EVIDENCE
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Forensic Analysis of the Vancouver Hockey Riot Videos

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5,000 Hours of Riot Video

The 2011 hockey riots in Vancouver proved the value of the latest innovations in forensic video technology

Written by Dale Garrison

THE CITIZENS of Vancouver, British Columbia, Canada are unlikely to recall anything very positive regarding the night of June 15, 2011. That was when the Vancouver Canucks lost the Stanley Cup Finals to the Boston Bruins—prompting an estimated 150,000 people to riot in downtown Vancouver. In just a few hours, the offenders managed to amass nearly $4 million in damage.

A handful of arrests were made that night and more were made during the next several days, but few officials were optimistic that many more rioters would be held accountable for their actions. Another riot in Vancouver (also following the Stanley Cup) in 1994 ultimately resulted in convictions of only 110 people—in spite of an investment of four months worth of investigation and analysis. Some speculated that the 2011 incident would repeat history.

But this time, things were different.

An international team of forensics experts assembled under the auspices of the Law Enforcement and Emergency Services Video Association (LEVA), a non-profit professional organization dedicated to the use and forensic analysis of video in law enforcement. At the request of the Vancouver regional Integrated Riot Investigation Team (IRIT), the group drew more than 50 experts from three countries to the LEVA Digital Multimedia Evidence Processing Lab at the University of Indianapolis in Indiana.

An incredible amount of video was captured in Vancouver on the night of June 15, 2011, providing evidence of more than 15,000 criminal acts that occurred in the course of just a few hours.

Working around-the-clock shifts, analysts and technicians examined more than 5,000 hours of video while tagging more than 15,000 criminal events and individuals. The approach proved quite powerful. Whereas investigators required four months to process just 100 hours of video after the riots in 1994, the thousands of hours of video recorded in 2011 were processed and initially tagged in just two weeks.

"This will go down as the largest investigation of its kind in Canadian criminal history because of the number of people we are charging," said Vancouver Police Department Sergeant Howard Chow, "but this is significant for a number of reasons."

Numbers Game

Chow explained that a huge advance in technology separated the 1994 riots investigation from the 2011 event. "In 1994, we had just 100 hours of video, and it was all in one format: VHS tape," he explained. "For this riot, we had more than 5,000 hours of video in more than 100 digital formats."

More than anything, these differences reflect the recent explosion in the number of digital recording devices. Video of the 2011 hockey riots came not only from hundreds of security and other institutional cameras, but also from hundreds of mobile phones handled by onlookers and sometimes even suspects.

Grant Fredericks, lead LEVA instructor and owner of Forensic Video Solutions, brought a unique perspective to the investigation. He was in charge of the Vancouver Police Department's 1994 riot video investigation, and was called on again to manage the technical challenges for the 2011 investigation. He said that one cannot underestimate the evidence potential of today's ubiquitous recording technology. Even under everyday circumstances, the average person is likely to be recorded on video 30 times a day.

"The Vancouver riot was probably the most recorded event in North America," Fredericks said. "We have video not just from security cameras but from hundreds of cell phones. In many instances, there are dozens and dozens of cameras from 360 degrees around a single event."

> **With around-the-clock shifts, the analysts and technicians examined more than 5,000 hours of video and tagged more than 15,000 criminal events and individuals.**

Fredericks noted one store that was heavily looted during the riots. In numerous cases, video from mobile phones showed groups and individuals outside as the violence escalated and the crowd started breaking windows. Inside, security cameras showed rioters entering the store, breaking things, and looting. Cell phones added ground-level perspectives. Still other cell-phone cameras and nearby security cameras showed people leaving the store. Police were offered a massive quantity of potential evidence. But it would only prove useful if they could find a way to deal with it effectively.

Activation of Know-how

The sheer number of recordings from a large event can be overwhelming, and many of the cameras use different, proprietary formats. Without software to unlock each unique code, the video is useless. Fortunately, technology has also provided solutions.

Solutions available today—developed, in part, because of lessons learned from events such as the 1994 Vancouver riots—include software that can process nearly any format of digital video, and hardware that allows dozens of analysts and technicians to simultaneously work on a massive collection of evidence.

"If we only had the technology they used in 1994, this would have been impossible," said Chow. "It would have taken months—even years—to wade through this." The Vancouver Police Department—a member of LEVA—knew the technology and expertise they needed for this investigation was available from LEVA.

The LEVA Digital Multimedia Evidence Processing Lab at the University of Indianapolis serves several purposes. Its most frequent application is as a facility for training personnel from agencies that cover the spectrum from the FBI to small police departments. But the lab was also designed to serve as a platform for taskforce investigation of large events. At the request of the Vancouver Police Department, LEVA activated its Forensic Video Analysis Response Team and deployed the group to the Indianapolis lab.

Technology to the Rescue

Like the LEVA lab, many police departments utilize advanced video-processing software and hardware that is based on technology offered by companies such as Ocean Systems and Avid.

Ocean Systems Vice President Charles Guarino said his company began developing forensic video technology in the early 1990s. In those early days of the forensic video field, gathering video evidence was generally a simple matter of ejecting a VHS or PAL tape from the recorder and taking it back to the office. The challenge, however, was the fact that security systems recorded multiple cameras to one tape in a multiplexed format. Viewing and processing this type of evidence required a de-multiplexing solution that could capture uncompressed video and then de-multiplex the video in order to separate the individual cameras' views.

Today, a trend video analysts are coping with is the ability to view and work with digital video that is recorded to various devices at different frame rates, screen sizes, and compression formats. Now, collecting and playing back the video is a much bigger part of the process. Each recording device can have its own means to export video, and different requirements for playing it back properly. One technology utilized in the 2011 riot case is Ocean System's Omnivore digital video capture drive—that, as the name suggests, is able to "ingest" just about anything.

"The Omnivore is a password-secured thumb drive that contains specialized digital video capture software. This allows investigators to take it on location and capture the video

evidence directly from the system that recorded it," Guarino explained. "Or, as in the 2011 riot investigation, evidence can be collected and processed after investigators have matched the proper proprietary video player to that unique video format."

The Omnivore's capture software assists investigators to process the video by providing smart tools such as "video optimization"—a feature that samples the original video's frame rate and screen size and then adjusts the video-captured settings so the video is captured properly without dropping frames. Once captured, the video can be saved and played back in a standardized, uncompressed format such as QuickTime or AVI for future processing.

Or, the video can be tagged and cataloged in video-editing software such as Avid Media Composer, which was used in the LEVA lab. This tagging appends a "video database" that is searchable by simple keywords or phrases. "And at any point in the video, you can insert a marker and add notes. It's like putting a Post-it Note on the video," said Guarino.

Many of the Vancouver hockey-riot video notes contain tags identifying suspect clothing or other features. A tag might cite the presence at a burning vehicle of a "white male with a blue team sweatshirt, a black ball cap, and red running shoes." Racing through hours of video, technicians were able to tag thousands of such sightings for hundreds of suspects. Police officials can then correlate these sightings to track a suspect who may have been involved in several crimes over several city blocks. A riot suspect who thought he was anonymous during a few hours of mayhem is now tracked from crime to crime.

Real-Time Innovation
Some of the technological advances utilized in the Vancouver riot case came about while analysts and technicians were processing evidence at the Indianapolis lab.

"As we realized the scale of this case and the deadline for processing the evidence, we arranged for the Omnivore's key programmer to be on location," Guarino explained.

The photos on this page show members of the Integrated Riot Investigation Team in Vancouver, British Columbia as they assembled in the Command Room to work with thousands of hours of video from the riot. Members of the team included detectives and civilian analysts. (Photos by Ross Harvey, Vancouver Police Department.)

"Not only was he available as a technical resource to investigators, but he was also able to make a couple of tweaks to the software that further streamlined the processing."

A second key to the effort involved the video server and storage hardware that managed all the video. The lab utilized Avid's ISIS shared-storage system that allows numerous technicians to work on video evidence at one time from separate workstations. In Indianapolis and later, back in Vancouver, that allowed literally dozens of team members to work through hours of video that otherwise might have required months to process.

"The big benefit is speed," explained Ed Jose, digital media specialist with Avid. "Without that capability, they wouldn't have a way of bringing it in fast enough and be able to have multiple analysts."

Especially in massive cases such as the Vancouver riots, that capability is critical, agreed Jacques Durocher, director of Avid's media-enterprise segment marketing. "This workflow

Members of the LEVA Forensic Video Analysis Response Team met at the LEVA National Digital Multimedia Processing Lab at the University of Indianapolis, Indiana. There, they worked with more than 5,000 hours of video evidence that documented the 2011 hockey riots in Vancouver. (Photos courtesy of LEVA.)

allows a lot of people to descend on the same media in a short period of time in a very cost-effective manner," he explained. "We developed these techniques in commercial video, but there's a huge opportunity in law enforcement."

In addition to enabling an efficient workflow, Avid's technology also provides the means for the tagging used so heavily in this case. Since the 1990s, Avid has implemented a plug-in architecture for its software that allows companies such as Ocean Systems to add specialized enhancements. Avid also creates the architecture for meta-data—in this case, the non-video information such as tags describing suspect clothing.

The intense, two-week session in Indianapolis focused on placing those tags. After that, the tagged video was returned to Vancouver and IRIT on October 22, 2011. There, a 60-member team from eight area agencies began to identify specific suspects and develop individual cases. Because the massive amount of video evidence had been tagged with such detail, a cascade of charges is expected.

"One of the biggest results for law enforcement is that everyone we're charging now is looking at a more serious offense," Chow explained. "Many are facing multiple charges rather than a relatively minor, single charge. The person who would have been charged with just a single 'mischief' offense is now facing multiple charges, some of them very serious, indeed. This new technology has changed the game."

Fredericks also credited the analysts with sound police techniques. He noted, for example, that along with detailed descriptions of clothing and other characteristics, analysts were often able to identify suspects because in the riot they tended to travel in groups. If one suspect could not be identified in one scene, it was often possible to find that person elsewhere by locating those near the suspect in other scenes. "They don't travel alone," Fredericks said. "They travel in groups."

Likewise, someone might try to wear a disguise, such as a mask. Using clothing matches in other scenes,

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however, the analysts could tag the suspect with and without a mask.

"Our ability to utilize this evidence just continues to grow," Fredericks concluded.

New Science, Traditional Techniques

Although the case may continue to develop for years, the first substantial legal impact occurred on October 31, 2011 when the first 163 charges against 60 individuals were recommended to Vancouver prosecutors. The following month, officials there approved the first 25 individuals for trial. Experts involved estimate that more than 500 people may eventually face charges. Many are turning themselves in and attempting to plea bargain.

Jose at Avid foresees other results as well. "I expect an evolution will continue as the cases become larger and more complex or just more frequent," he said. "For the larger cases, I believe you'll see a move toward forensic video task forces. On the big crime scenes, it's going to require this type of collaborative effort."

Chow saw law enforcement as changing qualitatively, not just quantitatively. "Originally, most of these types of cases were done by witness accounts," he noted. "But in this day and age, most investigations will have some component of forensic video. It's never been so pervasive and, with something like this, you can have literally hundreds, even thousands, of people taping with their smart phones."

Fredericks said such efforts would become virtually required, even for small departments. Citing *Brady v. Maryland (1963)*, he noted that police are required by law to disclose all available evidence. The fact that hundreds or even thousands of hours of video evidence may be difficult to analyze is not likely to impress a judge.

"Law enforcement will need to deal with this, and the Vancouver police are paving the way because they understood the implications right away," he said. "Police cannot ignore that this evidence is there. They can't say, 'That's too much for us to deal with.' That's unlawful, and it could lead to a challenge of all the evidence."

For law enforcement agencies of all sizes, managing the large volume of video will be the challenge. "Efficiency and accuracy are the focus at all levels and sizes of organizations," said Guarino. "I believe you will see more investments being made at the top end—by task forces and regional labs—in collaborative workflow solutions. Meanwhile, you will see powerful portable video-capture and image-clarification software being distributed to the frontline first responders for both large and smaller agencies. This way, cases both large and small can be processed more efficiently by all groups.

"With such an increase in the amount of video being acquired, it is going to take increased efficiencies at all levels, from the frontline to the labs."

No one is suggesting it will be easy. "I had a phone call yesterday from an agency that is being overwhelmed with video," Fredericks said. "That's new. We never saw that before. But as people become more sophisticated with the video systems they have on their hips, it's now the first thing they think about when something happens. Where massive amounts of people gather, you'll have massive amounts of video." ◉◉

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