



The San Francisco Zoo tiger escape and attack

3D visualization is used to reconstruct the escape and attack

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On December 25, 2007, a 243-pound, four-year old Siberian tiger named Tatiana escaped its open-air habitat at the San Francisco Zoo, stalked and attacked three young men who were visiting the Zoo. The tragic event made headlines around the world. Brothers Kulbir and Paul Dhaliwal suffered serious injuries and their friend, Carlos Sousa, Jr., 17, died from his injuries.

Mark Geragos represented Kulbir and Paul Dhaliwal in federal court in a lawsuit naming the Zoo, the San Francisco police department and the public-relations firm hired by the Zoo. On May 29, 2009, the Zoo settled with the two brothers for \$900,000.

Michael Cardoza represented the family of Carlos Sousa, Jr. and filed a wrongful death suit in San Francisco Superior Court. On February 13, 2009, the Sousa family reached a confidential settlement with the Zoological Society and the zoo's insurance carrier paid the entire amount.

Legal basis of the claims

The seminal case *Rylands v. Fletcher*, UKHL 1 (1868) established a rule of strict liability for abnormally dangerous conditions and activities. Although *Rylands* itself involved the breach of a water reservoir that flooded nearby coalmines, Justice Colin Blackburn added dicta to the opinion comparing the case to trespasses involving cattle and "dangerous animals," declaring:



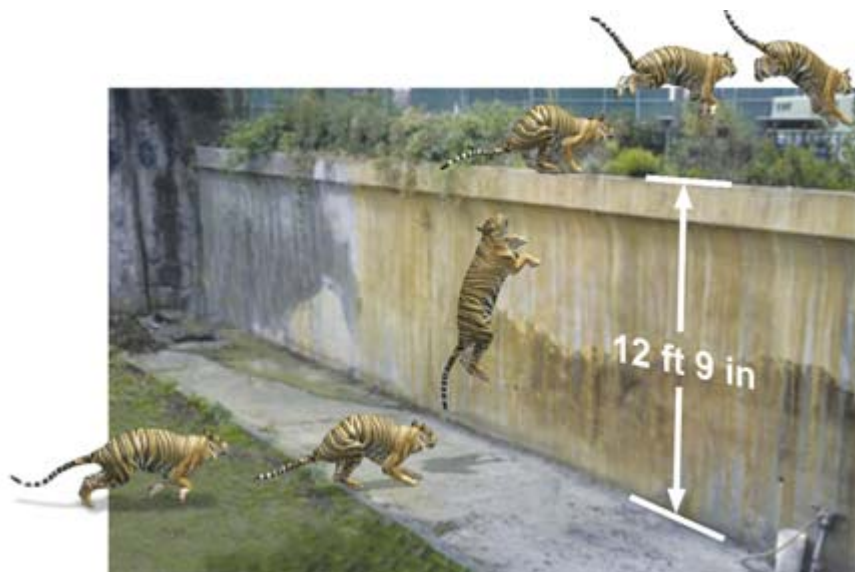
The true rule of law is, that the person who for his own purposes brings on his lands and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is self evident answerable for all the damage which is the natural consequence of its escape.

Although the "true rule of law" cited by Justice Blackburn is not technically the rule of the case, many people cite it as such. The concept of holding a party liable for "anything likely to do mis-

chief if it escapes" is, indeed, woven into the fabric of modern law.

While common sense might argue that a 243-pound tiger would qualify as something "likely to do mischief if it escapes," the defendants argued in pretrial proceedings that strict liability should not be applied to the facts of this case. In support of their position, the defendants referred to an older case where a zoo patron was bitten on the hand and arm while reaching towards or into a zoo cage while attempting to feed a polar bear. (*McKinney v. City & County of San Francisco* (1952) 109 Cal.App.2d 844, 847 [241 P.2d 1060].)

It is unclear whether or not the plaintiff in *McKinney* was actually reaching inside the bear's cage or whether his hand was still outside the enclosure. Nevertheless, the salient aspect of the case





lies in the appellate court's determination that strict liability would not apply and, instead, the court decided the case based on a negligence standard. The court found that it would be necessary to show "a dangerous or defective condition" of public property that the officials should have known about and failed to repair (a standard that the plaintiff in *McKinney* was unable to meet).

In the present case, the question of whether strict liability or negligence would apply as a legal standard could have been dispositive due to allegations that conduct of the plaintiffs may have been a contributing factor in the attack. Although the case was resolved prior to trial, press accounts suggested that the defendants were intending to present evidence that the young men had alcohol and marijuana in their systems and that they teased and taunted the tiger. If the defendants had been successful in convincing the trial court to apply a negligence standard, such contributory conduct, if proven, might have provided a whole or partial defense to the action.

Many courts have declined to apply strict liability to claims against governmentally run zoos on grounds that the operations constitute public enterprises. (See, *Guzzi v. New York Zoological Soc'y* (N.Y. App. Div. 1920) 182 N.Y.S. 257) (girl injured by bear). Several state legislatures have also enacted statutes that expressly prohibit judicial application of strict liability

to zoos and require that all claims must sound in negligence. (See, e.g., Alaska Statutes 09.65.180.) Many legal observers believe, however, that *McKinney* would not have been a serious impediment to the plaintiffs in this case for several reasons.

First, *McKinney* is more than a half-century old and therefore might not be an accurate statement of the law today in light of developments in liability theory.

Many authorities believe that the public-policy underpinnings of the case are no longer applicable and that the case would likely be limited if not actually rejected as precedent now.

Matt Davis, a former deputy city attorney who now practices with Walkup, Melodia, Kelly & Schoenberger, believes that the *McKinney* decision has dubious authority today in light of the fact that California overhauled its laws on suits against government agencies in 1963. "It remains subject to the traditional rule that a zookeeper, like a dynamite-hauler or anyone else engaged in what the law classifies as 'ultra-hazardous activities,' can be held responsible for injuries caused by those activities even when nothing is done wrong."

The second difference between the tiger attack and *McKinney* is that the tiger attack involved an actual escape of a dangerous animal, as opposed to *McKinney* where the polar bear remained confined in its cage.

Third, the tiger Tatiana had actually mauled a keeper while patrons watched in horror in 2006. Thus, the complaint would include the contention that defendants had actual knowledge of the animal's vicious propensities.

Fourth, in 1952 the zoo was open to the public at no charge. At the time of the 2007 tiger attack, zoo patrons were charged \$11 to \$15 for adult tickets, leading to the argument that there ex-

isted a greater duty on the defendants than in *McKinney*.

Finally, plaintiffs' primary contention was that the tiger enclosure was demonstrably inadequate according to all applicable safety standards. The physical configuration of the enclosure would likely have been the crux of the case for the plaintiffs, and it became the most important factor in the successful mediation of the case on behalf of the family of Carlos Sousa, Jr., according to plaintiff's attorney Cardoza.

David Levine, Professor of Law at Hastings College of the Law, opined that "the inadequacies of the enclosure were so egregious that an expert would conclude that 'any idiot would know a dry moat with a 12-foot wall' wasn't enough protection from a tiger." Moreover, Professor Levine minimized the significance of any allegation that the plaintiffs taunted or teased the tiger. "It depends on what they've done, but it's pretty unlikely that merely taunting the animal would lead to a finding of substantial fault. You shouldn't do it, but it happens all the time. It's not like coming in and unlocking the cage." One goal of the law of torts, or injuries, he said, is "to create liability rules that will make people act in the right way." After a verdict in the San Francisco case, he said, "zoos would know more about how they need to act."

Reconstructing the attack

The attorney for the Sousa plaintiffs, Michael Cardoza, explained why he chose to use 3D visualization to press his demands for settlement: "I felt it was very important to realistically show what occurred. I was able to effectively demonstrate the path of the tiger as it jumped the grotto wall, approached Carlos, and ultimately took Carlos' life.

"Being able to show a moving visual image of the tiger jumping out of the grotto and attacking a young man was an extremely powerful and persuasive tool. The image allowed the viewers to emotionally connect to the event. The visual



3D animation reconstructs the events as they were reported.

image made the situation come to life for the viewers.”

Extensive research was done on the Siberian tigers to include all the data necessary to reconstruct the tiger’s escape and attack on the boys. The computer software used by Litigation Animation, Inc. (LAI) in the reconstruction was developed by the French National Institute for Research in Computer Science and Control (INRIA). The software (Match Mover Pro) was developed specifically as a critical component for an autonomous robot’s vision system. This highly refined camera-matching software technology has become a standard in Hollywood and is used by innovative forensic animation companies around the country.

The tiger habitat at the Zoo measured 56 feet long by 76 feet wide with a 29-foot wide moat. The moat wall that was supposed to protect the public from Tatiana was 12 feet 9 inches high, which was 4 feet lower than the national standard (16 feet 4 inches), set by the Association of Zoos and Aquariums. In comparison, the Singapore Zoological Gardens lion’s habitat has a moat wall approximately 22 feet high.

Siberian tigers are super predators at the top of the food chain, the largest of six subcategories of tigers and considered the strongest and most dangerous. Siberian tigers have canines 2.5 to 3 inches long and claws 3.5 to 4 inches in length.

Their tongues are so rough that they lick the meat from the bones of animals that they have killed. Fearless nocturnal hunters, this species of tigers kill bear, moose, deer, ox and wolves. It is a true carnivore, meaning that it has to eat meat to survive. Tigers eat about 20 pounds of meat per day. Siberian tigers in the wild primarily live in eastern Russia and may occupy an area of approximately 15 square miles (418,175,999 square feet), dependent on how much prey is available. They mark their territory by scratching trees and spraying urine. Tatiana had a total living space of 3,500 square feet at the San Francisco Zoo. The tiger grotto was constructed in the 1930s and had not changed in design from 1940 to 2007.

Design criteria requiring that the tiger habitat have a specific level of water in the moat was not found during the research, but in the 1960s a Bengal tiger jumped out of the same enclosure and paced inside the fence before jumping back into the habitat on its own. The moat was then filled with water for the remainder of the tiger’s stay to prevent him from repeating the jump. After the Bengal tiger was relocated, the moat was drained.

So what happens when a Siberian tiger with highly evolved hunting and killing instincts is placed in an artificial habitat approximately 100,000 times smaller than its natural environment and fed without having to hunt and kill? Dr. Georgia Mason, a professor from the

University of Guelph in Ontario, Canada, who studies the effect that these tiny habitats have on animals’ mental health, says that repetitive behavior such as pacing back and forth is one sign that an animal is distressed.

Dr. Freeman Dunker, the San Francisco Zoo veterinarian, performed a necropsy (the animal equivalent of human autopsy) on Tatiana after she was shot by four San Francisco police officers at the Zoo’s Terrace Cafe. He reported that her claws were not frayed, suggesting that she made the 12-foot 9-inch leap on her first attempt. Dr. Dunker also reported that there was no disease or signs of trauma on the body other than bullet wounds.

Emergency 911 timeline

On December 25, 2007, the sun set at 4:57 p.m. on the San Francisco Zoo. At 5:04 p.m., a security guard at the Zoo made a call to the 911 dispatcher asking for an ambulance. At 5:11 p.m., a police officer broadcast over the radio to the emergency dispatcher that they were responding to a zoo call reporting an escaped tiger.

Zoo personnel then said that there were two males who they think... are 800 (code for mentally disturbed) and making something up... but one is, in fact, bleeding from the back of the head, according to a police log entry at 5:10 p.m.

At 5:16 p.m., Kulbir Dhaliwal called 911 from the Terrace Café asking for



help. He stayed on the line with the 911 dispatcher for 11 minutes. The medical crews were let in under police escort, and by 5:20 p.m. they found Sousa's body, according to police dispatch logs.

Kulbir's call was cut off at 5:27 p.m. due to the tiger attacking him. The officers reported that they saw the tiger at 5:25 p.m., 2 minutes before it attacked Kulbir. They fired on the tiger when it moved toward them. At 5:28 p.m., officers broadcast over the radio that they had shot the cat.

The San Francisco Zoo reopened on January 3, 2008, nine days after the escape of Tatiana. The moat wall is now 16 feet 4 inches high with an additional transparent barrier bringing the wall

measurement to 19 feet. In addition, an electric wire was added surrounding the inside of the habitat at about 12 feet from the moat floor.

Building the computer model

The first step in the recreation process was to build accurate 3D computer models of the tiger habitat and the three people attacked. The next step was to apply texture maps to the wireframe models to give the appearance of fur, skin, and clothing. This process is similar to applying wallpaper.

At this point the 3D wireframe surface model of the habitat was geometrically overlaid with the reference real-world digital images of the habitat. The process is described in engineering peer-reviewed papers.

Next, the 3D wireframe models of the tiger and people are rigged with internal skeletons. These internal skeletons are used to apply motion to the tiger and people. The skeletons are programmed to have the same range of motion as their real world counterparts. The skin surfaces deform realistically as the skeleton is articulated and can be made to show ligament and muscle movement if needed.

The motion is created in four ways: key frame animation, motion capture, Newtonian physics, and rotoscoping.

- **Key-frame animation** means that a skilled animator articulates the 3D skeleton on a frame-by-frame basis to create the desired motion.

- **Motion-capture** is 3D motion data generated from real-world actors wearing specialized optical suits. The motion is recorded with multiple high-speed optical cameras using special computer algorithms. Motion-capture data can be altered by blending with other motion-capture data to create a unique sequence of motion that fits the scenario. For exam-

ple, walking, running, falling or fighting motion data can be seamlessly blended together.

- **Newtonian physics** uses ridge-body dynamics to simulate the required movement. The 3D biomechanical models are carefully prepared with real-world attributes such as forces, gravity, mass, friction and range of movement. The computer simulation program used by LAI is Working Model 3D.

- **Rotoscoping** is an animation technique that uses reference video of the subject of interest as a moving template. The skeleton is articulated by matching the movement in the video. Reference video of Siberian tigers walking, running and jumping were used by David Violante, an LAI computer animator specializing in animating quadrupeds. LAI uses 3D Studio MAX software for animation.

It is not unusual for LAI's animators to combine all the four motion techniques to achieve the necessary movement.

In the final step, virtual lights and cameras are placed in the 3D scene for the final animation rendering. When complete, the animation is reviewed by animators and accident reconstruction experts for relevance and accuracy.

Alex Bevan and Jorge Mendoza are co-owners of Litigation Animation, Inc., a consulting firm in San Jose, California, specializing in 3D computer animation, photo analysis, and surveillance video analysis, vehicle crash analysis and visibility studies. Mendoza is a member of the Society of Forensic Engineers and Scientists (SFES). Their work can be viewed at www.litigationanimation.com. E-mail: litamotion@sbcglobal.net.



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