

NRL video game could help dog handlers train for detecting IEDs, illegal drugs

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A U.S. Marine patrols through Afghanistan. The U.S. Naval Research Laboratory (NRL) has created a video game to help military dog handlers practice reading their dog's behavioral cues and giving commands. Says Moses, "Not only should the dog be taking cues from the handler, the handler should be taking cues from the dog." Credit: Defense Video and Imagery Distribution System

Adam Moses is practicing dog command gestures with an Xbox Kinect

in his office at the U.S. Naval Research Laboratory (NRL). On the screen in front of him, a virtual Labrador dog obediently moves through an empty desert village; together, they're trying to locate a buried improvised explosive device (IED). Says Moses, "ONR [The Office of Naval Research] wanted a way for the human to train with a dog, with a virtual dog, that you can train with anytime, anywhere."

What looks like a video game is actually a training tool widely used by the U.S. Army, called Virtual Battlespace. After a lot of research into dog behavior, including watching 100s of hours of tapes of handlers and their dogs in Iraq, Moses worked with others to create ROVER. ROVER is a distinct module that employs Virtual Battlespace and helps handlers practice commands and learning to read the dog's silent cues. "Gestures are important, the whistle commands are important, even the voice commands are important," says Moses. He wrote what he calls a skeleton tracker program for ROVER, so the Xbox camera can "see" a player's gestures.

"There's a lot of stuff going on in the background," he says. "Our challenge was not only doing the plume part of it, which is actually the easier part. The harder part was, how do you account for dog psychology?"

Says Lisa Albuquerque, the former ONR Program Manager, "This collaborative effort between ONR and NRL demonstrates [...] our ability to provide multi-disciplinary solutions to warfighter-identified problems. Use of IEDs will persist, and efforts such as this will help our nation to be ready to respond."

Moses models where an IED is detectable downwind, similar to toxic plumes

If simulating a plume was easy for Moses, that's because he's been

working with first responders for 10 years to model how airborne toxins would spread through a city after an explosion of hazardous materials or a chemical attack. The NRL program, CT-Analyst, was used by command and control centers during the 2009 and 2013 Presidential Inaugurations, and even at a Super Bowl.

"CT-Analyst is unique because it simulates worst-case scenario plumes based on minimal information," he says. As more information comes in (more detail about where the origin of the attack might be, or which sensors are "hot" and picking up the toxin and which aren't), it can be instantly refined through a very intuitive interface.

"Really this is the only program that does this rapid computing by pre-calculation," says Moses, referring to the week the team spends building the city model. "Everyone else computes when they need it." CT-Analyst can also plan for where sensors should be to protect key parts of a city.

A buried IED releases a plume (or trail), similar to that from a toxin. "It's actually leaking all this gas subtly, at levels no human-built sensor could read because the particles are so small," says Moses. "Per billion is the level these dogs can sniff." The plume model powering ROVER simulates that the scent is strongest when the dog is closest to the IED, then gets harder and harder for the dog to detect as it spreads downwind.

ROVER trains handlers to read a dog's behavioral cues

To pinpoint the IED, it's not enough for the dog to just detect some part of the plume; the handler also has to monitor the dog's behavior and help safely guide the dog to its origin. Says Moses, "Not only should the dog be taking cues from the handler, the handler should be taking cues from the dog."

As an example, "If a dog's going down a street, every now and then you'd see him glance to the left or right when he passed an alleyway. And sometimes he would glance longer or stop, and that's one of those cues that's really important; that's when you have to read something from the dog." A dog is trying to please the handler, so if the handler keeps the dog moving instead of looking at what's caught the dog's attention, the dog is less likely to display that cue again.

"An inexperienced handler can un-train a dog by accident," says Moses, "so better that they could spend a week on one of these and, if they make a mistake here, it's no big deal."



Adam Moses of the U.S. Naval Research Laboratory (NRL) was asked to build a program for handlers of improvised explosive device (IED)-detecting dogs to train in a virtual environment, because of NRL's expertise with modeling plumes for hazardous material releases and attacks in urban environments. "[An IED is] actually leaking all this gas subtly, that no human built sensor could read because the particles are so small," says Moses. "Per billion is the level these dogs can

sniff." Credit: U.S. Naval Research Laboratory

The future of ROVER: as a knowledge base or for drug- and human-trafficking law enforcement?

ROVER was created during combat operations in Afghanistan, one of many areas being investigated by the Office of Naval Research. Now that the U.S. Marine Corps is closing its IED dog detection training facilities, Moses says, "My hope is that with something like this, all that other research and institutional knowledge could at least be kept around and studied further," in case we need these dogs again.

Moses also sees a potential for this program to be adapted for law enforcement agencies. Hidden narcotics also release plumes detectable by dogs, and Moses imagines using Virtual Battlespace to help handlers practice in different scenarios, like crowded airports or border crossings or city streets. With multiplayer capabilities, other players could join, simulating good guys and bad guys in the scene.



U.S. Marines patrol through poppy fields in Afghanistan. The U.S. Naval Research Laboratory (NRL) has created a video game for practicing IED detection with a dog. Now that the U.S. Marine Corps is closing its facilities, Adam Moses of NRL says, "My hope is that with something like this, all that other research and institutional knowledge could at least be kept around and studied further." Credit: U.S. Marine Corps

If Moses were to take ROVER to the next phase, he'd like to focus on expanding and improving the dog's behaviors. "You know if you play a racing video game, you can pick your car?" He'd like to do the same thing with [dogs](#), creating maybe 20 different dog personality types that would all handle crowds and noise and traffic differently. "This one's super obedient, this one is distracted a lot, this one is more aggressive. [The handlers] don't know which dog they'll end up with, so if they train against 20 different kinds they'll be better in the long haul."

He even imagines adding a quantitative component, scoring the handlers

on: "How well did he interact, did he notice all the cues that the dog gave him? Did he keep the dog on track?"

Provided by Naval Research Laboratory

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