The Heartbeat of a Beehive

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One sunny July morning I noticed a swarm of bees were making a home in my garage wall.

My grandfather and father were both beekeepers, so I asked my dad what he thought about urban beekeeping. He didn't think it should be done.

So with the added encouragement of proving my dad wrong, my friend Jon and I borrowed some bee suits from a friend, and proceeded to relocate the bees into a beehive I'd also borrowed, and balanced on a cooler on a ladder…

20,000 stinging insects and a ladder, what could possibly go wrong dad?

Fortunately for the bees and my neighbors, the bees happily came with us and took to their new spot.

Wearing a bee suit is a lot of fun - it’s all your childhood dreams at once - you’re halfway between feeling like an astronaut… and a ghostbuster.

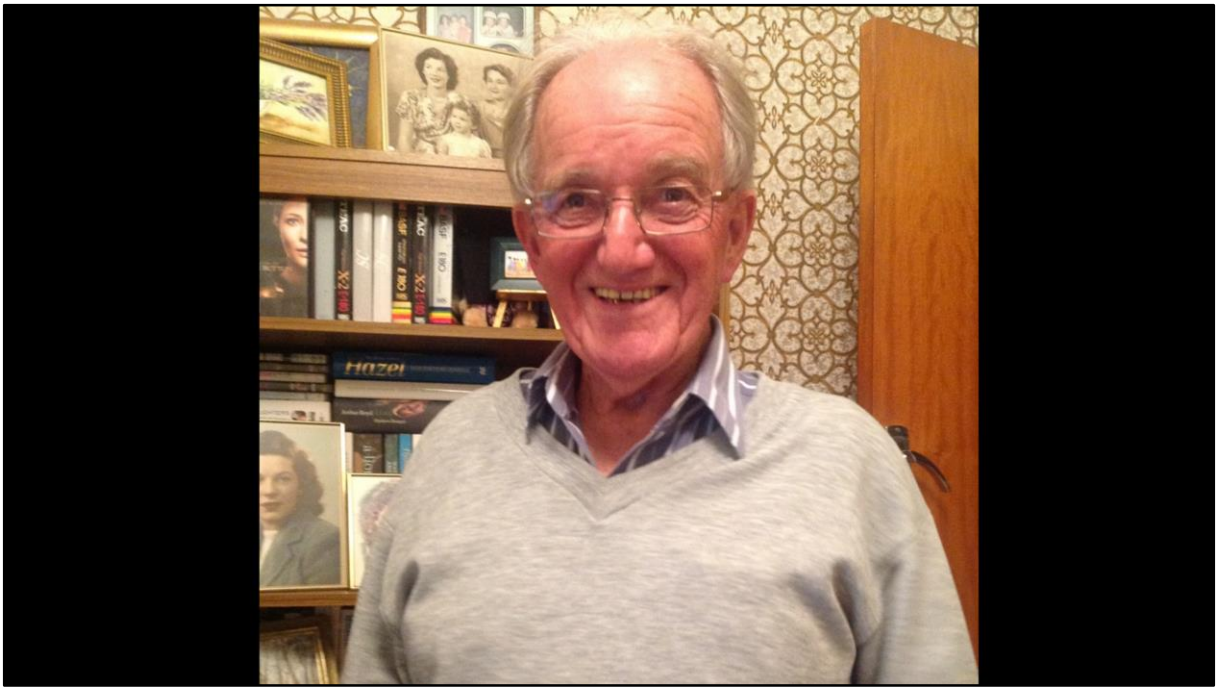
From the outside they looked ok, but the bee colony was doomed.

There was no sign of the queen - no eggs, no ‘brood’, no baby bees.

These bees were doomed to be part 30% of the other hives that died that year, and every year since 2006,

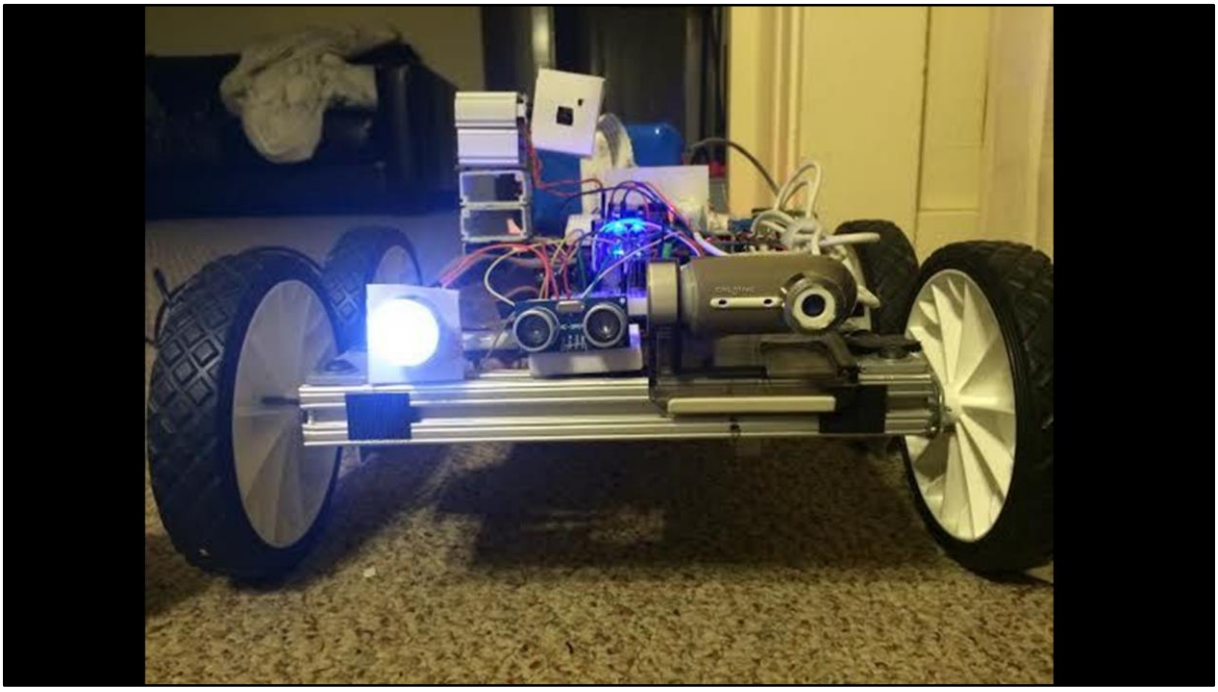
I started paying attention to the bees, and I was inspired to see if I could help them.

My day job and background is in medical robotics technology - I help doctors treat patients remotely through robots.



About 15 years ago my Grandfather, I call him Pa saw his Cardiologist, and he learned there was something wrong with his heart, and he needed a valve replacement.
They opened him up for surgery, and found more issues - he needed a triple bypass as well,
Pa got it and survived. It was touch and go, but he was really lucky, recovered. Pa has a great quality of life and he just turned 94.
What's really important is Pa now checks his heart rate and vitals every day.
Now he can monitor and proactively address issues before they become severe.

So I was trying to make a robotic assistant for beekeepers
as you do -



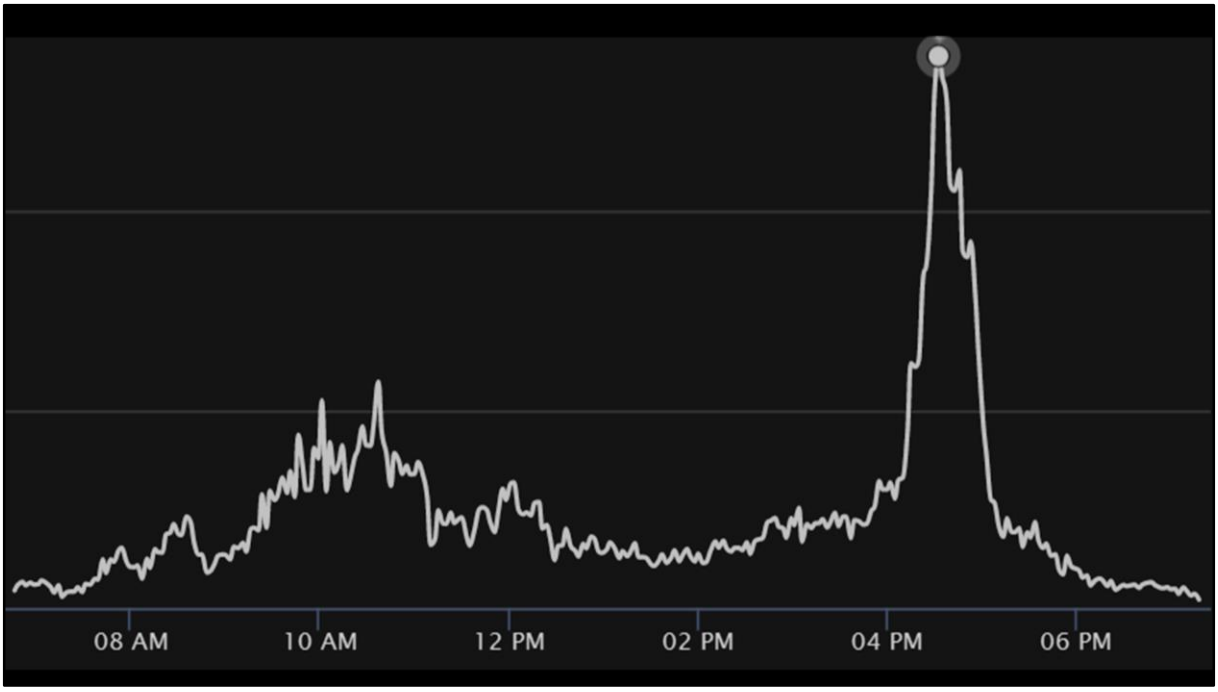
Here’s the glamorous robot.

I wanted to teach the robot how to see bees

In the real world of bees living outside, this meant putting a laptop in a bucket pointed at a beehive.

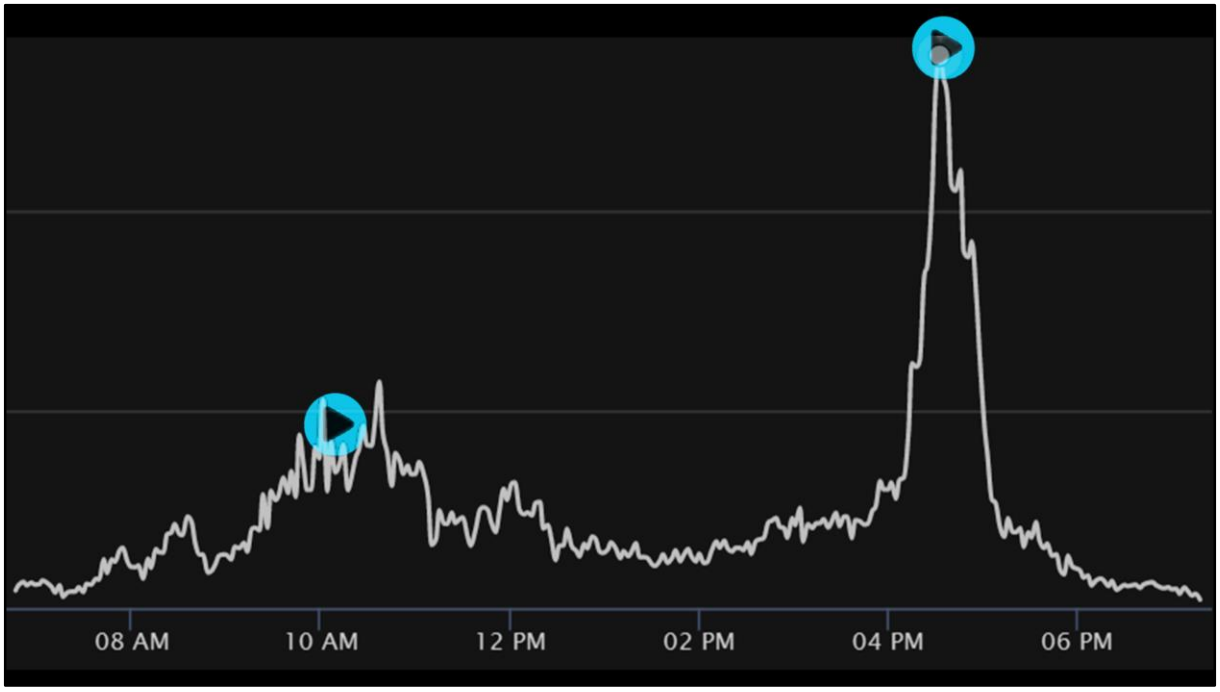
Even more glamorous.

But I did teach it to see and count bees, and it was able to watch the beehive all day every day.



That same friend Jon helped me graph the data from a whole day
The robot's computer vision accidentally discovered this bee flight activity pattern.
Do you see this spike?
No one had noticed this before.
Nobody had measured it before.
And it turns out every healthy beehive has this.
This is the heartbeat of a beehive.

[Animate it – show each day progressing, make a video of the heartbeat] – can we synthesize sounds as well – bee volume level and number of bees.


08 AM
10 AM
12 PM
02 PM
04 PM
06 PM

When you observe nature and you see some crazy signal in the noise you have to pay attention.
So I googled it. Nothing really came up.

I showed this data and the videos to some more experienced beekeepers than me. Paul Cronshaw, a beekeeper of 40 plus years said “Im surprised that it’s such a spike… and it’s probably orientation activity”.
Another said “I bet the healthy hives have this”.

We were paying attention to the bees in a new way - I had to find out what this all meant and whether it was true.

Beekeepers check their hives about every 2 weeks by pulling the lid off and seeing what the bees are up to.

We aim to see whether there are signs of disease, if the bees have enough food - both nectar and pollen.

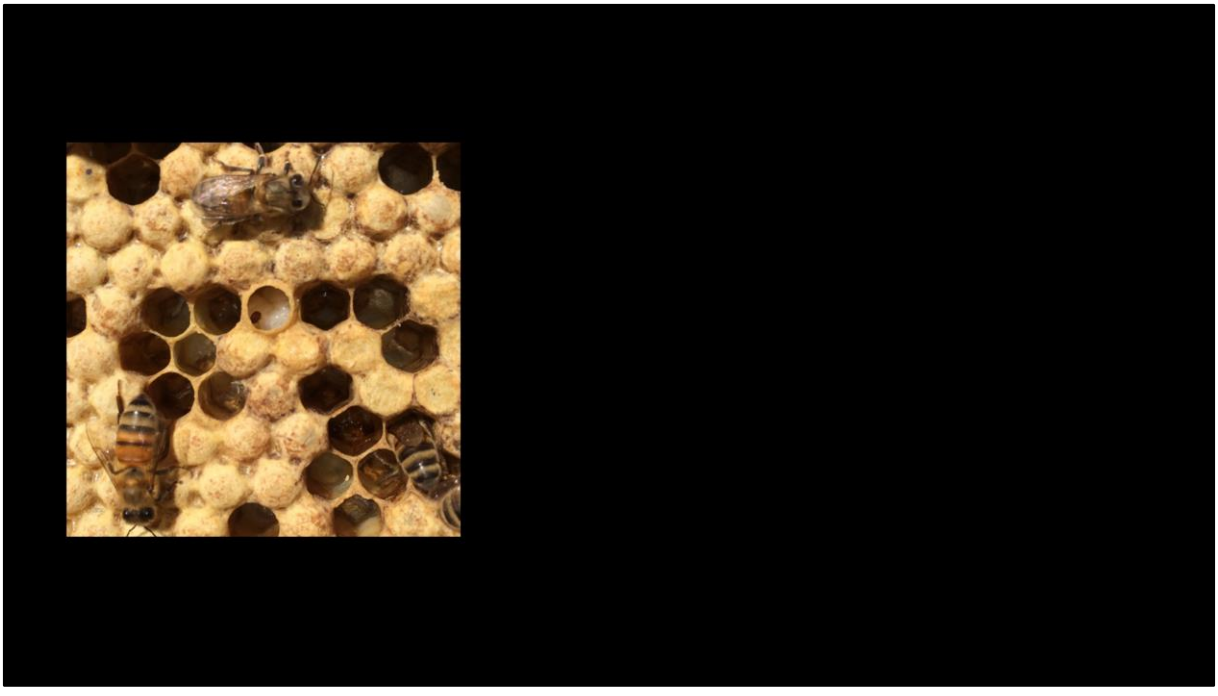
Sometimes looking inside a beehive I feel like I'm a guest in natures cathedral.

The colors of pollen you see here are from the variety of local flowers these bees have been visiting remind me of stained glass.

You can see the hexagon shape of the bee’s comb too – the strongest possible shape and most efficient for storage. As an engineer is hard not to be impressed by these creatures.

That’s bee bread by the way – the bees have been fermenting pollen to make bee bread for millions of years.

Bee bread is more nutritious than even pollen, and the bees will make it to feed their babies to help them grow.



We’re also looking to see if there are a problematic amount of pests in the hive,
And most importantly whether we can see evidence of a healthy queen – the queen herself, and if there are eggs and baby bees.

Unfortunately inspections are like a minor surgery to the bees - we're as gentle as possible, but the process is disruptive and stressful to the bees, and the hive won't get back to normal for a couple of days.

What's shocking is that many beekeepers I have spoken to would tell me they would inspect a hive, and two or three weeks later come back and find the hive had died.

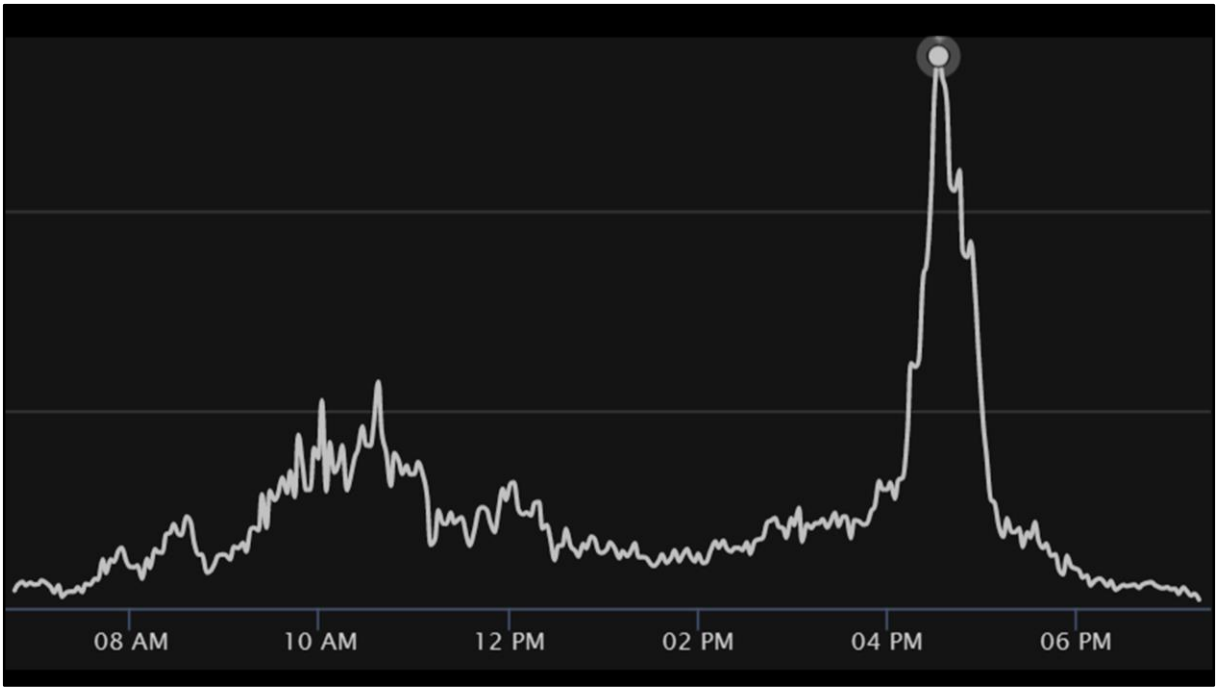
What happened in that in-between time? Are even beekeepers not paying enough attention to the bees?

My epiphany came when my friend Paul, a local beekeeper of 45 years asked me to check on his colony by counting the number of bees flying out of it, so he could get a sense of the hive strength and health.

I couldn’t believe it.

Could monitoring bee flight activity be just like monitoring Pa’s heart?

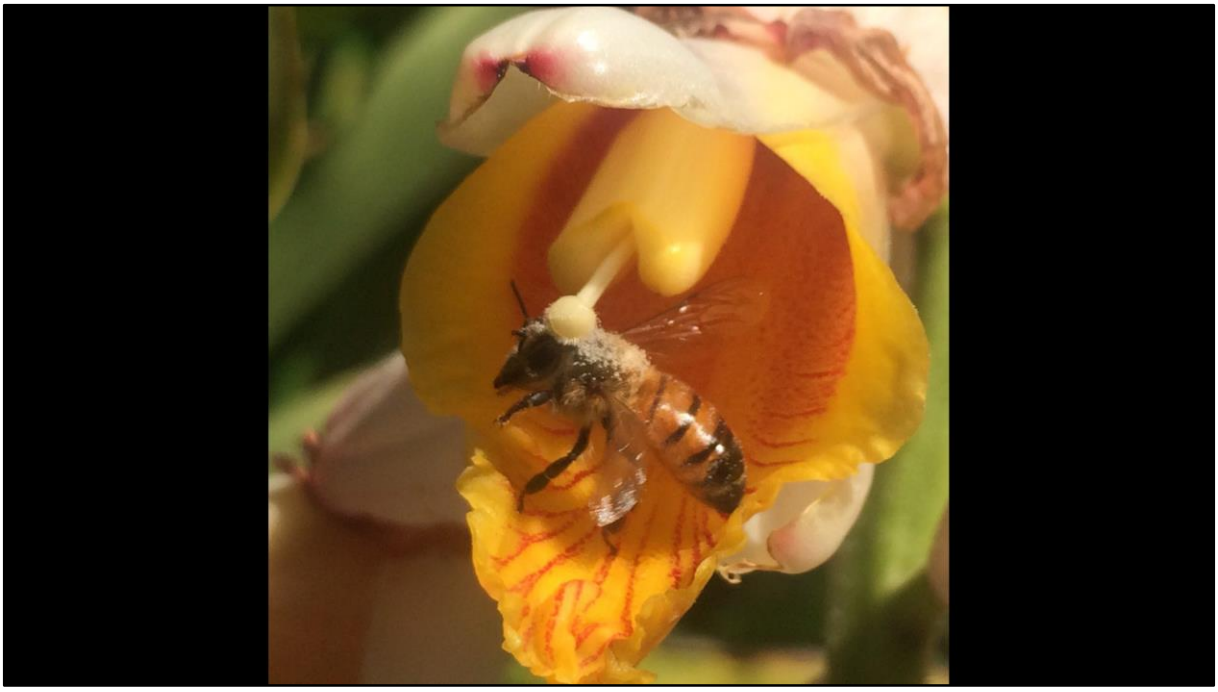
What can we learn from paying attention to the bees?



We learned that the Orientation activity healthy hives have this activity pattern because it's the baby bees flying in front of the hive, learning where they live.

We found that hives without baby bee activity spikes were telling us they were in trouble, and we needed to pay attention to why.

Honeybee colonies are failing at an unsustainable rate - and a quarter of wild bee species are at risk of extinction.



We know bees have a crucial role in pollination of 1 in three bites of the food we eat.

I'm talking about you apples, squash, tomatoes, almonds, watermelon.

The food bees don't pollinate directly, like the grapes to make a glass of your favorite wine, depend on the nitrogen plants pollinated by bees help put in the soil.

Bees are an indicator species for our environment. They're the canary in the coal mine that all of us live in, and they're in trouble.

Bees need flowers to get that nutritious pollen to feed their baby sisters

What you might see as “weeds on your lawn”, bees call family dinner.

The things that kill the bees, also kill the other things we care about - our cats, our dogs, our pets.

They're telling us our practices in monoculture agriculture, the use of pesticide and transmission of pathogens are not sustainable, and we need to act now.

You can plant pollinator friendly gardens.
You can set up a native bee box in your backyard, or keep honey bees.
Try growing a meadow in your back yard
You can ask your local council to reduce or eliminate the use of herbicides
You can put a bunch of ladybugs in your lettuce patch instead of spraying pesticides.
You can teach your kids that not only bees pollinate our food, but what they're telling us about our own choices for sustainability and survival.

We need to pay more attention to the bees.

Next time a bee flies by, pay attention - where is it going, what is it doing. We need observe. Pay attention