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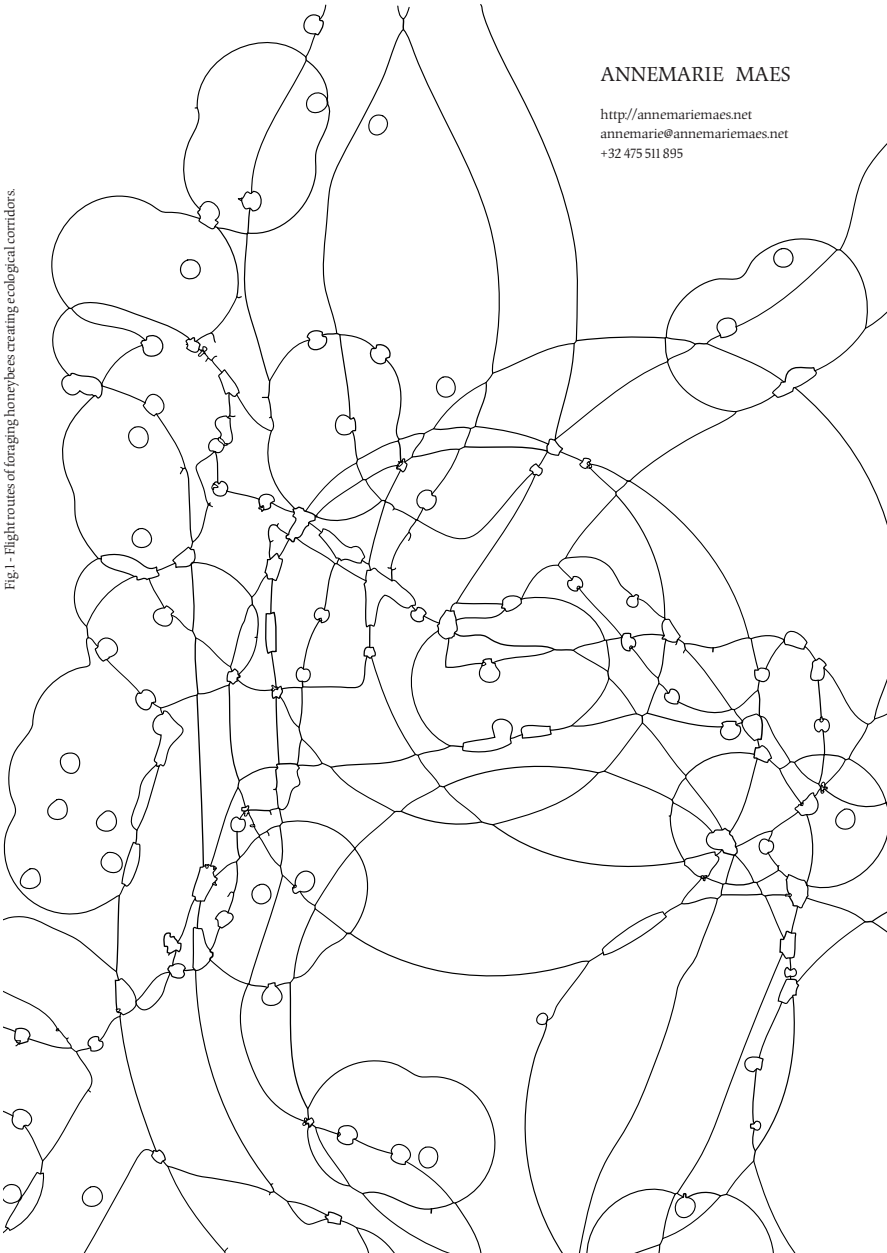

Fig.1 - Flight routes of foraging honeybees creating ecological corridors.

Fig.2 - The Transparent Beehive renders the development of the honeybee colony in real time audio.

THE BEE LABORATORY

I am a media-artist and beekeeper. Since 2009, I study the tight interaction between city honeybees and urban ecosystems. Urban bee populations function and evolve in accordance with the human activities developing around them. The honey an urban colony produces differs depending on the flowers we plant and the garbage and pollution we produce.

My preoccupations with bees come partly from a fascination with these amazing insects: the way their bodies look and function, they way they organize their complex societies, and the way they explore their environment.

But I have also another motivation. In many industrialised nations, bee colonies are now threatened. There are many causes - amongst them pesticides and parasites - but the compromised state of the foraging areas for bees is just as worrisome. So I work also towards an improvement of the environment of bees with the creation of urban gardens and guerilla planting. Moreover, because bees reflect the health of their surrounding ecosystem and the cumulative effects of different pollutants, I use them as bio-indicators to make citizens aware of the increasingly negative effects of our life styles and methods of industrial production.

For many years now, I have been creating experimental set-ups using sustainable beehives that have been augmented with sensors and sensory processing algorithms to analyse the state of the colony, the quality of pollen and propolis and the behavior of the bees [Fig.2]. These "Intelligent Beehives" are progressively linked in a European-wide network and the data is being made available online.

More specifically, I have set out several urban test fields in the Brussels' Canal Zone. This area features diverse activities: from community gardening and urban agriculture to accidental nature, interspersed between industrial buildings, office zones and living areas. My test sites are connected by the flight routes and foraging activities of the bees [Fig.1 - Front cover]. They create a green corridor in the city.

My Bee Laboratory should be seen as an open framework. It is a long-term project on the edge of art, science and technology.

GUERILLA BEEHIVES

I want to populate cities with a network of intelligent "guerilla-beehives". These beehives should offer shelter to bee colonies "in the wild" - rather than force bees into artificial apiaries. The bee colony should be able to thrive without the help of a beekeeper. Guerilla-beehives are intended for pollination and thus preservation and remediation of biodiversity.
I imagine a world where biological fabrication replaces traditional manufacturing and thus where new sustainable beehives can be generated simply by growing them. The design of such beehives will be inspired by art forms from nature and so I am searching the scientific literature to find the requirements for an ideal honeybee nest and create physical prototypes using smart and organic materials [Fig.3 a, b, c].
A guerilla beehive is intended to function completely independently. I equip them with biodegradable sensors that make distant, non-intrusive monitoring possible. The hives therefore do not need to be opened and bees do not need to be disturbed to monitor the colony. The audio- and visual data is aggregated, processed and shared in real time over the Internet. Moreover I believe that solar energy, honey batteries or microbial fuel cells can power the sensors and I am collaborating with scientists to make this possible.
The whole system is set up as a fully organic project: cradle-to-cradle. If the bees decide to leave the hive in search for another home, the hive (with its integrated electronics) will biodegrade and compost completely.

a

b

c

Fig.3 - Guerilla Beehives built from (a) plaster, (b) Japanese cocos, and (c) wax from Brussels honeybees.

Fig.4 - Urban Farm located on connected rooftops in the center of Brussels.

THE URBAN FARM

Bees are a means for exploring how humans interact with and understand nature. As an urban ecologist, I study the link of the honeybees to the environment. The bees' overlapping foraging areas create ecological corridors throughout the city. By hacking rooftops and transforming them into urban gardens, I am experimenting with new forms of sculpting the public space. It generates a form of site-specific art intended to provoke change. Ecological corridors in urban environments are a new medium of social sculpture, a Gesamtkunstwerk that relies on the creative participation of many.
The Urban Farm [Fig.4], Brussels' first rooftop farm, is one of my open-air laboratories. It is built on a set of connected rooftops in the historical center of Brussels, on the same spot where in medieval times vegetable and fish markets were set up, among houses and cloister gardens. The farm, built on top of a big parking lot, is a place where artists and urban gardeners develop new strategies for sustainable living in the city. An artistic attitude, green technology and the philosophy of permaculture present new opportunities to contribute to sustainable living.

BEE MONITORING

How can we study the differences between a biological corridor and the rest of the city? The honeybee colonies forage in a radius of 3 kilometers around their beehive. They fly on their own airborne roads back and forth from their collecting jobs and bring a sense of rural to the urban environment. I analyse the pollen that the bees bring back from their foraging trips, and compare them with existing scientific databases [Fig.7 - poster]. With this information I can determine and map the melliferous plants in the green corridors and monitor the evolution of the plant diversity. Complex systems analysis and machine learning techniques then detect patterns to predict ongoing social and biological processes.
The Transparent Beehive [Fig.2] is one of the observatories to study how a bee colony evolves. Contact microphones are embedded in the hive and its comb frames, and the bees' activities are recorded on 12 mono audio channels. The final -slow art- output creates 3D sound-scan of life in the hive. It is complemented with additional measurement of internal temperature and humidity and external measurements of climate, soil and vegetation. Storing the data over a 12 months period provides very detailed observations and it allows us to discover and follow long-term trends in the complex relations between the colony and its environment.

Fig.5 - Monitoring the movement of adancing bees on the frames.

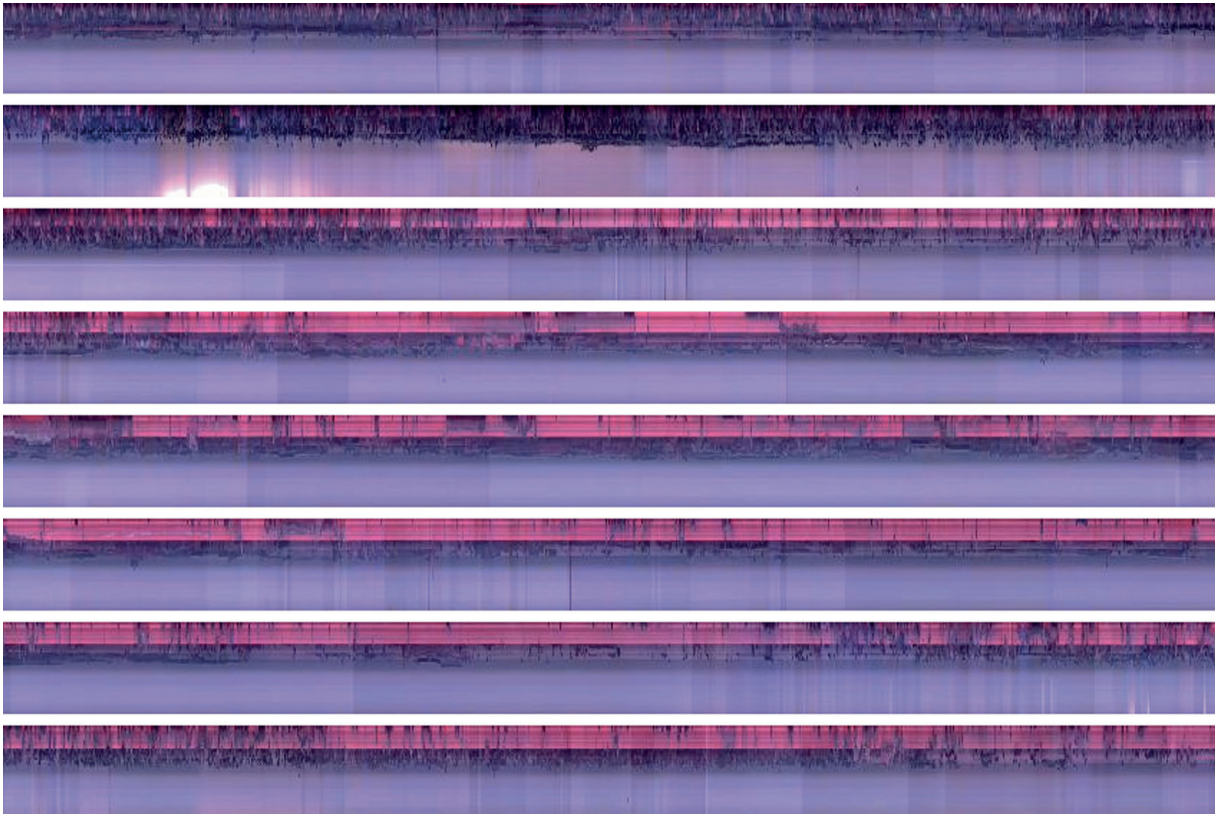

Fig.6 - Video timeline depicting 12 months of webcam recordings inside the beehive.