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BioRobotics: Surveillance and the automation of biological life

Felicity Amaya Schaeffer
UCSC
fsg@ucsc.edu

Abstract

New developments in state surveillance technologies and Biorobotics at Harvard University turn to nature, such as bees, with the goal of automating border control, labor, and to fill the vacuum of disappeared pollinating bees. The turn to insects for use in Automated Intelligence (AI) relies on a racialized understanding of biology, and the body rather than the brain, as the mechanism for automated intelligence with consequences for revitalizing binary notions of primitive from rational intelligence, stripping humans as well as the historical and social context from the violent causes and consequences of border governance, automated labor, and ecological disaster.

In my broader book project, "*Tracking Indigenous and Latinx Migrants: Bio-surveillance across Sacred Borders*," I propose that the enforcement of border control aimed at migrants has intensified, leading to the expansion of what I call a border-biosecurity industrial complex. Science and technology have become *the* solution to border control and security,

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necessitating university, military and state research and funding loops back into the Science Technology Engineering and Mathematics (STEM) fields as well as defense technology markets driven by war. To win this war, the government must identify and eradicate a host of threats: abnormal biology (biometrics); suspicious objects; and nuclear, chemical and viral threats. I refer to biosecurity to call attention to the automated detection of "suspect life." The body's biometric data, that is to say, the automated and precognitive physiognomy (e.g., heart-rate, eye movements) and the gait signatures of the body have become more authentic terrain to determine safe (white) versus threatening populations (non-white). Stripping human-insect physiognomy and behavior from individual intention or agency is where the racial consequences of biometric technologies turn, especially as the governance of security relies more heavily on biological sciences to govern life at the borders.

Today governing institutions track not just (demographic) populations with predictable patterns of life and death but also the suspect biomass, a concept produced at the intersection of the life sciences and rapid computational algorithms that view risky or suspect life as automated matter that can be known in advance of deviant acts. As the life sciences meet Artificial Intelligence (AI), intelligent design and consciousness find the body's behavioral movements as an intelligent pathway to coordinated action (rather than the brain), alienating the active properties of the body-as-matter (biomass) from human intelligence, intention, will, and agency. Colonial binaries continue as racial otherness is relegated to a natural or evolutionary force automating the "erratic" body's biological movements in need of control by whiteness, or the invisible hand of a techno future heralded by its ability to control nature.

The automation of the body-as-lively matter turns suspect bodies into a primitive biology motivated by natural forces such as instinct, emotions, and the collective. Scientists during the nineteenth century revered dead body parts, such as skulls, as empirical proof of hierarchies of primitive versus civilized and especially mental difference that would provide clues to unlock the past. Anthropologist Marcello Levi Bianchini

(1906), developed a kinesiological biotypology of race that separated "primitive" from "advanced" races. He states, "In primitive societies all the affective reactions of the individual and collective psyche are essentially manifested by phenomena of movement ...." (Pugliese, 2010, p. 84). For Bianchini, primitive societies displayed a wider range of motor expressions (or affect) than the more evolved societies. Even earlier, the French doctor and early scientist of film, Félix Regnault (1898) thought those he called savages had no language, and instead spoke through the language of the body and that their "savage locomotion" was closer to nature, or untouched by cultural influences (p. 315).

Today the terrorist supposedly follows behavioral "laws of nature" that resemble automated life, or mechanization, offering science visible and predictable patterns of movement. As found by Joseph Pugliese (2010) in a statement by the International Association of Chiefs of Police (IACP), suicide bombers display "an unusual gait, especially a robotic walk. This could indicate someone forcing or willing himself or herself to go through a mission" (p. 88). Important to note here is the idea that suspicious gait turns the body itself into a primitive weapon since it is controlled by a force larger than the self-determined individual. While an extreme example, a suspect biomass refers to a body tethered to its web of connections (what the military calls a "pattern of life"), a mass not driven by individual rationality, the brain, or self, but dangerously susceptible to the "higher call" of religion, biology, instinct, and the collective. Thus, the suspect biomass, (i.e., flesh stripped of human intelligence) meets the turn to "nature," or insects for inspiration on how to detect human scent or chemical traces in cargo and as a model to replace the automated movements of racial labor.

The assumption that we can know and see difference in the body re-packages a settler/colonial logic driven by what Sylvia Wynter (2003) details as the shift in genres during colonization from the Supernatural (religious law) to the Natural (laws of nature). With the dominance of the natural sciences in definitions of the human from the nineteenth century to today, secular science, mathematics and logic defined and tracked

human life in ways that conflated evolutionary notions of racial selection (i.e., white rationality at the apex of the species) and dysselection (i..e., racial primitivity at the bottom) with the invisible hand of the market. It is the racial consequences of the invisible hand of automated life (biology) that I explore in the rest of the paper.

BioRobotics, border governance, and war technologies center biology and life sciences as part of the core sciences that drive the "innovative" strategies in national security. As stated by the director of Defense Advanced Research Projects Agency (DARPA), "Today and in the years ahead, our potential adversaries will still include nation states, but also smaller, less well defined bad actors and an increasingly networked terror threat." To get at the smaller nature of threat, he continues, "biology is nature's ultimate innovator, and any agency that hangs its hat on innovation would be foolish not to look to this master of networked complexity for inspiration and solutions" (Prabhakar, 2014).

DARPA, the Department of Homeland Security (DHS), and Harvard researchers seek to know what animates the mysterious movements of insects in order to mobilize this intelligence for border security. For instance, DARPA and scientists at Los Alamos have been studying bee sensing of chemical and nuclear traces since 2005 in hopes of launching bees to detect bombs, narcotics, biological threats, and migrants at various land, sea, and transit borders. In a video called, *Los Alamos National Laboratory: The Stealthy Insect Sensor Project*, they state: "honeybees are nature's rugged robots." Given bees' powerful odor sensors, "honey bees are one of nature's most sensitive detection platforms" (2008).

Scholars in postcolonial ecology, science studies, and feminist materialism question the separation of nature from human intervention to interrogate how insects, animals, and the natural world become altered through human-environmental influences. These scholars trespass segregated epistemologies in the academy that separate the natural sciences from the human and social sciences, and nature from culture. For example, Jake Kosek (2010) argues that it is not enough to ask what

is happening to honey bees, but demands we look at the reengineering of human/bee environments, biology, and behaviors throughout the US empire or during years of military use in battle, intelligence, and testing. Some material feminist scholars also repudiate the notion of an autonomous, self-sovereign human by reclaiming a more entangled notion of the human in the name of saving the earth. Yet, indigenous world views that have long thought the intrarelated ontologies of the human-animal-spirit world are often absent (Schaeffer 2018). I question the overlap of some materialist accounts with state science that, in a vital materialist turn to automated life, reinforce racial colonial divides between primitive and civilized science, labor, and ontologies.

Researchers in BioRobotics at Harvard University are currently developing "softer, smaller and smarter robotics," attempting to get at more sensual, even organic relations between nature, humans, and robots. They hope to build robots that are less mechanistic and more organic, and to detour AI from the brain to embodied communication between the robots themselves and the environment. In 2009, Radhika Nagpal developed the controversial Robobee Project (with Obama funding) to build a robotic pollinating bee that would temporarily replace the loss of 50% of bee hives between 1950 and 2006. Many teams today hope to build bee swarms called Kilobots across a range of uses including border surveillance and war, search and rescue missions, and as a future labor force that can build, not hives, but actual buildings.

Nagpal situates the rise of BioRobotics at the intersection of computer science (AI/Robotics) and biology. If Robotics asks what makes things work intelligently in the world, the field of biology offers, she argues, the best example of autonomous systems. The push in AI to build robots that can act on their own behalf, without the constant direction of human operators, turns biology, and nature, into an ideal system to emulate with the goal of producing robot swarms that are "self-organizing," an automated mass that relies on sensory intelligence to make collective decisions. Cellular biology offers similar inspiration in computer science such as in the field of Amorphous Computing, which

looks to biology and physics to structure distributed computers that network across a mass scale (McNally 2015, 2:37). By looking to cellular biology, they analyze how cells, miniscule parts of life, work together with millions of other cells to sustain the body's life form. And while AI has predominantly debated whether consciousness, as a mental faculty, could translate to robots, Nagpal and her associates want to think computation and intelligence beyond the brain and beyond the individual. Similar to the parts of the body that work in concert to get us up a steep hill, even though we may not be conscious of each body part's role in the act, each ant, bee, or termite is imagined to be a part, or cog that has insignificant power without the collective working together as a team. As Nagpal states during an online interview, "the brain is really the colony, no individual in the colony actually has the full picture. The full picture is distributed over these many, many minds" (2015, 8:11).

Nagpal's team has left the lab to trek their way to Namibia to observe and study termites. Along with other scientists, they investigate massive termite mounds, as well as bee and ant colonies, to think about decentralized computing algorithms. In an unsurprising move, nature's collective, democratic, and autonomous structures drive the revolutionary language of BioRobotics. Nagpal states,

> termites are a classic system where people have studied decentralized cooperation or implicit cooperation. The idea is that with termites, there's definitely no supervisor who's telling them what to do, there isn't even some sort of hierarchy. Instead there's sort of these chance encounters where information is propagating, but there's also just encounters with the environment (2015, 8:11).

Rather than see robots at the mercy of fascist humans in control, automation here becomes part of the natural system that proceeds not through individual intention, or a pre-determined goal or plan of action. In fact, rather than locate consciousness in the brain or as an outside (divine/sovereign) force, a colony of insects feels, senses, and acts consciously through their bodies, in relation to each other and to changes in the environment. Nagpal is clearly influenced by Rodney Brooks's AI

research during the 1980s which argued that behavior-based robots (rather than human intelligence) offer a simple, or primitive intelligence in which behavior does not respond to a central brain that plans out actions in advance; instead, the body moves in response to the environment through non-hierarchical sensor signals (1999, pp. 138-9). While there is potential for disrupting the centrality of rationality and the human brain as the apex of consciousness, the racial imaginary driving the research, development, and use of this technology suggests otherwise.

Nagpal's team developed what they called, "TERMES" in 2014, a robotic construction crew that can assemble blocks into 3D structures "without any human intervention; no foreman, no central brain" (2015, 30:30). One day they will scale up to a thousand tiny robots, or Kilobots. In a TED Talk podcast "Taming the Swarm: Collective Artificial Intelligence (2016)," Nagpal moves from a discussion of termites (that build massive structures without talking to each other) to a construction site. In her TED Talk, our gaze is directed to a large screen behind her depicting dark shadowy human bodies taking a break at a construction site. Consistent with Harvard's promotion of a softer robotic model that will replace massive, clunky robotics, here too, the tiny and lightweight Kilobots are cheaper and more tasteful robotic accomplices. It is clear that the "robotic construction crew" will replace precarious workers (perhaps migrant laborers, or Mohawk ironworkers) on the job site, workers who sit perched high up on dangerous high-rise buildings, who get tired and hungry and take breaks, and who labor at the bottom of a hierarchical labor structure, beneath the white-collar owners and creative/intellectual class (Atanasoski and Vora 2015). Not only will kilobots remove dangerous, even exploitative, labor conditions, the thousands of tiny robots will learn how build without the need for human intervention (and salaries).

Not only are "low skilled" workers absented from the job site, thousands of fast-building kilobots enter the scene as quietly and efficiently as cells building the body and as a force of nature itself, an unremarkable presence in human perception. Kilobots are the next phase

of a mechanized labor force whose invisibility and exploitation resemble the work of racialized laborers, the shadowy silhouettes who haunt this evolutionary scene where time automatically evolves to the inevitable tempo of a future when more efficient and less exploitative bio-bots will replace human laborers. Nature's demoted status as an automated, unintentional mass here becomes ideal for manipulation and replacement, especially as these movements are imagined without the aid of human intelligence. The title of Nagpal's talk, "Taming the Swarm," offers a clue as to how absenting humans from the forces of the natural world (evolution), and from the invention of bio-robotics, hides from view the logic of whiteness as an ever-present force that must control the chaotic threat of nature's unwieldy evolutionary design with a tame replacement. Kilobots (1,000 robots) become an even stronger, and more docile breed, so cheap to produce they are easily replaced.

Nagpal asks, "So the field of engineered self-assembly is basically — How do we make the molecules or the robots or the cells to self-assemble the thing we want, as opposed to the thing that they're naturally going to do?" (2015, 27:55). And ironically, the swarm concept driving the Kilobots is depicted as a militarized force of nature, a docile army of insects ready to mobilize at any moment. This fascist visual iconography ironically shares interpretive logic with the democratic lure of bee colonies that drive researchers to reproduce bee and wasp swarms that can be tamed and controlled, unlike the potential threat of mass human laborers whose likelihood of revolt grows as they increase in numbers, or when they become a self-organizing mass that evolves into an intelligent or even rebellious swarm.

The question guiding this cross-disciplinary research is: How do these little creatures coordinate when no one individual is in charge? This question of how insects determine their behavior is one scientists in other life sciences obsess about, such as how birds know when and where to migrate or, in physics, how snowflakes form. In her recent book, *Biocultural Creatures*, Samantha Frost asks a similar question about how proteins affect cells: "Given we do not impute intention or self-conscious

deliberation to proteins, how can we account for the ingenuity, the precise coordination, and the efficiency of their actions?" (2016, p. 79). She argues that each act is done so that the next may be done — purposively or with a reason. But she struggled with this thesis because she thought, how absurd, molecules do not have reason and they do not intend what they do. Through such astonishment she said, "I realized that, in spite of my theoretical training, I had a theological hangover, which is to say that I could not figure out how such processes could be possible without someone, somewhere, knowing what to do" (80)." Frost's resistance to theorizing matter as having its own logic and reason was held hostage to a lingering belief in God, or an outside totalizing force directing all life, that remains separate or above the material world. Religious and spiritual beliefs must be banished, relegated to a primitive past and segregated from matter in order to engage in feminist science that views matter as self-directed, sovereign and with its own rationality. The process of how one sees proteins, through technological visioning, as matter with a distinctive intention and trajectory, naturalizes a secular Western view of life. Alienating life to its molecular scale shares conceptual space with state surveillance technologies that differentiate dangerous from safe border crossers by scanning bodies with sensors that compute unconscious physiological data such as heart rate and eye twitches. The state's reliance on the body's biological signatures to speak the truth of who we are and what we will do in the future increasingly trump human narration and testimony (Schaeffer, forthcoming).

Within BioRobotics, the life force of matter is segregated from humans. This alienation of material spheres preserves categorical divides between matter, animal, human reason, and the secular from the intra-connected spirit force that materializes constantly changing forms across the environment-insect-animal-human. Turning to robotic insects to revolutionize and naturalize security imagines a world in which technological objects can outpace human intelligence and replace nature itself. Replacing diverse bee species with Robo-bees steers us away from

industrial agricultural practices that overwork and contaminate the pollinating bees on which we depend. In addition, by positing biology as an automated biomass, how might the biological stand in once again as the primitive racial other stripped of human intention, agency, and intelligence while humans disappear from the scene of racially motivated violence? In other words, might the current turn to automated biology in BioRobotics, surveillance, and mechanized labor reinforce a racial logic of nature as an unknowable and threatening evolutionary force in need of white containment?

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Bio

Felicity Amaya Schaeffer is an Associate Professor and Chair of the Feminist Studies Department at UC Santa Cruz. Her book, *Love and Empire: Cybermarriage and Citizenship Across the Americas*, was published in 2013 with NYU Press. She is working on a new project called *Tracking Indigenous and Latinx Migrants: Bio-surveillance across Sacred Borders* that follows the entangled histories of indigenous, migrant, and U.S. techno-sovereignty that continues to erupt in surveillance practices along the U.S.-Mexico borders and beyond. She has published articles in a variety of international journals in Mexico, France, and Brazil as well as U.S. journals such as *Signs: Journal of Women in Culture and Society, American Quarterly, and Sexualities*.