Yeawon Kim: MFA Candidate 2018
Art Center College of Design

Insectile indices: Los Angeles, 2027

Abstract
Insectile Indices is speculative design project that considers how electronically augmented insects could be trainable to act as sophisticated sensors, working in groups, as part of a neighborhood policing initiative in the city of Los Angeles, year 2027. The project is partly an investigation into the ethics of this controversial idea, but also an aesthetic exploration of such a deliberate alteration to a wildlife ecosystem.

In 2007, the Defense Advanced Research Projects Agency (DARPA) asked American scientists to submit proposals to develop technology to create insect-cyborgs. Building off this frightening initiative, this project inverts the sinister military connotation of this proposed future and imagines instead an aesthetically pleasing utopia where sensored insects work towards the public good of humanity. Insectile indices also plays with the idea of aesthetics in our techno-futures: if these sensored insects are approachable and pleasing to the eye, are we more apt to silently "turn the cheek" to more pervasive surveillance?

As a result, this project is partly an investigation into the ethics of this controversial idea, but also an aesthetic exploration of such a deliberate alteration to a wildlife ecosystem.

Speculative Scenario: Los Angeles, 2027
Nowadays, we can easily encounter beautiful cyborg moths in the city of Los Angeles, secretly surveilling our daily life. Initially, research in this area was limited to robots being created to imitate insect behavior, and technology was further developed to manipulate the bodies of insects for surveilling humans. There are numerous reasons to use insects to monitor humans – namely, because of an insect's high sensitivity to smell, ease in which their DNA can be modified and programmed, and their power and ability to swarm in great numbers. Designers and scientists that engage in this field believe that the insect itself is the most guaranteed source of innovation for surveillance as a result of nature's billion years of evolution, as insects contain a gigantic breadth of evolutionary experience of solving problems in both artificial and natural ecosystems. Also, it is more efficient and sustainable to grow insect bodies for mass production, rather than making robots which require expensive materials.

Background
As mentioned above, in 2007, DARPA asked American scientists to submit "proposals to develop technology to create insect-cyborgs". The United States military had been hoping to develop "micro air vehicles" – ultra-small flying robots capable of performing surveillance in dangerous territories. To that end, Cornell University researchers were successful in implanting electronic circuit probes into tobacco hornworms as early as in the pupae growth stage. Specifically, the hornworms passed through the chrysalis stage to mature into moths whose muscles can be controlled with the implanted electronics. Various insect species such as dragonflies, beetles, cockroaches and crickets were used for Cornell's research in creating the cybernetic organism. The lifespan of the resulting "cybug" also increased through converting heat and mechanical energy that the insects naturally generated.

Twenty years after this research, this technology trickled down to everyday life in the city of Los Angeles. Cybug farms are prevalent in the suburbs of Los Angeles, and produce up to 70 million cybugs a year. Artificial intelligence manages the quality control of these cybug breeds – for example, ensuring caterpillars suitable for surveillance and supporting the successful metamorphosis of these insects to create healthy cybugs. Full grown moth

cybugs are freshly stored at special designed vehicles in low temperatures, and are safely transported to the Cybug Hotel in Los Angeles. Cybug gardeners also supervise the process of cultivating cybugs.

Jobs

The cybug infrastructure has created numerous jobs, such as the cybug gardener, analyst and collector.

The Species

There are three different electronically augmented moth species that are located at the Cybug Hotel: the Hyalophora Cecropia moth, the Antheraea Polyphemus moth and the Lunar moth.

The Hyalophora Cecropia moth, which is a blue colored moth, gathers audio from the Los Angeles urban landscape, secretly listening or recording your voice or mechanical sounds implying problems occurring in Los Angeles. The species has been used for gathering sound data, such as conversations in intimate urban spaces such as elevators, alleys or homes to detect suspicious dialogue. While this moth used to be found as far west as the Rocky Mountains and as far north as many Canadian provinces, it is largely produced in Cybug farms for human surveillance purposes. The larvae of these moths were most commonly found on maple trees, but is now difficult to find in the wild due to the prevalence of cybug farms.

Antheraea Polyphemus, the red moth species, is used to catch images and track movement in everyday life – much like that of a CCTV camera. But, the cybug is more effective in this regard as it is well camouflaged in a city landscape as compared to a CCTV. This type of month was widespread in continental North America, with local populations found throughout subarctic Canada and the United States. But, like the Hyalophora Cecropia moth, it is now largely produced in cybug farms.

And finally, the green Lunar moth detects suspicious odors. This moth is commonly used for investigating chemical compounds such as explosives, drugs and weapons, rather than its historical and evolutionary use to detect pheromones and other attractants in flowers. Lunar moths are also known for their ability to effectively swarm when needed and, as such, can effectively perceive suspicious chemical odors to help people quickly notice danger and escape from a dangerous situation.

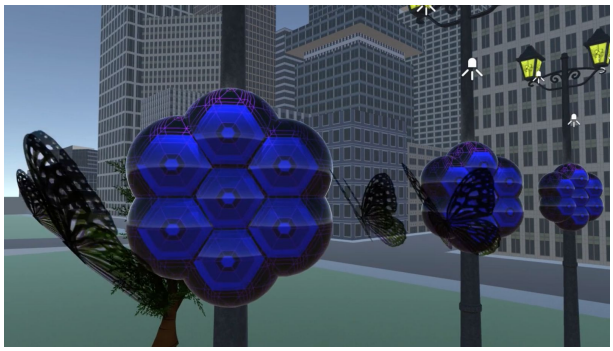
Most mature moths in wildlife can live around one to two weeks, but the genetically modified cybugs can live up to one month with proper electrical energies controlling the body. It has been controversial to categorize the cybug as a robot or an insect because of their lack of freedom to fly around nature. When the cybug eventually dies, microprobes that were initially inserted in the body are then recycled upon death for future use at the Cybug farm.

Cybug Hotel

The Cybug Hotel is the hub that manages the city infrastructure. It analyzes data foraged by the cybug insects and can control their movements. All the data gathered from cybugs are stored as memory by the Cybug Hotel. And, the Cybug Hotel sends feedback to operate urban infrastructures such as street lights, mass transportation, and the police. As a result, every system in the city infrastructure is interconnected because of the actions of the cybugs.

Based on the data gathered from the cybugs, the Cybug Hotel system analyzes the pattern of events in the city and determines the optimal route and method for the cybugs to investigate neighborhoods. The interaction between different moth cybugs and Cybug Hotel is based on electric signals that help cybugs react rapidly on the constant change, stream and influx of data.

A cybug rotates back to the Cybug Hotel every four to six hours to recharge its energy and to report data to the Cybug Hotel's artificial intelligence system.



Swarm Behavior

The cybugs swarm based on received data to inform of dangers and prevent crimes. There are three commonly known cybug group swarm behaviors - trap building, flocking and synchronization, all of which are learned from the evolutionary group patterns of other wild insects and animals.

Trap building behavior is derived from the Amazonian ant species Allomerus Decemarticulatus. The trap resembles a honeycomb, but works like a web. After building the honeycomb-like structure, the cybug secretly waits for a suspicious individual, and then traps them by swarming. Flocking behavior is emulated from bird migration patterns, which improves the Cybugs efficiency of flying from one spot to another. Finally, synchronization behavior, which is derived from the fireflies' bioluminescence during mating season, allows the cybugs to be released into the urban infrastructure with the necessary synchronized data from the Cybug Hotel to complete its mission and achieve its objectives.