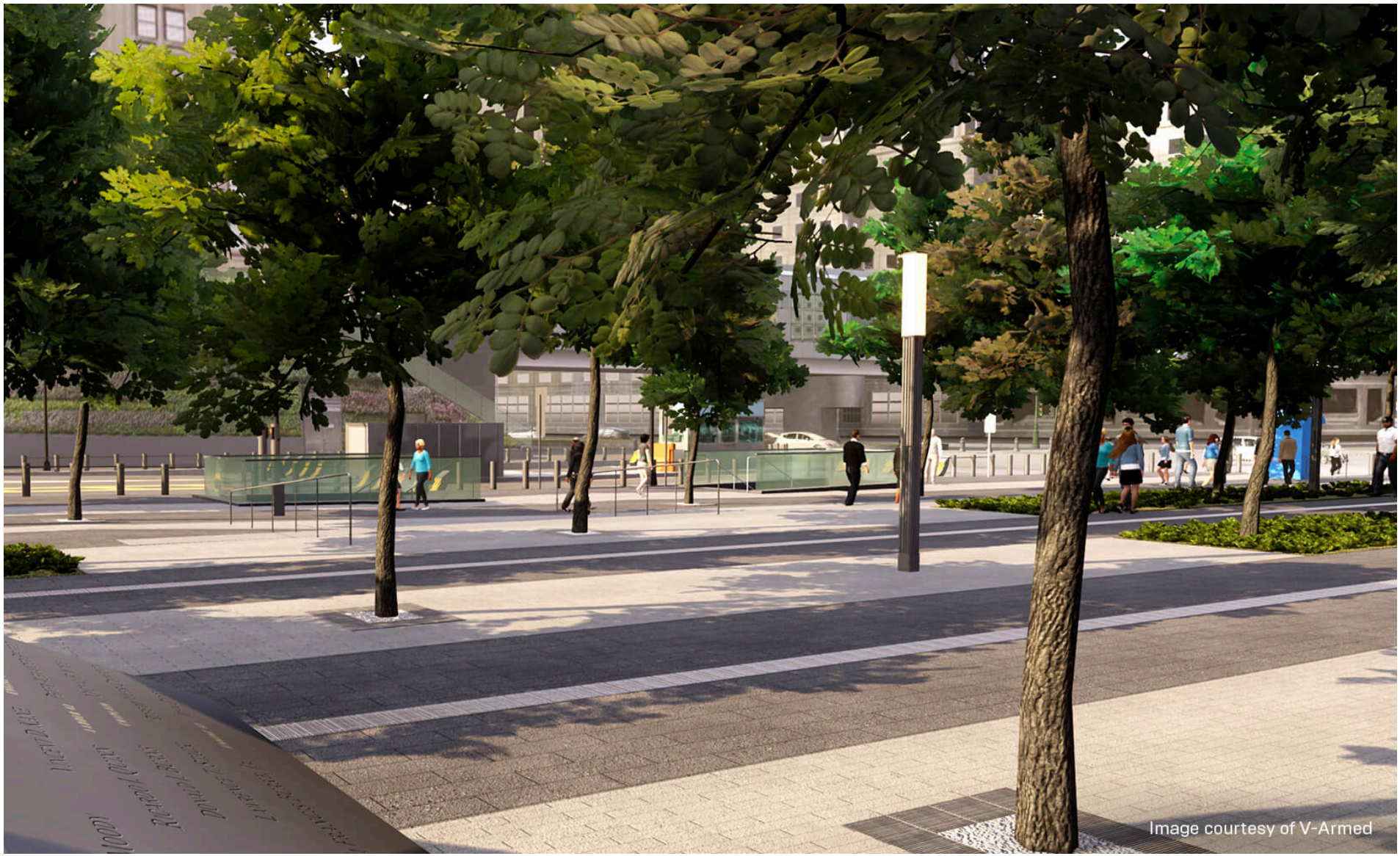
With the right balance of realistic detail and playback speed, V-Armed's scenarios hit the sweet spot for immersive training. "We see trainees coming out the end with elevated heart rates, and out of breath," says Shiffman. "You can tell by their voice that they are acting as if they were really in that environment."

One of V-Armed's training sessions was recently featured on ABC news, where senior law enforcement praised the effectiveness of the training and also the value of reviewing officer performance after the fact. They also recognized the convenience of being able to train hundreds of officers at any virtual location without the hassles of real-world logistics.

Evolving the training with the Scenario Editor

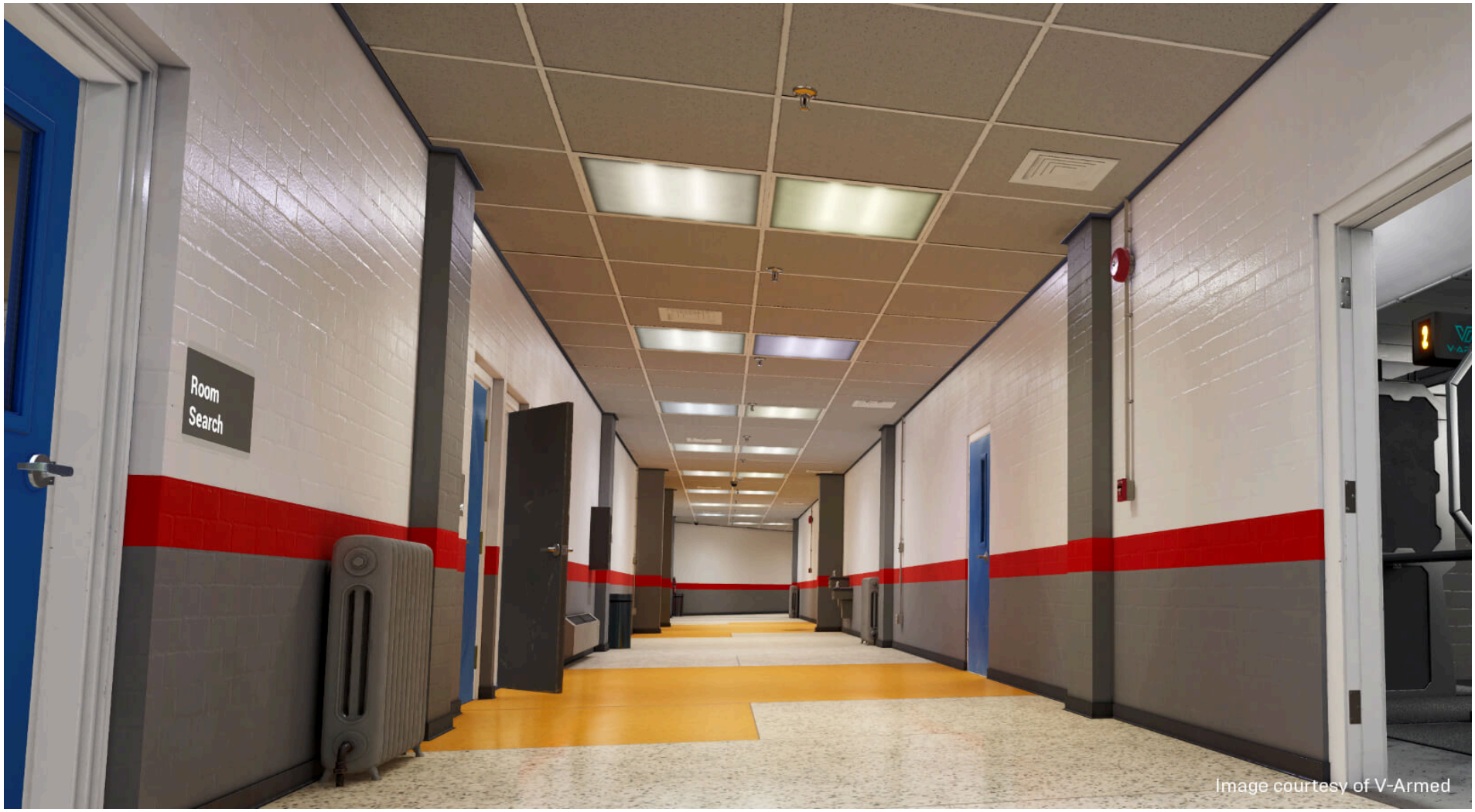
Late last year, V-Armed had rented a space in Brooklyn, NY when by chance, an NYPD detective saw their sign and stopped in for a visit. This auspicious beginning led to V-Armed offering the VR training to NYPD for free. The training was made possible with support from the Department of Homeland Security and the Academy of Counter-Terrorism Education at Louisiana State University (LSU NCBRT/ACE (https://www.ncbrt.lsu.edu/)).

V-Armed built Scenario Editor, their own scenario authoring tool, on top of Unreal Engine, so training leaders themselves can customize the experience and create completely new scenarios within the environments. For example, specific types of civilians can be added to make the scenario more realistic, such as children for a school environment or a mix of ages and genders in an outdoor park.



Shiffman wrote Scenario Editor to satisfy NYPD's requirement of having trainees go through a wide variety of scenarios—rather than V-Armed creating the scenarios themselves, they enabled users to create and modify them at will. Starting with a basic layout such as a school, warehouse, or park, a trainer can drag-and-drop furniture, props, avatars, audiovisual

stimuli, and action triggers into the layout, building it up until the scenario is complete.



“The Scenario Editor enables trainers, even someone with no development experience, to create a training scenario from scratch,” says Shiffman. “For example, the user can place an adversary and civilians in room A, and add a trigger such that when a participant enters room B, the adversary starts shooting, directing the participants’ attention to that room. It's very flexible, and it allows them to create a lot of scenarios for a varied array of training goals. On top of that, the operator can

control and trigger actions in real time as the scenario is unfolding."

The analysis tools included in the system provide law enforcement with opportunities they've never had with live training. For example, a senior officer can replay a session from an overhead view and evaluate the performance of a specific officer or the entire team. With live training, this simply isn't possible. And after they've run dozens or hundreds of officers through the training, command can analyze patterns and identify areas for improvement.

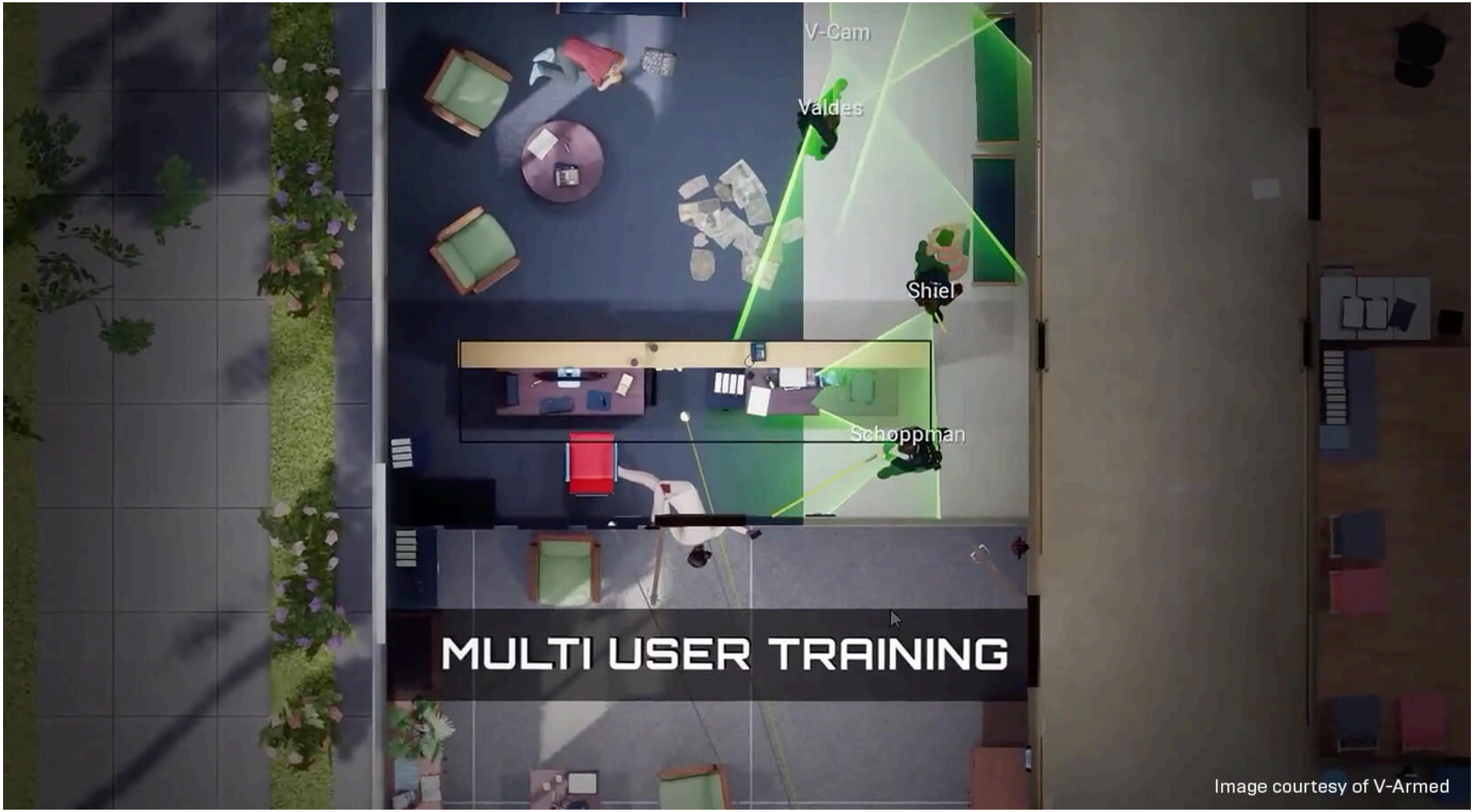


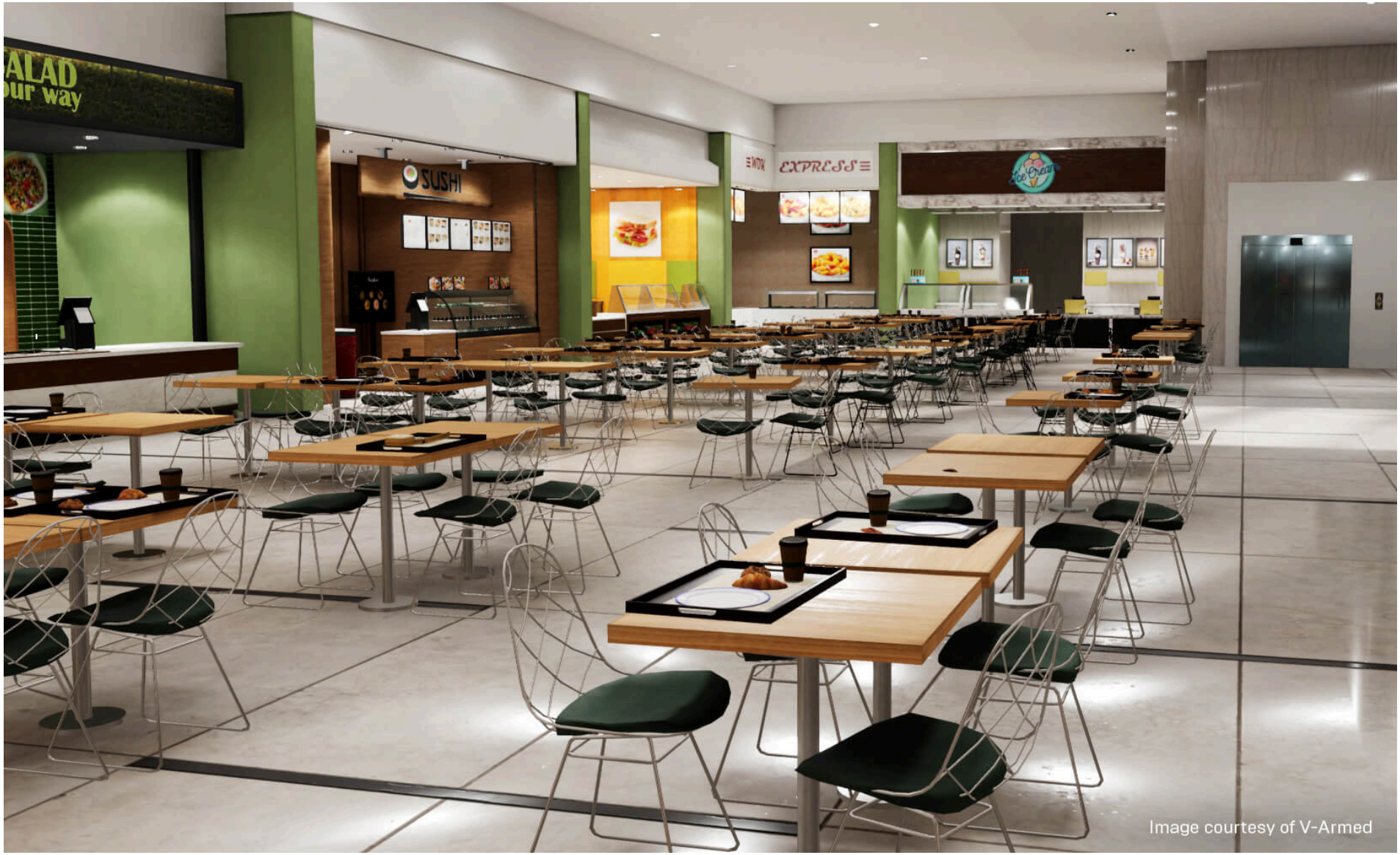
Image courtesy of V-Armed

V-Armed has also produced a more mobile version of the system that can be shipped and installed within a few days. All that's required is a location with sufficient space.

"Our vision is to get this amazing training tool to every agency that needs it," says Dabush.

Choosing Unreal Engine for the job

Dabush and Shiffman started working with real-time technology even while still working in the entertainment sector. “We tried some other engines, but we just started getting better results much faster inside of Unreal,” says Dabush.



For training and simulation solutions, the team likes the fact that they can use C++ for all their low-level code alongside Blueprint (https://docs.unrealengine.com/en-US/Engine/Blueprints/index.html) scripts for scenario-specific code. The fact that the code is open source gives them the opportunity to debug much more quickly. V-Armed implements all their

base code as a series of plugins over the standard Unreal Engine build, and attaches the plugins to all the projects they create.

“We usually prototype using Blueprint, and extract all reusable pieces into our shared C++ libraries, leaving only a minimal amount of high-level Blueprint work we need to do for each specific project,” says Shiffman. “Unreal’s two-tiered development environment is very helpful in this regard.”

It was these features, plus the visual fidelity and playback speed they were able to achieve, that sealed the deal for their selection of a real-time engine. “Without Unreal,” says Shiffman, “we couldn't make it happen.”

Looking to the future

These early successes has V-Armed excited about the use of VR for the police training of the future. “Learning from PowerPoint presentations is the way of the past,” says Dabush. “Once you put on a headset and see a virtual avatar teaching you and showing you something, and you have a recollection or a memory that you were in a certain situation, it has an impact and it teaches you better.”

Shiffman concurs, with a specific takeaway for law enforcement. “What we do isn’t just teaching marksmanship. There are a lot of decisions involved in when to shoot. And more importantly, when not to shoot.”

Want to explore the use of real-time technology for your own training needs? Get in touch (mailto:simulation@epicgames.com) and we’ll be happy to start that conversation.

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