

---

---

# Private Security Robots, Artificial Intelligence, and Deadly Force

Elizabeth E. Joh\*

*Robots equipped with artificial intelligence will transform existing notions of work in fields as diverse as fast food, health care, manufacturing, and the military. A recent use of a remote-controlled robot equipped with lethal force has raised the question of how police might use robots to supplement or replace existing police work. Those same questions apply equally to private individuals who will want security robots, some of which are already in development and for lease. What about a future in which people employ autonomous and lethally armed security robots for protecting their homes and themselves? How would courts characterize security robots? One possibility involves spring guns. While spring guns may not be perfect analogues for security robots, many of the questions considered in the spring gun cases offer a helpful framework for courts when robots enter the security business.*

## TABLE OF CONTENTS

INTRODUCTION .....	571
I. THE DECLINE OF SPRING GUNS.....	572
II. THE RISE OF SECURITY ROBOTS.....	576
III. THE CHALLENGE OF SECURITY ROBOTS FOR COURTS.....	582
CONCLUSION.....	586

---

\* Copyright © 2017 Elizabeth E. Joh. Professor of Law, University of California, Davis, School of Law (King Hall). Thanks to the participants in the 2017 UCLA School of Law PULSE workshop, Kyle Edgerton, Charles Reichmann, the editors of the UC Davis Law Review, and the organizers of the UC Davis Law Review's 50th Anniversary symposium, *Future Proofing the Law: From rDNA to Robots*.

\*\*\*

INTRODUCTION

*Homeowner Charged with Manslaughter for Fatal Security Robot Shooting of Intruder*

This headline does not describe any actual incident. But one day, it could. A court, one day in the future, will be asked to decide a case involving a death caused by a person's security robot. This death will not be accidental. The robot will have been intentionally designed to cause harm to one person in order to protect the home or life of another. The robot's owner<sup>1</sup> may face either a civil lawsuit, criminal charges, or both.

Unlike the police, the limits of private defensive force are not regulated by the Fourth Amendment, but rather by the legal rules of self-defense — either recognized in state statutes or developed in judge-made law.<sup>2</sup> While there are jurisdictional variations, the law of self-defense usually means that people are entitled to resort to force, even deadly force, in circumstances where they face the threat of immediate death or great physical harm.<sup>3</sup> And, generally speaking, people are also entitled to use deadly force when they reasonably believe that they are faced with a person who is about to enter their home without permission and commit a serious crime.<sup>4</sup> No company today offers an armed robot for private defense in the United States. But one police department has already used a jury-rigged robot in order to kill a barricaded man who had fatally shot several police officers.<sup>5</sup> And the market for unarmed security robots for private

---

<sup>1</sup> Such robots could be leased as well, but for the sake of simplicity, I will refer to robot owners.

<sup>2</sup> See 2 WAYNE R. LAFAVE, *SUBSTANTIVE CRIMINAL LAW* § 10.4(a) (2d ed. 2016); cf. *Burdeau v. McDowell*, 256 U.S. 465, 475 (1921) (holding that the Fourth Amendment was “not intended to be a limitation upon other than governmental agencies”).

<sup>3</sup> See, e.g., LAFAVE, *supra* note 2, § 10.4(b) (“[One] may justifiably use *deadly* force against the other in self defense . . . only if he reasonably believes that the other is about to inflict unlawful death or serious bodily harm upon him (and also that it is necessary to use deadly force to prevent it).” (footnote omitted)).

<sup>4</sup> *Id.* § 10.6. LaFave notes that American courts have rejected older rules permitting deadly force to be used to protect the home as “too broad.” *Id.* § 10.6(b). Courts now permit the use of deadly force in situations where the defender “reasonably believes that the trespasser intends to commit a felony or do harm to him or another within the house.” *Id.* Other courts have adopted a narrower rule that permits deadly force “against an entry of a dwelling reasonably believed to be for the purpose of committing a felony (including killing or doing great bodily harm therein).” *Id.*

<sup>5</sup> W.J. Hennigan & Brian Bennett, *Dallas Police Used a Robot to Kill a Gunman, a New Tactic that Raises Ethical Questions*, L.A. TIMES (July 8, 2016, 2:22 PM),

customers is already in development.<sup>6</sup> These trends follow the significant investment in robotics research and development in the military.<sup>7</sup>

These developments mean that, at some point, there will be an armed security robot, and some robot will be the first to seriously injure or even kill a person thought to pose a threat. Because our legal system depends on analogies, a judge will have to decide — absent a statute specifically regulating their use — what existing legal doctrines are closely analogous to armed defensive robots.

Armed security robots will raise a number of legal questions, but in a hypothetical case like this one, a judge may turn to a staple of American law school classes: the spring gun. People have used spring guns and other crude mechanical devices since at least the eighteenth century to protect their property while they were elsewhere. Should twenty-first-century armed security robots be analogized to a nineteenth-century spring gun? This Essay considers this question, and suggests why the analogy, if used, harbors serious limitations.

## I. THE DECLINE OF SPRING GUNS

While serving mostly as a historical curiosity today, spring guns remain a favorite legal topic because of the questions of fault, defense, and precaution they pose.<sup>8</sup> Spring guns are designed to discharge when triggered by a trip wire or other mechanism, without the need for a person to operate it.<sup>9</sup> Eighteenth-century English landowners used them to thwart poaching, but spring guns injured and sometimes

---

<http://www.latimes.com/nation/la-na-dallas-robot-20160708-snap-story.html>.

<sup>6</sup> See, e.g., Robbie Gonzalez, *I Spent the Night with Yelp's Robot Security Guard, Cobalt*, WIRED (Aug. 4, 2017, 7:00 AM), <https://www.wired.com/story/i-spent-the-night-with-yelps-robot-security-guard-cobalt> (describing growth of autonomous robotics, including security robots, for private clients).

<sup>7</sup> See, e.g., SINGER, WIRED FOR WAR: THE ROBOTICS REVOLUTION AND CONFLICT IN THE 21ST CENTURY 423 (2009) (noting that “much of the funding for robotics research comes from the military.”).

<sup>8</sup> The topic was most famously discussed by Judge Posner. See Richard A. Posner, *Killing or Wounding to Protect a Property Interest*, 14 J.L. & ECON. 201, 202 (1971) (“What makes the deadly-force issue worth discussing, however, is not its topicality but its theoretical interest . . . . [T]he privilege (if there is a privilege) to use deadly force to protect property cannot fail to raise fundamental issues of legal policy.”) Posner concluded: “[N]either blanket permission nor blanket prohibition of spring guns and other methods of using deadly force to protect property interests is likely to be the rule of liability that minimizes the relevant costs.” *Id.* at 214.

<sup>9</sup> See, e.g., Geoffrey W.R. Palmer, *The Iowa Spring Gun Case: A Study in American Gothic*, 56 IOWA L. REV. 1219, 1222 (1971) (describing the mechanics of the spring gun in the *Katko* case).

killed both thieves and innocents alike. Americans and Britons concerned about grave robbers looking for medical cadavers devised cemetery spring guns to thwart “resurrection men.”<sup>10</sup> Whatever their purpose, spring guns posed enough of a problem in England that Parliament generally prohibited their use in the nineteenth century.<sup>11</sup>

One of the most famous English cases about spring guns begins with a story of tulips and self-help gone wrong. The industrial revolution made it possible for commercial tulip horticulture to thrive in the otherwise unsuitable British climate. To protect tulips “of the choicest and most expensive description” growing in his Gloucester garden, Holbrook concealed a mechanical gun on his property to deter any would-be thieves.<sup>12</sup> Connected to this spring gun were trip wires placed fifteen inches above the ground.<sup>13</sup>

A nineteen-year-old named William Bird had the misfortune of triggering Holbrook’s spring gun.<sup>14</sup> Bird had climbed over the walls of Holbrook’s garden to retrieve a neighbor’s stray peahen.<sup>15</sup> Unaware of the trip wires close to the ground, Bird set off the device and received a “severe wound” from the “large swan shot” loaded in the spring gun.<sup>16</sup>

The *Holbrook* court permitted Bird to recover against Holbrook in 1828. In his opinion, Chief Judge Best emphasized both Holbrook’s failure to provide notice that the spring gun had been set in the garden, and that the device was intended to maim would-be tulip thieves.<sup>17</sup> Of this “certain dangerous engine,”<sup>18</sup> Best opined that “he who sets spring guns, without giving notice, is guilty of an inhuman act, and that, if injurious consequences ensue, he is liable to yield redress to the sufferer.”<sup>19</sup>

American courts, too, have generally disfavored the use of spring guns and other deadly devices. The Iowa Supreme Court’s decision in

---

<sup>10</sup> E.g., Rebecca Onion, *The “Cemetery Gun”: One Defense Against Grave Robbers*, SLATE: THE VAULT (Jan. 29, 2013, 1:00 PM), [http://www.slate.com/blogs/the\\_vault/2013/01/29/cemetery\\_gun\\_invented\\_to\\_thwart\\_grave\\_robbers.html](http://www.slate.com/blogs/the_vault/2013/01/29/cemetery_gun_invented_to_thwart_grave_robbers.html).

<sup>11</sup> 7 & 8 Geo. 4 c. 18 (1827) (Eng.).

<sup>12</sup> *Bird v. Holbrook* (1828) 130 Eng. Rep. 911, 912; 4 Bing. 628, 631.

<sup>13</sup> *Id.* at 912; 4 Bing. at 631-32.

<sup>14</sup> *Id.* at 911, 913; 4 Bing. at 628, 632-33.

<sup>15</sup> *Id.* at 913; 4 Bing. at 632-33.

<sup>16</sup> *Id.* at 912-13; 4 Bing. at 632-33.

<sup>17</sup> *Id.* at 916-17; 4 Bing. at 640-43.

<sup>18</sup> *Id.* at 911; 4 Bing. at 629.

<sup>19</sup> *Id.* at 916; 4 Bing. at 641. The Parliamentary Act of 1827 prohibited spring guns even with notice, except “in dwelling-houses by night.” *Id.*; 4 Bing. at 642.

*Katko v. Briney*<sup>20</sup> provides one of the most well-known examples. Edward and Bertha Briney had mounted a loaded 20-gauge shotgun in an unoccupied home on their property frequently targeted by break-ins.<sup>21</sup> Wired to a doorknob, their spring gun was designed to discharge at anyone opening the door.<sup>22</sup> Marvin Katko, looking inside of the house for old bottles and fruit jars, triggered the spring gun and was left with a permanently disfigured leg.<sup>23</sup>

The Iowa Supreme Court in 1971 upheld the jury's \$30,000 civil damages award to Marvin Katko.<sup>24</sup> The state supreme court found that the jury instructions properly stated the law: while a person could use reasonable force to protect property, that privilege did not include the use of deadly force.<sup>25</sup> Moreover, a spring gun would only be justified in order to stop a trespasser from committing a violent felony or endangering human life.<sup>26</sup>

The view in *Katko* that spring guns may not be used to protect property alone is widely held.<sup>27</sup> Using a spring gun in the way the Brineys did can subject a person to both civil and criminal liability.<sup>28</sup> This is consistent with the general principle that while one may resort to the use of reasonable force to protect property, the use of deadly force is generally not included in that privilege.<sup>29</sup> Courts have upheld

---

<sup>20</sup> 183 N.W.2d 657 (Iowa 1971).

<sup>21</sup> *Id.* at 658.

<sup>22</sup> *Id.*

<sup>23</sup> *Id.*

<sup>24</sup> *Id.*

<sup>25</sup> *Id.* at 659, 662.

<sup>26</sup> *Id.* at 659.

<sup>27</sup> *E.g.*, *State v. Plumlee*, 149 So. 425, 430 (La. 1933) (noting that "it is now generally held that if a homicide results from the setting of traps or spring guns for the protection of property, the person setting the trap or gun is guilty of murder or manslaughter and that the use of such instruments of death can never be justified on the ground that they were used solely for the protection of property").

<sup>28</sup> *See, e.g.*, *State v. Beckham*, 267 S.W. 817, 821 (Mo. 1924) (finding defendant guilty of criminal negligence); *State v. Green*, 110 S.E. 145, 146 (S.C. 1921) (holding that setting a trap gun that led to death constituted murder). There are some early cases, however, finding no liability for setting such traps. *See, e.g.*, *United States v. Gilliam*, 1 Hay. & Haz. 109 (D.C. Crim. Ct. 1882) (acquitting defendant of murder when the deceased attempted to burglarize defendant's goose house); *State v. Moore*, 31 Conn. 479, 486-87 (1863) (holding that the potential danger to the public in defendant's placing spring guns in his shop to protect against burglars was not "real and substantial," thus finding that such guns did not constitute a nuisance); *Gray v. Combs*, 30 Ky. (7 J.J. Marsh.) 478, 485 (1832) (finding defendant not guilty of homicide when his spring gun killed a slave in the defendant's warehouse).

<sup>29</sup> *See LAFAVE, supra* note 2, § 10.6 (calling prohibition on deadly force the "better view").

civil jury awards and criminal convictions against those who have set up spring guns and other deadly devices to protect melon patches,<sup>30</sup> vineyards,<sup>31</sup> cigarette vending machines,<sup>32</sup> shoe repair stores,<sup>33</sup> henroosts,<sup>34</sup> and gasoline pumps.<sup>35</sup> Even notice, such as a posted sign alerting a would-be trespasser to the deadly device does not generally relieve the person from legal responsibility.<sup>36</sup>

While disapproving of spring gun use generally, courts have recognized some exceptions permitting their use. Some courts have noted that a person may use spring guns if, had he been present during the discharge of the gun, he would have been legally permitted to use deadly force himself.<sup>37</sup> That means that a person may use a spring gun in a situation where he also could have *personally* used deadly force. That deadly force can be used for self-defense or to protect others.<sup>38</sup> Early English law also permitted people to use deadly force to protect entry into their homes.<sup>39</sup> Although most American

---

<sup>30</sup> State v. Childers, 14 N.E.2d 767, 770-71 (Ohio 1938).

<sup>31</sup> Hooker v. Miller, 37 Iowa 613, 614-15 (1873).

<sup>32</sup> McKinsey v. Wade, 220 S.E.2d 30, 31-32 (Ga. Ct. App. 1975).

<sup>33</sup> Pierce v. Commonwealth, 115 S.E. 686, 687, 692 (Va. 1923) (remanded on other grounds).

<sup>34</sup> State v. Plumlee, 149 So. 425, 427, 431 (La. 1933).

<sup>35</sup> Starkey v. Dameron, 21 P.2d 1112, 1113 (Colo. 1933) (remanded on other grounds).

<sup>36</sup> See J.D. Perovich, Annotation, *Use of Set Gun, Trap, or Similar Device on Defendant's Own Property*, 47 A.L.R. 3d 646 § 15 (1973) ("Notice, warning, or knowledge of the maintenance of a spring gun or similar device has been held not to constitute a complete defense to a criminal prosecution arising out of the death or injury caused by the device, or to constitute no defense at all.").

<sup>37</sup> See, e.g., Allison v. Fiscus, 100 N.E.2d 237, 239 (Ohio 1938) ("A person is not justified in taking human life or inflicting bodily harm upon the person of another by means of traps, spring guns, or other instrumentalities of destruction unless, as a matter of law, he would have been justified had he been personally present and taken the life or inflicted the bodily harm with his own hands." (quoting State v. Childers, 14 N.E.2d 767, 767 (Ohio 1938))); Marquis v. Benfer, 298 S.W.2d 601, 604 (Tex. Civ. App. 1956) ("The law does not look with favor upon the setting of spring guns intended to injure human beings, and it is only when a person would have been justified in firing the shot if he had been personally present at the time the spring gun was discharged that he is justified in having set such spring gun, and therefore not liable for the damage done to another as the result of its being discharged."). That exception has been recognized in cases involving civil and criminal liability. See, e.g., Plumlee, 149 So. at 429 (recognizing the principle in a manslaughter case).

<sup>38</sup> Generally, the legal privilege of self-defense permits a person to use even deadly force if he has a reasonable belief that he is facing serious harm or death. See LAFAVE, *supra* note 2, § 10.4(b).

<sup>39</sup> See generally LAFAVE, *supra* note 2, § 10.6(b) (discussing American limitations on the rule).

jurisdictions have rejected a broad version of this rule,<sup>40</sup> many permit deadly force to protect a dwelling in more limited circumstances. For instance, in some states deadly force may be permitted when the defender reasonably believes that the intruder intends to commit a felony within the home.<sup>41</sup> Those limitations have been imposed by statutes or judicial decisions.

Of course, that exception poses some logical difficulties. In cases involving spring guns and other deadly devices, it is precisely because the person was not there that the problem arises. A spring gun lacks the subjectivity and judgement of an actual person.<sup>42</sup> An actual (reasonable) person should be able to recognize that children, innocent people mistakenly wandering on private property, and petty thieves cannot be met with deadly force.<sup>43</sup> Spring guns cannot make the calculations of necessity and proportionality that a person can.

## II. THE RISE OF SECURITY ROBOTS

If spring guns have declined as a form of self-help, then their descendants can be found in security robots. There is already enormous interest in the development of robotics for fields ranging

---

<sup>40</sup> The Model Penal Code takes the position that the use of a deadly device is *never* justified to protect property. See MODEL PENAL CODE § 3.06(5) (AM. LAW INST. 2016) (allowing a device only if “not designed to cause or known to create a substantial risk of causing death or serious bodily injury”).

<sup>41</sup> See LAFAVE, *supra* note 2, § 10.6(b); see, e.g., *People v. Curtis*, 37 Cal. Rptr. 2d 304, 318 (Ct. App. 1994) (“Accordingly, a homicide involving the *intentional* use of deadly force can never be justified by defense of habitation alone. The defendant must also show either self-defense or defense of others, i.e., that he or she reasonably believed the intruder intended to kill or inflict serious injury on someone in the home.”); *State v. Avery*, 120 S.W.3d 196, 204 (Mo. 2003) (“In Missouri, defense of premises is essentially accelerated self-defense because it authorizes ‘protective acts to be taken earlier than they otherwise would be authorized, that is, at the time when and place where the intruder is seeking to cross the protective barrier of the house.’” (quoting *Perkins v. State*, 77 S.W.3d 21, 24 (Mo. Ct. App. 2002))); *State v. Blue*, 565 S.E.2d 133, 139 (N.C. 2002) (noting that “under the defense of habitation, the defendant’s use of force, even deadly force, before being physically attacked would be justified to prevent the victim’s entry provided that the defendant’s apprehension that he was about to be subject to serious bodily harm or that the occupants of the home were about to be seriously harmed or killed was reasonable and further provided that the force used was not excessive”); *State v. Boyett*, 185 P.3d 355, 358 (N.M. 2008) (observing that defense of habitation “gives a person the right to use lethal force against an intruder when such force is necessary to prevent the commission of a felony in his or her home”).

<sup>42</sup> See generally 2 PAUL H. ROBINSON, CRIMINAL LAW DEFENSES § 142(e) (1984) (outlining the proportionality requirement for self-defense).

<sup>43</sup> See *id.*

from health care, banking, service work, and the military.<sup>44</sup> Robots increasingly assume tasks once performed by people. The job of truck driving, for instance, will almost certainly become obsolete when self-driving trucks appear on the highways.<sup>45</sup> While the idea of robots is not new, their ever-increasing capacity and autonomy is. The ability to process data with artificial intelligence *and* to react to it in the world pose difficult legal, policy, and ethical questions.<sup>46</sup>

And no one rivals the military in its investment in and growing use of robotics.<sup>47</sup> Air Force pilots in Syracuse, New York, fire missiles from Reaper drones flying in the Afghanistan skies.<sup>48</sup> Some 500 pilots launch missiles in Syria and Iraq from Predator drones while sitting in Air Force base trailers in Nevada.<sup>49</sup> Some of the same companies providing robotics to the military are also looking to the domestic policing market for potential customers.<sup>50</sup> Previously theoretical questions made headlines in July 2016, when the Dallas Police

---

<sup>44</sup> See Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513, 529-32, 538, 541-45, 555-58 (2015); see also SINGER, *supra* note 7, at 67-68.

<sup>45</sup> In December 2016, the White House released a report that predicted 1.3 to 1.7 million heavy and tractor-trailer truck driving jobs could disappear because of automation. See EXEC. OFFICE OF THE PRESIDENT, ARTIFICIAL INTELLIGENCE, AUTOMATION, AND THE ECONOMY 17 (2016), <https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF>; Alana Semuels, *When Robots Take Bad Jobs*, ATLANTIC (Feb. 27, 2017), <https://www.theatlantic.com/business/archive/2017/02/when-robots-take-bad-jobs/517953> (discussing that, while some human involvement may be required in the short term, traditional truck driving jobs will disappear).

<sup>46</sup> While there is no single definition of a robot, this definition has wide acceptance among those writing about robotics. See, e.g., SINGER, *supra* note 7, at 67 (using this definition); Calo, *supra* note 44, at 532. But see Adrienne LaFrance, *What Is a Robot?*, ATLANTIC (Mar. 22, 2016), <https://www.theatlantic.com/technology/archive/2016/03/what-is-a-human/473166> (observing that there is no clear consensus on defining a robot).

<sup>47</sup> See SINGER, *supra* note 7, at 423 (observing that “much of the funding for robotics research comes from the military”).

<sup>48</sup> Elisabeth Bumiller, *A Day Job Waiting for a Kill Shot a World Away*, N.Y. TIMES (July 29, 2012), <http://www.nytimes.com/2012/07/30/us/drone-pilots-waiting-for-a-kill-shot-7000-miles-away.html?smid=pl-share>.

<sup>49</sup> W.J. Hennigan, *Drone Pilots Go to War in the Nevada Desert, Staring at Video Screens*, L.A. TIMES (June 17, 2015, 3:00 AM), <http://www.latimes.com/nation/la-na-drone-pilots-20150617-story.html>.

<sup>50</sup> See, e.g., Patrick Tucker, *Military Robotics Makers See a Future for Armed Police Robots*, DEFENSE ONE (July 11, 2016), <http://www.defenseone.com/technology/2016/07/military-robotics-makers-see-future-armed-police-robots/129769> (“As military research pushes robotics prices down and Pentagon policies push battlefield gear to domestic law enforcement agencies, expect to see more armed robots on American streets.”).

Department attached a pound of plastic explosives to their bomb disposal robot in order to cause the death of Micah Johnson, who had already fatally shot five officers.<sup>51</sup> That incident, the first time the police had deployed a robot to kill a suspect, prompted questions about future uses of armed robots by police in similar situations.<sup>52</sup>

Outside of policing, some companies have already developed robots for private security use. One of the most prominent is Knightscope, which offers two 300 pound versions of its “Autonomous Data Machines.”<sup>53</sup> These dome-shaped physical security robots are autonomous, not remote controlled. These security robots possess features such as automatic license plate recognition, video collection, thermal imaging, and “people detection.”<sup>54</sup> Knightscope is also developing technologies for its robots to identify weapons and unusual activity.<sup>55</sup> In May of 2017, a Knightscope spokesperson stated that thirty of their security robots were in use by private clients.<sup>56</sup>

Another American robotics startup, Aptonomy, is developing and marketing a fleet of “self-flying” drones to “actively deter crime by establishing physical presence at the site.”<sup>57</sup> Aptonomy drones are

---

<sup>51</sup> See Andrea Peterson, *In an Apparent First, Dallas Police Used a Robot to Deliver Bomb that Killed Shooting Suspect*, WASH. POST (July 8, 2016), <https://www.washingtonpost.com/news/the-switch/wp/2016/07/08/dallas-police-used-a-robot-to-deliver-bomb-that-killed-shooting-suspect>; Kevin Sullivan et al., *Dallas Police Used a Robot to Kill. What Does That Mean for the Future of Police Robots?*, WASH. POST (July 21, 2016), [https://www.washingtonpost.com/national/dallas-police-used-a-robot-to-kill-what-does-that-mean-for-the-future-of-police-robots/2016/07/20/32ee114e-4a84-11e6-bdb9-701687974517\\_story.html?utm\\_term=.b2db66cbd9f4](https://www.washingtonpost.com/national/dallas-police-used-a-robot-to-kill-what-does-that-mean-for-the-future-of-police-robots/2016/07/20/32ee114e-4a84-11e6-bdb9-701687974517_story.html?utm_term=.b2db66cbd9f4).

<sup>52</sup> See Hennigan & Bennett, *supra* note 5 (quoting Ryan Calo as stating that robot use is “a creative solution to a very challenging problem”).

<sup>53</sup> Knightscope, Inc., Preliminary Offering Circular (Form 1-A) 12-13, 16 (Nov. 7, 2016), [https://www.sec.gov/Archives/edgar/data/1600983/000114420416131843/v451501\\_partiandiii.htm](https://www.sec.gov/Archives/edgar/data/1600983/000114420416131843/v451501_partiandiii.htm).

<sup>54</sup> *Id.* at 13.

<sup>55</sup> *Services*, KNIGHTSCOPE, <https://knightscope.com/services/> (last visited Oct. 24, 2017).

<sup>56</sup> Citing non-disclosure agreements, the spokesperson declined to state exactly where the robots were deployed. Trisha Thadani, *Knightscope Robot Bruised, but Startup Is Unbowed*, S.F. CHRON. (May 8, 2017, 6:00 AM), <http://www.sfchronicle.com/business/article/Knightscope-robot-bruised-but-startup-is-unbowed-11125658.php>. The robots, however, have been spotted at various places in California, including the Stanford Shopping Center, and the Uber parking lot in San Francisco. Curtis Silver, *Knightscope Security Robots Spotted on Uber Parking Lot and Mall Patrol*, FORBES (July 5, 2016, 3:55 PM), <https://www.forbes.com/sites/curtissilver/2016/07/05/uber-knightscope-security-robots/#3b4f5685d674>; Troy Wolverton, *Robot on Patrol at Stanford Shopping Center*, EAST BAY TIMES (May 27, 2016, 11:12 PM), <http://www.eastbaytimes.com/2016/05/27/robot-on-patrol-at-stanford-shopping-center>.

<sup>57</sup> *Interested in Joining Us?*, APTONOMY, <https://www.aptonomy.com/jobs/?rq=self->

equipped with “powerful onboard lights” and speakers designed to “engage with intruders.”<sup>58</sup> Should an Aptomomy drone encounter a person who should not be there, it should flash warning lights and deliver a prerecorded warning.<sup>59</sup> A human operator could then speak through the drone’s speakers if necessary.<sup>60</sup>

And just as self-driving cars may eliminate the job of truck driver, security robots may soon offer a practical and cheaper alternative to the job of human security guards. While some private security officers are involved in complex investigations and rival their public counterparts, many guards are low-wage workers in a largely under-regulated industry. While hiring off-duty police officers for private security work may cost about thirty-five dollars an hour, entry level guard jobs can start at twelve dollars an hour.<sup>61</sup> But robots are even cheaper.<sup>62</sup> Knightscope security robots can be rented for seven dollars an hour.<sup>63</sup> One highly cited 2013 study of automation identified “security guards” as a job with a high probability of being replaced by automation.<sup>64</sup> Security robot companies like Knightscope have already begun to introduce the idea. Its CEO William Li has stated that “those [security] jobs are miserable for a lot of folks.”<sup>65</sup>

---

flying%20security%20drones (last visited Oct. 24, 2017); *Robocop Lives: AI Security Guard Drone Flies Low, Fast, and Recharges*, RT (Aug. 23, 2016, 2:37 AM), <https://www.rt.com/usa/356794-security-guard-drone-ai>.

<sup>58</sup> *Tactical Aerial Security for Enterprises*, APTONOMY, <http://www.aptonomy.com> (last visited Sept. 15, 2017).

<sup>59</sup> Tom Simonite, *Drone Security Guard Scolds Intruders from the Sky*, MIT TECH. REV. (Sept. 20, 2016), <https://www.technologyreview.com/s/602412/drone-security-guard-scolds-intruders-from-the-sky>.

<sup>60</sup> *Id.*

<sup>61</sup> Shan Li, *Robots Are Becoming Security Guards. ‘Once It Gets Arms . . . It’ll Replace All of Us*, L.A. TIMES (Sept. 2, 2016, 3:00 AM), <http://www.latimes.com/business/la-fi-robots-retail-20160823-snap-story.html>.

<sup>62</sup> *See id.*

<sup>63</sup> *See* Knightscope, Inc., *supra* note 53, at 17.

<sup>64</sup> *See* CARL BENEDIKT FREY & MICHAEL A. OSBORNE, THE FUTURE OF EMPLOYMENT: HOW SUSCEPTIBLE ARE JOBS TO COMPUTERISATION? 57, 67 (2013), [http://www.oxfordmartin.ox.ac.uk/downloads/academic/The\\_Future\\_of\\_Employment.pdf](http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf) (ranking security guards at a 0.84 probability of computerisation with 1 being the most likely); *see also* Arwa Mahdawi, *What Jobs Will Still Be Around in 20 Years? Read This to Prepare Your Future*, GUARDIAN (June 26, 2017, 6:00 AM), <https://www.theguardian.com/us-news/2017/jun/26/jobs-future-automation-robots-skills-creative-health> (referring to the “Future of Employment” report as a “highly cited study” that found the jobs of telemarketers, tax preparers, and sports referees to be at risk).

<sup>65</sup> Nick Statt, *This Crime-Predicting Robot Aims to Patrol Our Streets by 2015*, CNET (Dec. 5, 2013, 11:30 AM), <https://www.cnet.com/news/this-crime-predicting-robot->

The mass marketing of private security robots would not only threaten to displace human guards. Wide availability of inexpensive and reliable security robots may create a market for individuals who never could have afforded a human guard at all, or may have felt uncomfortable hiring one. Moreover, while security robots may replace most of the kinds of human guarding that exist now, private security may in the short run require human operators to supervise many security robots at once. Thus the future of private security may not only look more robotic; its configurations may look quite different than they do now.

That future will almost certainly involve at least some armed autonomous private security robots. Security robots will harness two technologies already in development and use. The first will involve the increasing physical capabilities of robots. Robotics companies are already developing prototypes with human (running, lifting) and non-human (scaling walls, flying) capabilities.<sup>66</sup> For military and police robots, those physical capabilities may mean detaining suspects and defusing physical threats by lethal and non-lethal means.<sup>67</sup>

The second technology security robots will use is artificial intelligence. While the term has no single meaning, artificial intelligence generally refers to a set of techniques for machines involving algorithms<sup>68</sup> that approximate human thinking.<sup>69</sup> While the

---

aims-to-patrol-our-streets-by-2015.

<sup>66</sup> See, e.g., Kelsey D. Atherton, *Flying Robots 101: Everything You Need to Know About Drones*, POPULAR SCI. (Mar. 7, 2013), [https://www.popsci.com/technology/article/2013-03/drone-any-other-name-\(flying-robots\)](https://www.popsci.com/technology/article/2013-03/drone-any-other-name-(flying-robots)); Jacob Brogan, *Disney's Awesome New Robot Can Climb Walls*, SLATE (Dec. 29, 2015, 3:12 PM), [http://www.slate.com/blogs/future\\_tense/2015/12/29/disney\\_s\\_new\\_robot\\_vertigo\\_can\\_climb\\_walls\\_using\\_propellers.html](http://www.slate.com/blogs/future_tense/2015/12/29/disney_s_new_robot_vertigo_can_climb_walls_using_propellers.html) (climbing wall robot); Anthony Cuthbertson, *This Two-Legged Robot Can Run Without Thinking*, NEWSWEEK (May 3, 2017, 12:01 PM), <http://www.newsweek.com/two-legged-robot-can-run-without-thinking-593809> (running robot); Joseph Quinlan, *Investors Should Wake Up to Japan's Robotic Future*, FIN. TIMES (Sept. 24, 2017), <https://www.ft.com/content/2cff1dba-9f87-11e7-8cd4-932067fbf946> (lifting robot).

<sup>67</sup> See Elizabeth E. Joh, *Policing Police Robots*, 64 UCLA L. REV. DISCOURSE 516, 529-30 (2016) [hereinafter Joh, *Policing Police Robots*] (discussing possibilities for police robots).

<sup>68</sup> Algorithms are not new, although their capacities and their influence on people's lives has grown significantly. "An algorithm is a self-contained step-by-step set of operations that computers and other 'smart' devices carry out to perform calculation, data processing, and automated reasoning tasks." Press Release, Ass'n for Computing Mach., Statement on Algorithmic Transparency and Accountability (Jan. 12, 2017), [https://www.acm.org/binaries/content/assets/public-policy/2017\\_usacm\\_statement\\_algorithms.pdf](https://www.acm.org/binaries/content/assets/public-policy/2017_usacm_statement_algorithms.pdf).

<sup>69</sup> Ryan Calo defines it as "a set of techniques aimed at approximating some aspect

field of artificial intelligence goes back to the 1950s, its prominence today can be attributed to advances in computing power and the enormous amounts of digitized data now available.<sup>70</sup> Police departments around the country are already using artificial intelligence to predict locations where crime may occur and to identify people considered at high risk of becoming involved in or victimized by gun violence.<sup>71</sup> While these big data programs rely on police officers to implement their suggestions, a police or security robot could use such artificial intelligence for direct action.

Autonomous and semi-autonomous armed military robots already exist. Some police departments in the near future will surely adopt some of them, just as they have made use of other technologies originally designed for the military but ultimately adopted by local police.<sup>72</sup> No one has yet been killed by an armed autonomous security robot as part of its design.<sup>73</sup> But a remote-controlled police robot has been used to kill. At least one robotics company has already introduced a security robot with a shock prod intended for use in dispersing crowds.<sup>74</sup> And people have expressed concerns about robots being used by criminals and by private individuals in self-defense.<sup>75</sup>

---

of human or animal cognition using machines.” Ryan Calo, *Artificial Intelligence Policy: A Primer and Roadmap*, 51 UC DAVIS L. REV. 399, 404 (2017). See generally Elizabeth E. Joh, *Policing by Numbers: Big Data and the Fourth Amendment*, 89 WASH. L. REV. 35, 42-45 (2014) [hereinafter Joh, *Big Data Policing*] (discussing the application of artificial intelligence to predictive policing).

<sup>70</sup> See Calo, *supra* note 69, at 401-02.

<sup>71</sup> See Joh, *Big Data Policing*, *supra* note 69, at 42-49 (describing geographical predictive policing and social network analysis).

<sup>72</sup> See Joh, *Policing Police Robots*, *supra* note 67, at 528 (“What develops first in the military often finds its way to domestic policing.”).

<sup>73</sup> But robots have already accidentally killed and injured people. A Knightscope robot used to patrol a shopping center in Palo Alto, California, hit a child in the head and ran over him in 2016. Veronica Rocha, *Crime-Fighting Robot Hits, Rolls over Child at Silicon Valley Mall*, L.A. TIMES (July 14, 2016, 8:29 AM), <http://www.latimes.com/local/lanow/la-me-ln-crimefighting-robot-hurts-child-bay-area-20160713-snap-story.html>.

<sup>74</sup> The Chinese-designed Anbot can patrol autonomously and can engage in riot control by firing an electroshock weapon. See Jeffrey Lin & P.W. Singer, *China Debuts Anbot, the Police Robot*, POPULAR SCI. (Apr. 27, 2016), <http://www.popsci.com/china-debuts-anbot-police-robot>.

<sup>75</sup> Acting Superintendent Brad Wright of the Queensland, Australia, Police Department predicted that personal robots “will be used to protect Australian homes in the future.” See Tony Moore, *Robots Could Guard Private Homes in the Future: Senior Police*, BRISBANE TIMES (Aug. 20, 2017, 6:36 PM), <https://www.brisbanetimes.com.au/national/queensland/robots-could-guard-private-homes-in-the-future-senior-police-20170820-gy0aos.html>. Wright guessed that security robots “would happen as these things get cheaper and people may start thinking this way.” *Id.*

Just as regulators are trying to anticipate the problems of self-driving cars, it makes sense to consider the legal and policy challenges that private security robots will pose.

### III. THE CHALLENGE OF SECURITY ROBOTS FOR COURTS

Imagine the security robot of the future: autonomous, capable of identifying dangerous threats, and armed with lethal force. An educated guess: in the first civil or criminal case concerning a death caused by an armed security robot, the judge will likely be asked to decide whether such a security robot is analogous to a spring gun. The analogy is appealing. Both spring guns and security robots appear to be deadly machines. Both embody defensive self-help measures that do not require direct human presence. Whether that comparison is persuasive matters enormously. Recall that courts have generally disfavored the use of spring guns and other deadly traps. Defendants have faced prison and civil liability as a result.

The analogy likely will and should fail. The spring gun differs from the security robot because it is, quite literally, dumb. Many courts have made the general observation that the use of a spring gun is justified if the defendant could have used deadly force had he personally been present.<sup>76</sup> The ability to use deadly force generally depends on the defendant's reasonable beliefs. Yet a spring gun or other "mechanical device" "pretermits the existence [and] exercise of human discretion."<sup>77</sup>

What has troubled courts about spring guns is that they can kill without any reasoned assessment of a perceived threat. There is, of course, no perception at all. In 1974, the California Supreme Court observed that when a person is present, "there is always the possibility he will realize that deadly force is not necessary, but deadly mechanical devices *are without mercy or discretion*."<sup>78</sup> Unlike spring guns, people can determine the seriousness of the criminal activity

---

<sup>76</sup> See discussion *supra* Part II.

<sup>77</sup> *State v. Britt*, 510 So. 2d 670, 673-74 (La. Ct. App. 1987) (affirming defendant's manslaughter conviction for killing victim with spring gun).

<sup>78</sup> *People v. Ceballos*, 526 P.2d 241, 244 (Cal. 1974) (emphasis added). See generally Francis H. Bohlen & John J. Burns, *The Privilege to Protect Property by Dangerous Barriers and Mechanical Devices*, 35 YALE L.J. 525, 529 (1926) (observing that "the action of such devices differ from that of a human guardian in that they are incapable of gauging the exact amount of force which it is permissible to apply to the various classes of trespassers who may intrude, and in that they cannot give the warning to desist from the intrusion which a human being is generally required to give immediately before acting").

they encounter on their property; an attempted home arson may justify deadly force, but a theft of a chicken will not.<sup>79</sup> Security robots of the future will simply be unlike spring guns. Whatever form they assume, none will be as crude as an eighteenth-century spring gun so as to be “absolutely incapable of exercising discretion.”<sup>80</sup>

Perhaps more likely — and more difficult — would be a determination that an armed autonomous security robot is similar enough to a person that its killing or wounding of an intruder perceived to be dangerous may be considered reasonable, and thus justifiable. A judge might conclude, for example, that the use of a security robot which made a determination to apply deadly force could embody a reasonable exercise of self-defense by the person protected. That in turn could mean that a death in these circumstances would not lead to a conviction or a civil judgment against the person protected by the robot.

The potential to conclude that security robots might fall within the scope of traditional rules about the use of deadly force may be appealing. Think of the issue in this context. Would an armed and artificially intelligent security robot be preferable to George Zimmerman? A Florida neighborhood watch volunteer, Zimmerman shot and killed an unarmed teenager, Trayvon Martin, in 2012.<sup>81</sup> He was acquitted of second-degree murder.<sup>82</sup> Although Zimmerman claimed he had acted in self-defense, some commentators understood the case as one more example of racial profiling turned deadly.<sup>83</sup> The acquittal sparked national attention and criticism. By contrast, a robot that would not be racist, fearful, or hot-tempered would be appealing.

A closer look, however, reveals that courts should be wary of making hasty decisions about the reasonability of armed security robots. As the emerging literature on algorithmic accountability and

---

<sup>79</sup> See, e.g., *State v. Plumlee*, 149 So. 425, 429 (La. 1933) (affirming defendant’s manslaughter conviction for killing victim who attempted to steal chickens with a spring gun).

<sup>80</sup> *Falco v. State*, 407 So. 2d 203, 208-09 (Fla. 1981) (affirming defendant’s manslaughter conviction for killing victim with a spring gun for attempting burglary).

<sup>81</sup> Lizette Alvarez & Cara Buckley, *Zimmerman Is Acquitted in Trayvon Martin Killing*, N.Y. TIMES (July 13, 2013), <http://www.nytimes.com/2013/07/14/us/george-zimmerman-verdict-trayvon-martin.html?mcubz=3>.

<sup>82</sup> *Id.* (“In finding him not guilty of murder or manslaughter, the jury agreed that Mr. Zimmerman could have been justified in shooting Mr. Martin because he feared great bodily harm or death.”).

<sup>83</sup> See, e.g., Ekow N. Yankah, *The Truth About Trayvon*, N.Y. TIMES (July 15, 2013), <http://www.nytimes.com/2013/07/16/opinion/the-truth-about-trayvon.html> (“Every step Mr. Martin took toward the end of his too-short life was defined by his race.”).

robotics has already shown, there are good reasons to be concerned about the increasing role algorithms have in important decisions affecting our lives.<sup>84</sup>

By taking into account factors raised by automated decision-making more generally, courts can identify and respond to concerns that span many different technology issues, rather than being technology-specific. These concerns include: (1) the algorithm's design; (2) algorithmic transparency; and (3) design of the robot itself.

The first issue concerns itself with how a robot would identify threats worth attention and even physical response. This can be divided further into a series of questions. What is the objective of the algorithm? A deadly threat is a legal term of art capable of many interpretations, rather than a scientific determination. Much depends, then, upon how particular engineers define the objective of what constitutes a deadly threat. What does the algorithm of a security robot consider, weigh, and ignore in a deadly threat analysis? Does it use facial recognition technology linked to public records, factor in crowdsourced reporting from the neighborhood, or something else?<sup>85</sup> Finally, which data is incorporated into the algorithm, and how much does that "raw" data itself reflect human judgements and biases?<sup>86</sup>

This leads to the second issue: transparency. Such questions can only be answered if the plaintiff or the prosecutor has access to the algorithm relied upon by the security robots — information that will be within the possession of the company, not the defendant. We know already that in cases where technologies like DNA analysis and cellphone surveillance played a key role, the companies whose products have been challenged by defendants have refused to divulge their details.<sup>87</sup> Whether because of prior non-disclosure agreements or

---

<sup>84</sup> See, e.g., Nicholas Diakopoulos & Sorelle Friedler, *How to Hold Algorithms Accountable*, MIT TECH. REV. (Nov. 17, 2016), <https://www.technologyreview.com/s/602933/how-to-hold-algorithms-accountable> ("Indeed, there is growing awareness that the public should be wary of the societal risks posed by over-reliance on these systems and work to hold them accountable.").

<sup>85</sup> Knightscope's founder envisioned a future where security robots would be connected to a centralized server, "making it possible to recognize faces, license plates and other suspicious anomalies." John Markoff, *A Night Watchman with Wheels?*, N.Y. TIMES (Nov. 29, 2013), <https://nyti.ms/2wWCuwD>.

<sup>86</sup> For an extended discussion of the problems raised by data employed for crime prediction algorithms, see Elizabeth E. Joh, *Feeding the Machine: Policing, Crime Data, & Algorithms*, WM. & MARY BILL RTS. J. (forthcoming 2017) (manuscript at 4-9), <https://ssrn.com/abstract=3020259>.

<sup>87</sup> See Elizabeth E. Joh, *The Undue Influence of Surveillance Technology Companies on Policing*, N.Y.U. L. REV. ONLINE (forthcoming 2017) (manuscript at 5-8) (on file with author) (collecting examples).

by invoking trade secrets protection, these companies have thwarted attempts by defendants and courts to find out how their products work. In the case of security robots, the situation is surely more difficult. Companies engineering the algorithms for private security robots have no obligations at all under state public records laws;<sup>88</sup> they are providing a private service to private clients. Without access, however, we cannot know whether the algorithm used by a robot might be reliable in its ability to assess threats, or equally troubling, produce results with noticeable racial biases.<sup>89</sup>

These concerns about automated decision-making pose especially difficult questions because security robots can translate these analyses into action. Courts should therefore consider a third factor: how design choices about robots factor into considerations of self-defense. If developments in military robots are indicative, then security robot manufacturers may respond to concerns about armed robots by incorporating a human “in the loop.”<sup>90</sup> The Department of Defense has adopted this self-imposed limit to address concerns about “killer robots” that might decide on their own to kill.<sup>91</sup> So too may private companies decide their robots cannot make a final decision about acting on a threat. That oversight might be accomplished remotely by a private security operator, or by the decision of the person protected by the robot.

But as robotics researchers have pointed out, the “human in the loop” limitation is misleading. Asking a person to assess, and then veto or approve a split-second decision made by a machine whose

---

<sup>88</sup> See, e.g., CAL. GOV'T CODE § 6253 (2017) (noting that “public records” are generally subject to disclosure).

<sup>89</sup> In an extensive analysis, ProPublica journalists checked a widely used sentencing algorithm and found that not only was the algorithm “remarkably unreliable,” it also showed significant and unexplained racial disparities in sentencing recommendations. See Julia Angwin et al., *Machine Bias*, PROPUBLICA (May 23, 2016), <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>.

<sup>90</sup> See Joh, *Policing Police Robots*, *supra* note 67, at 530-31 (discussing the human “in the loop” problem that will arise with police robots).

<sup>91</sup> See Tom Simonite, *Sorry, Banning ‘Killer Robots’ Just Isn’t Practical*, WIRED (Aug. 22, 2017, 11:46 AM), <https://www.wired.com/story/sorry-banning-killer-robots-just-isnt-practical> (observing that Department of Defense has a policy to keep a “human in the loop”). That policy can be found in Directive 3000.09, which states that “It is DoD policy that . . . [a]utonomous and semi-autonomous weapon systems shall be designed to allow commanders and operators to exercise appropriate levels of human judgement over the use of force.” See Press Release, Dep’t of Def., Directive 3000.09: Autonomy in Weapons Systems (Nov. 21, 2012), <https://www.hsdl.org/?abstract&did=726163>.

logic may not be immediately clear may not be practicable.<sup>92</sup> And in outsourcing the judgment of a threat to a machine, we may have traded the personal, reasonable fear of a human for a black box decision about algorithmic threats.

None of these factors lead to easy resolutions, but they highlight two issues. First, the spring gun analogy should not be adopted, as it ignores key issues about technology, responsibility, and transparency that will arise with security robots. Second, courts should address these issues directly. Courts are certainly capable of incorporating technological complexity into legal decisions. Courts have issued rulings on technological matters such as application programming interfaces (“APIs”)<sup>93</sup> and the use of network investigative techniques (“NITs”).<sup>94</sup> How courts will initially characterize and understand the first security robot cases matters; they will shape the legal debate for them, for better or worse.

#### CONCLUSION

The likely future of robots used for private security purposes will inevitably lead to some tragic cases. Someone will be seriously harmed or even killed as a result of a robot whose primary purpose is to provide safety and security for its owner or client. A court asked to decide who is responsible in such a case will have to characterize that robot’s actions.

The understandable temptation to analogize a security robot to a spring gun should be rejected. Spring guns are machines without discrimination or discretion, and thus provide little analytical help in thinking about machines equipped with artificial intelligence and perhaps with weapons.

---

<sup>92</sup> See, e.g., SINGER, *supra* note 7, at 75, 126-28 (discussing impracticability of waiting for human response for semi-autonomous weapons).

<sup>93</sup> After a much followed case involving APIs and copyright, U.S. District Court Judge William Alsup was praised repeatedly for mastery of the complex underlying technological issues. See Dan Farber, *Judge William Alsup: Master of the Court and Java*, CNET (May 31, 2012, 6:03 PM), <https://www.cnet.com/news/judge-william-alsup-master-of-the-court-and-java>. The Federal Circuit reversed Judge Alsup’s decision, however, that APIs were not subject to copyright. *Oracle v. Google*, 750 F.3d 1339, 1348 (Fed. Cir. 2014).

<sup>94</sup> A number of federal judges have been called upon to issue decisions regarding the FBI’s use of a NIT — also known as malware or a Remote Access Tool (“RAT”) — to take over a Tor hidden service website. See Andrew Crocker, *With Remote Hacking, the Government’s Particularity Problem Isn’t Going Away*, JUST SECURITY (June 2, 2016, 9:55 AM), <https://www.justsecurity.org/31365/remote-hacking-governments-particularity-problem-isnt> (discussing NIT cases).

Instead, if a security robot causes death or serious injury as part of its design, courts should ask questions about how its artificial intelligence identified and responded to the perceived threat. A recognition, for instance, that the algorithm used by a robot to identify a threat might reflect human biases would in turn disabuse courts that such decisions are wholly objective. Indeed, decisions about deadly security robots may help inform broader discussions about automated decision-making that will arise in other fields.

There may indeed be improvements in efficiency and safety if robots become embedded in our everyday lives as security guards. But the substitution of machines for people will invite new questions that may not lend themselves to existing analogies.