RESONATING BODIES—BUMBLE DOMICILE
July 4-27, 2008 **new* gallery*, 906 Queen W., Toronto
A co-presentation between InterAccess Media Arts Centre and New Adventures in Sound Art
interaccess.org and resonatingbodies.wordpress.com

Sarah Peebles - audio installation, project lead
Rob King - programming, visualization and projection
Anne Barros: copper offering plate, electroformed Bombus hive; silver bowl
Rob Cruickshank - ultraviolet video; technical assistance and consultation

Collaborating researchers: Laurence Packer (York University), Jessamyn Manson (University of Toronto), Peter Hallett (University of Toronto), and Stephen Buchmann (University of Arizona).

Garden assistance generously provided by Gene Threndyle and resident gardeners of 900 Queen W, Michele Bakic, and Trinity Bellwoods Art in the Park and CARE youth.

Gallery Notes

Resonating Bodies is a series of mixed media installations and community outreach projects which focuses on biodiversity of pollinators indigenous to the natural and urban ecosystems of the Greater Toronto Area. Conceived by **Sarah Peebles** with **Rob King**, **Rob Cruickshank** and **Anne Barros**, the installations illuminate aspects of local biodiversity such as bumblebee colonies and their foraging activities, ultraviolet bee vision, pollinator/plant co-evolution, solitary bee and wasp nesting life/life cycles, and colour-coded DNA barcodes (a novel new technique for species identification pioneered by Canadian researchers). *Resonating Bodies* coincides with the release of Toronto's first guide to native bees, "A Guide to Toronto's Pollinators", by Laurence Packer, Professor of Biology at York University (published by the David Suzuki Foundation). Talks on indigenous pollinators, habitat and co-evolution by collaborating researchers, and artist talks take place throughout July take place at co-presenting venues.

Bumble Domicile weaves observation of an on-site bumble bee hive containing live video and audio of its internal activity with the hive's pollen-collecting activity, and, real-time ultraviolet video of flowering plants in the building's communal garden adjacent to the gallery. **The foraging activities** of our bees are the focus of our observation. As we know, the collection of pollen is both necessary for the feeding of the bees, and the pollination (and thus reproduction) of the plants and creation of genetic diversity. While this fact is common knowledge, the time scales and distances involved make it difficult for most people to link cause and effect or have first-hand knowledge of the link between bees, plant reproduction and genetic diversity. This part of the project aims to draw a direct causal relation between bee pollination and plant reproduction by both to shrinking the time and distances involved in the process and linking the real-life act of bees collecting pollen with the growth of flowers in virtual/gallery space. To do this, a video camera has been placed at the entry point of the hive so that the comings and goings of the bees will be monitored. By swabbing the stamens of a variety of flowering plants outside with fluorescent dye insect tracking powders, it is possible to track which plants the bees are collecting pollen from. The camera identifies which plants the bees are likely pollinating by measuring the colour of pollen on their bodies as they return to the hive. These data trigger the growth of virtual flowers within the gallery space. The form that the virtual flowers take are procedurally generated based on the genetic data (DNA sequences) of the plants which are tagged with fluorescent powder in the garden. A second camera has also been placed to monitor the behavior of the hive as a whole and can be viewed as a central fixture in the virtual garden. Youth involved in Art in the Park at Trinity Bellwoods are regularly swabbing anthers of various flowering plants in the adjacent Artscape tenants' garden and in Trinity Bellwoods Park with the colourful fluorescent tracking powders and are keeping a log of their activities in the gallery.

Live ultraviolet video of specific flowering plants in the garden are projected separately in the gallery using an adapted video camera which has been modified and fitted with a UV filter. This camera reveals petal markings visible only in ultraviolet light which are known to function as pollen guides for bees and other pollinating insects (markings invisible to the human eye, but visible to bees and other insects). A patch of rudbekia hirta (black-eyed susans) as seen in UV alternate with the flowers as seen in visible light in a silver bowl.

Visitors are invited to place aromatic offerings of beeswax and pine resin - materials utilized within honey beehives and some solitary bee nests - into a **heated copper tray** which resembles the interior of our bumble bee hive: "When asked by Sarah Peebles to make an offering plate for the exhibition, 'Resonating Bodies', I initially thought of electroforming a sheet of beeswax. Because the project focuses on bumble bees, not honey bees, I was given the remnants of a discarded hive (the colony cycle completed and the bees no longer living) from the James D. Thomson lab at the University of Toronto to work with. Electroforming is a process that deposits a thin layer of metal on a matrix, in this case the beeswax hive. The hive is first coated with electroconductive paint and immersed in a plating bath of sulfuric acid and copper sulfate. An electric current is passed through and copper is deposited on the hive until it is of sufficient thickness. After much experimentation and failure, I managed to put together enough of the fragile cells to reconstruct a hive. As the raised focal point for the offering plate, the bees' naturally built structure picks up the patinated colour and surface of the copper plate itself." (—Anne Barros)

Headphones which "plug" into the bumble bee hive bring together sight and sound of our bees as they go about their hive activities, while continuous **audio transformations** of pre-recorded masses of honey bees and shoh (Japanese mouth-organ) fill the gallery. These (pre-recorded) bees were gathered inside glass jugs and recorded from inside the vessels, their wings vibrating against the glass and causing the containers to ring at their resonant frequencies. These beautiful, complex sounds smoothly and continuously shift in pitch while overlapping with shoh tones, whose upper frequencies subtely shift in timbre (hear an audio excerpt or listen while watching the video of DATA visualization by Rob King). The tones of the shoh - the Japanese mouth-organ, an instrument which has utilized beeswax and pine resin since ancient times - reflect an ancient human connection with bees. The shoh was introduced to Japan from mainland Asia between 400-500 A.D. and has changed little since then, though its mainland cousins have transformed considerably. It reflects a remarkable historical relationship between humans, bees, trees and metalsmithing. Its metal reeds, hidden within bamboo reed pipes, are traditionally held into place with a preparation of beeswax and pine resin, and are tuned using a similar substance containing fine lead pellets. The initial placement of reeds within the pipes and their tuning requires a gentle heating of the wax-resin substance and the metal tools used for these tasks. The 17 pipes which make up the entire instrument are held snug by a silver band designed to emulate the shape of bamboo. A solo shoh performance will take place in the gallery on Saturday, July 26th, 2008.

Free bee trading cards feature macro photography of bee anatomy, life facts and colour-coded DNA barcodes of some local bumble bee, megachile (leaf cutter) and osmia (spring bee) species. These barcodes serve as a metaphor for biodiversity and evolving strategies of pollinators, and by extension, of all living things. They also serve as representations of our ability to perceive (with the aid of technology) and better understand the genetic aspects of the biological diversity of the region in which we live through a specific group of pollinators indigenous to this region, whom we can also observe in their natural habitats. These cards are the first in a series of trading cards of pollinators featured in Resonating Bodies at both *new* gallery and at our Pink Bee-Wasp Condo at the Franklin Children's Garden on Toronto Island (our data gathering site for "Nest Wall", 2009). Full sets of trading cards, colour-coded DNA barcodes of these bee species, Pink Condo details and more are available at our blog site, resonatingbodies.wordpress.com.). Copies of "A guide to Toronto's Pollinators" booklet are available in the gallery for PWC.

On colour-coded DNA barcodes "A DNA barcode is a short sequence of mitochondrial DNA that can be used to identify species. The four letter code of the genetic language can be translated into colour for easy visual inspection. A colour DNA barcode then becomes 650 vertical stripes made out of four different colours. DNA barcodes have been used to identify species of almost all groups of animals, seaweeds and fungi. It works because the level of difference between different species is much larger than the amount of variation within species. DNA barcoding is useful in the study of pollinators for many reasons. First, with almost 20,000 described species, bees are often extremely difficult to identify using traditional external morphology and a microscope. It is often easier to get an identification using barcodes than by eye, even when the eye is aided by 200X magnification. Second, many "species" turn out to be complexes of different species that we cannot learn to tell apart using traditional methods. In some instances single species have turned out to be ten or more species when we look at their genetic make-up as shown through a DNA barcode. Third, many species of bee are known only from males or females, yet obviously both sexes must exist. DNA barcoding allows us to associate males and females of the same species, even if they were originally given different names." (—Laurence Packer)

About pollinators and co-evolution

Intimate Relationships

Plants and their pollinators began evolving their intricate dance of codependency over 100 million years ago with the origin of the flowering plants (angiosperms). They fine-tuned it during the Cenozoic era (beginning 65 million years ago) as flowering plants began to dominate all the world's living landscapes. These millions of years of plant-pollinator coevolution have produced a world in which flowers have their anatomy and scents finely tuned to their pollinator partners. In exchange for pollination services, flowers provide food (nectar, pollen), shelter, and chemicals used by insects to produce such things as pheromones (chemicals produced by animals and released into the environment to stimulate a behavioural response from another animal). The relationship between flowering plants and their pollinators is so intimate that, should pollinator populations decline (or worse yet, go extinct), the impact on their plant associates would be immediate and profound. Because pollinators are species upon which the lives of so many other species depend, they are regarded as "keystone species". Pollinators are thus essential to the stability of the global ecosystem itself. In fact, without pollinators, life on planet Earth would be very different.

Not only are our native plants dependent upon pollinators for their continued existence, but so are our crops. Eighty percent of the world's crop species, including food, beverage, medicine, dye, and fiber crops, rely on animal pollinators. The critical importance of pollination has been recognized since humans first gave up nomadic lifestyles. That great symbol of human-pollinator partnering, beekeeping, began long ago, at least by 600 B.C. in the Nile Valley and probably well before that. The first beekeepers were most likely Egyptians who floated hives up and down the Nile to provide pollination services to floodplain farmers while simultaneously producing a honey crop. Domestic honey bees (Apis mellifera), introduced to North

America from Europe in the mid-1600s, now play a role in pollinating 80 percent of the crop varieties grown in the United States and a significant percentage in Canada. However, the story is complex. Because European honey bees have been introduced worldwide they now compete with native bees (and other native insects) around the world, and it is now virtually impossible to find an area free of managed or feral honey bees. Honey bees out-compete native insect pollinators by overwhelming them with their sheer numbers and superior ability to detect and direct one another to pollen and nectar sources. Further complicating the story, at the same time that the almost the whole world has become dependent on domestic honey bees, their populations are declining in many parts of the world, including Canada, due to exotic (introduced) bee parasites (e.g., mites, beetles), loss of habitat and, use of pesticides, and the invasion by highly aggressive Africanized bees (A. mellifera scutellata) into the United States (since 1990). The aggressive Africanized bees out-compete the European honey bees but do not pollinate all the same plants and crops. The direct competition between European and Africanized honey bees with native species is reducing the numbers of native pollinators, and it is adding to the pollination crisis that the world faces today. And most recently we have colony collapse disorder, which does not seem to be impacting Canadian beekeepers, at least not yet.

Like many other animals on Earth, pollinators today face growing threats of extinction. Disruption of habitat, widespread and often inappropriate use of pesticides, and the development of certain genetically engineered plants further add to the crisis, as pollinating insects are locally extirpated and native plant and domestic crop reproduction and fruit production plummet. It is suspected that many thousands of pollinator species have become extinct over the past century as a result of worldwide, rampant land-use change and deforestation. With accelerating global biodiversity losses, estimates of the number of insect species alone that will go extinct by the year 2050 range into the hundreds of thousands. The impact on native plants and on crops cannot be predicted in detail, but will surely be enormous.

—Richard C. Brusca, Executive Program Director, Arizona-Sonora Desert Museum

General introduction to bees

When we think of bees, we tend to think of honey, wax candles, venomous stings, traditional and reinvented apitherapies. As of late, we ponder more seriously their declining numbers and mass disappearing acts, and how we ultimately rely on them for much of our food, most of which is true and which is relevant — regarding the world of honeybees. What most of us aren't aware of are the 19,000 (and counting) diverse species of bees world-wide (most of which are not honeybees; hundreds of which are found in Canada), their ancient associations with plants and ecosystems which make up the world as we know it, and their place in the bigger picture of the earth's pollination story. This story includes moths, butterflies, beetles, birds, wasps, bats and even a few larger mammals. It involves "pollination corridors"— routes which maintain migrating pollinators like hummingbirds and Monarch butterflies — routes which can extend thousands of miles, from the Arctic to Mexico. It encompasses a wide variety of survival strategies on the parts of pollinating animals *and* the plants on which they depend, strategies honed through the ages in an ever-evolving dance of adaptation through time and change, including change resulting from human presence. It involves genetic diversity, that essential ingredient to the survival of all living things on Earth, including us.

So, who are these indigenous bees? Most of us know so little about them: where they live, when they live and when they're active, what they look like, how they nest, what they eat, where they forage, how they navigate, how they communicate, what they pollinate. We don't even really know if or how they positively affect - or might affect - our capacity to produce food sustainably, given our penchant for monocultural practices (including the pollinators we use). It is known that there are at least some 800 species of indigenous bees in Canada, perhaps 150 of which still exist in the Greater Toronto Area. Some live in small groups, most live entirely alone, in their very own apartments. And somehow they manage to make it through the Winter. Let's meet them, up close and personal.

Bombus Bumble bee colonies in nature often live underground in hollows such as discarded mouse nests. Their colonies grow throughout the summer months and naturally die off by the first frost. The mated new queens then find different underground locations in which to over-winter to start a new colony cycle the following Spring. Bumble Domicile's live observation hive is developed, implemented and monitored with assistance from the Professor James D. Thomson lab at the University of Toronto Department of Ecology and Evolutionary Biology. Bombus impatiens are its residents and are one of many species of bombus which live in Toronto. Our hive will grow from approximately 12 inhabitants at the beginning of July to some 30 bumble bees —half of whom forage, and half of whom work only in the hive—by the end of the month. 5

—Sarah Peebles

Got Bee Questions? **Pollinator Partnership** provides information on pollinator – habitat conservation, pollinator gardens, co-evolution and more; this site brings together information regarding Mexico, the United States and Canada (pollinator.org). **Pollination Canada** provides valuable additional insight into Canada-specific issues of topics related to pollination (pollinationcanada.ca).

Biographies (see blog for full biographies at resonatingbodies.wordpress.com)

Sarah Peebles is a Toronto-based American composer, improviser and installation artist. Much of her work explores alternative performance settings and found sound manipulated via computer and physical objects, often combined with shô (Japanese mouth-organ). She has performed and exhibited worldwide, and has collaborated with a wide range of musicians and artists. Her music is available on a number of audio and video publications.

Rob King is currently finishing a MA degree in the Communications and Culture joint graduate program at Ryerson and York Universities. He is a New Media artist based in Toronto, Ontario. His work explores the social dynamics of networked spaces, the potentials of mobile and ubiquitous computing, and system theory.

Anne Barros, RCA, specializes in small functional hollowware and flatware. Her work is included in the permanent collections of the Canadian Museum of Civilization, Seymour Rabinovitch, and the Macdonald Stewart Art Centre. She has received numerous awards, including the Canada Council's Paris Studio.

Robert Cruickshank is a Toronto-based multidisciplinary artist. He works in various media includes electronic, kinetic and robotic installations, sound art, electroacoustic music and lo-fi and stereo photography. He has exhibited in Toronto and internationally.

Credits

Bee/wasp trading cards: Amro Zayed and Rob Cruickshank (living bee images), Claudia Ratti - Packer Lab, York University (macro images), The Barcode of Life Data Systems (colour-coded DNA barcodes), Jessamyn Manson (text), Kevin Steele (text/image assembly), Anneli West (graphic design) **Pin and business card**: Kat Cruickshank (bumble bee cartoon), Robert Cruickshank (bumble bee hive image), Anneli West (design).

Technical assistance and consultation: Dr. Laurence Packer, Professor of Biology, York University; Jessamyn Manson. Michael Otterstader and Dr. James D. Thomson, University of Toronto Department of Ecology and Evolutionary Biology; Dr. Stephen L. Buchmann, adjunct professor of Entomology at the University of Arizona, and, Professor Peter Hallett, University of Toronto and Department of Natural History, Royal Ontario Museum, in co-ordination with Koffler Scientific Reserve at Jokers Hill – University of Toronto.

Bombus impatiens hive generously provided by Biobest Canada.Bombus hive box enclosure by Don Taylor – Bookbinder. Pink Bee–Wasp Condo (Franklin Children's Garden) enclosure woodworking by Reena Katz. Audio recordings of honey bees made with the assistance of Frank Lindsay at Lindsay's Apiaries, Jonsonville, New Zealand. Laura Paolini, project manager; Mark Pennock, technical installation and Mark Pellegrino, audio installation assistance.

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