## How Vegas Security Drives Surveillance Tech Everywhere

Las Vegas casinos are incubators of the world's most advanced surveillance tech. Here's how the spy gear that helps Sin City has taught everyone from government to big banks how to snoop more effectively.

By Michael Kaplan

It is 2 AM inside the bunker-like surveillance room at the Mirage Resort in Las Vegas, but 28 wall monitors show there's still plenty of action down on the floor. A surveillance worker we'll call Tom logs in and starts the graveyard shift, taking an overhead tour of the 100,000-square-foot casino. Using a joystick, keypad and three desktop screens, he surveys video from some of the 1000 ceiling cameras.

Tom is a table-games specialist, so he starts by scrutinizing a few poker hands, then sweeps over medium-stakes blackjack and watches a busy craps table. Nothing looks unusual until he stops at a baccarat game in the high-limit room, where betting minimums start at \$100 per hand. He focuses on a young Asian man in a white suit who keeps his hands curiously positioned. Sometimes they cover the cards in front of him; at other times they rest on the side of the table. Suddenly, the man sweeps one hand up along a lapel of his jacket.

Like many gamblers in Las Vegas, the man presented a players card, the equivalent of a customer-loyalty card, to the dealer before buying into the game. Through these cards, the casino monitors the play of guests and dispenses complimentary goodies accordingly (risk enough money, and you may wind up in a villa with a butler). The card enables Tom to retrieve a profile of the player: his name, date of birth, address, amounts won and lost on previous visits and other data.

Tom checks the player's long-term success rate at baccarat: He's a stone-cold loser. Common sense suggests that his poor record should exonerate him. Playing a hunch, Tom uses an internal search engine to correlate every player and dealer that the suspect has gambled with at the Mirage. One name repeats—a big winner, also Asian. On this trip alone, he's ahead hundreds of thousands of dollars, and he happens to be playing right now, at the same table as Mr. White Suit.

Less than an hour later, Tom makes the call. He is convinced that the fellow in the white suit is not rubbing his lapel but dipping his finger inside his jacket. He is swapping cards in and out of the game, a tactic known as hand mucking. Capitalizing on baccarat's simple rules, which allow

gamblers to take the side of player or banker, Mr. White Suit loses minimal wagers while his confederate wins large ones from the casino.

When the winning conspirator attempts to cash out his chips, guards detain him. Other guards hustle the mucker from the table. The cheater tries to break free, then drops to his knees and eats the card that he had slipped inside his jacket. He may have swallowed the evidence, but the casino's digital ceiling cameras have captured all of his illicit actions.

Soon after this incident, the Mirage outfitted its baccarat tables with a system known as Angel Eye. A scanner hidden in the shoe—the plastic case out of which cards are dealt for multideck games—reads invisible bar-code strips on the cards. "Angel Eye identifies the cards as they come out and conveys that information to the dealer," director of surveillance Ted Whiting says. If a player swaps in a card, the dealer knows. "That one change put card muckers out of business here."

Enter a major Las Vegas casino, and you might as well be walking into a complex computer built to study your relationship with money, your motivation for gambling, even your taste in food. Cameras capture your every move, software calibrates your play, and regressive-analytic applications (like those used on Wall Street to predict a stock's future) estimate your long-term worth to the casino.

Given the wild bets taken recently by investment banks, the overlap of gambling and financial technology may not be surprising. But the innovations pioneered for Las Vegas surveillance rooms have significance and applications that reach a lot farther than a trading floor. According to Dave Shepherd, former executive director of security at the Venetian Resort Hotel Casino, Las Vegas is an ideal proving ground for innovations that eventually end up in airports, shopping malls and government agencies. "There is no Underwriters Laboratory for security technology," says Shepherd, who serves on a casino-focused council affiliated with Homeland Security. "Casinos use the earliest versions of security and surveillance devices. People in other industries see how they work, and those people come up with fresh applications for the technology."

Vegas's gaming industry, after all, has the resources and incentives to be a pioneer in surveillance tech and data mining. "Casinos employ the most talented cryptographers, computer security experts and game theorists," says John Pironti, chief information risk strategist for Archer Technologies, a Kansas-based company that specializes in data protection. "Casinos are vulnerable and have a vested interest in being innovative."

A modern Vegas property is a microcosm of a wider world, with restaurants, a hotel, entertainment venues, retail shops and a sophisticated system of currency exchange. It's all in a highly controlled environment where customers eagerly volunteer personal data for a chance at comps. As a result, casinos maintain a treasure trove of information on customer behavior that most marketers would die for. Players cards and gambling in general are opt-in propositions. The casino industry is highly regulated, and the watchful tech is not only legal but, in many cases, mandated. Still, the opaqueness of the programs is a cause of concern for some privacy advocates. "Why should casinos have secret files on their best customers?" asks Marc Rotenberg,

executive director of the Electronic Privacy Information Center (EPIC). "People should know the information that casinos gather on them."

Digital data has a long memory, and effective surveillance technology spreads fast. The software that measures your gambling skill at the blackjack table today could be gathering data for your performance review at work tomorrow.

Paying close attention to customers is as much a security concern as it is a marketing opportunity for casinos. From the moment you place your first bet with your players card, the casino starts paying attention. "That financial transaction feeds into a data-warehousing platform," says David Norton, chief marketing officer of Harrah's Entertainment. The most direct interface with the system is a modern slot machine. These days most slots are run by computers, and until recently, all of these computers have been self-contained machines. To make adjustments on standard slots, attendants have to stop play, open the housing and swap out chips, a time-consuming process that reduces profits for the casino. The Mirage's soon-to-open sister property, Aria Resort & Casino, however, will be the first casino in Las Vegas outfitted with server-based slot machines. That means Aria's one-armed bandits will run off a single computer, allowing supervisors to alter machines simply by pushing backroom buttons that can change games, odds and limits to suit the player or the situation. If a player is in town for the National Finals Rodeo, the slot machine could load up a game with a rodeo theme, and alert the player when certain comps kick in or provide the showtimes of events he might be interested in. It'll even wish him happy birthday.

All the personal attention may seem flattering so long as the casino values your business. But what about those people who are viewed as undesirable? At the Venetian Resort Hotel Casino, special software allows security workers to enter a suspected bad guy's characteristics (a mustache, say, along with a forearm tattoo and a habit of lurking around roulette tables). If there is a visual match from the casino's database, it pops up on the screen, along with identification data. "We have a lot of coverage, a lot of cameras, a lot of information," says Dan Eitnier, head of surveillance at the Venetian. "A couple of years ago we had a collusion situation, and by finding the suspected dealer's car-loan application in our file on him"—the lender had asked the Venetian to confirm his employment there—"I saw that he gave one of his frequent players as a reference." The scheme unraveled from there, and both men were busted. New algorithms have elevated this type of on-the-spot background check to a Vegas art form.

Non-obvious relationship awareness (NORA) software allows casinos to determine quickly if a potentially colluding player and dealer have ever shared a phone number or a room at the casino hotel, or lived at the same address. "We created the software for the gaming industry," says Jeff Jonas, founder of Systems Research & Development, which originally designed NORA. The technology proved so effective that Homeland Security adapted it to sniff out connections between suspected terrorists. "Now it's used as business intelligence for banks, insurance companies and retailers," Jonas says.

According to EPIC's Rotenberg, any industry that collects so much data on its customers is at risk for a computer security breach. "Even if casinos have no interest in using their information

for any purpose other than the intended one, things don't always go as planned." Especially, he points out, since security teams at competing casinos often share information.

With all the data collection and camera monitoring going on in casinos, a sense of gambler's paranoia is understandable. But it's worth remembering that the same technology that protects the house could end up protecting you. Casinos are tempting places for pickpockets; customers stroll the floors with cocktails in their hands and thousands of dollars in their pockets. Some of the sexiest-sounding software—facial-recognition systems that promise to set off alarms as soon as a known criminal enters the property—is still too primitive to be useful. However, more reliable analytic software is employed in casinos such as the Mirage to monitor video feeds for suspicious activity—someone hiding in a stairwell, for example, or a purse left unattended too long.

The most advanced surveillance tool in the gaming industry is focused on the blackjack tables at Barona Resort & Casino in Southern California, where management aggressively tests new technology. The system, called TableEye21, was created by Canadian computer engineer Prem Gururajan to profile and rate players according to skill.

TableEye21 uses overhead video cameras and video analysis software, and can track information from casino chips embedded with radio frequency (RFID) transmitters. The system quickly identifies "advantage" players who can cost casinos profits. These gamblers use legal strategies such as card counting and shuffle tracking, in which the player watches for clumps of favorable cards. Gururajan says TableEye21 will be coming online soon at a Vegas casino, and surveillance specialists are enthusiastic about the product. "You get a printout of the player's skill level, how much you can expect to win from him and whether the dealer is making errors," Gururajan says. "Since the system tracks the player's bets, the casino knows exactly how good a customer the player is."

Sometimes, casino monitoring can go too far. A few years ago a product called MindPlay hit the market. Fourteen tiny cameras photographed cards as they came out of the blackjack shoe. The system's software executed a quick bit of analysis and notified dealers, in real time, whether shoes were cold or hot—that is, when the remaining cards favored players. "That would be a good time for the casino to come up with an excuse to shuffle," says veteran security director Arnie Rothstein. "Players found out about it and complained to the Gaming Control Board." The product, according to its manufacturer, is no longer in use.

Inside his plushly carpeted surveillance lair at the rococo Venetian, Dan Eitnier inspects the flatscreen monitors on the walls. He acknowledges that technology runs both ways in the gaming business: The operators aren't the only ones who capitalize on cheaper bytes and easy access to data.

Eitnier admits that all casino games are vulnerable. Enhancements in technology have simply added another layer to the endless cat-and-mouse game played by those who are paid to protect casinos and the renegades who get rich by out-thinking the protectors. "Whenever new technology is introduced, you always have people out there who want to beat it," he says. Cheaters buy and dissect slot machines, angle-shooters analyze automatic shufflers in search of

patterns, and card counters continue to stymie facial recognition. "They find weaknesses in the technology, and then we come up with new technology that they have not yet figured out."

Eitnier leans back in his chair and keeps his eyes on the monitors. He smiles. "Of course," he says, "without those people trying to beat everything, I wouldn't have a job."