Interspecies Love in an Age of Excess: Being and Becoming With a Common Ant, *Ectatomma ruidum* (Roger)

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Insect love has lately become the subject of much attention from anthropologists.[1] In confessing my own affections for *Ectatomma ruidum*—an ant species that is flourishing in the forested landscapes, agricultural fields, and suburban lawns of Central and South America—I must be clear that our feelings are not at all mutual. At best, *Ectatomma* remains indifferent to human beings. When an *Ectatomma* forager sees a large vertebrate, a potential predator like me, she will often turn her whole body to face-off—jaws open, legs firmly planted, stinger ready. If these persistent threats were empty (any *Ectatomma* aficionado knows that the ant has difficulty stinging humans and will scurry away, and try to hide, upon serious molestation) they still served as reminders of the unease generated by my fondness for their kind. Threats also became evidence that these ants were capable of returning my gaze.[2] Recognizing gaps in our gaze, and disjunctures in our interests, offers a point of entry to rethinking the species interface.[3]

Martin Heidegger, the philosopher of the twentieth century who more than any other strove to separate man from the living being, articulated a famous triple thesis about human exceptionalism: "the stone is worldless; the animal is poor in world; man is world-forming."[4] Tussling with Heidegger, I suggest that *Ectatomma* is also exceptional. Appropriating the keyword of Heidegger's triple thesis, and torquing it with help from a host of recent scholars, this essay will stroll through the social worlds, cosmopolitical worlds, and the environmental worlds (*umwelten*) that orbit around this remarkable insect. If literal amphibians can choose among modes of existence—if they can live both on earth or in water—I argue that *Ectatomma* ants are figural amphibians that never stick to just one world (to borrow the words of Peter Sloterdijk, a neo-Heideggerian).[5] These amphibious animals are constantly moving among worlds, always exploring lines of flight that might lead somewhere else.

Ectatomma ruidum

Nomadic subjects, such as these figural amphibians, can be dangerous, irredeemably destructive or tolerant, in the words of Isabelle Stengers. The challenge, for Stengers, is to trap nomads, to enfold them in production of what she calls cosmopolitical worlds. Cosmopolitics offers an idiom for considering the diverging values and obligations that structure possible nonhierarchical modes of coexistence.[6] "The cosmos refers to the unknown constituted by multiple divergent worlds," Stengers writes, "and to the articulations of which they could eventually be capable."[7] These common worlds involve contingent "political" articulations. We have to build them together, tooth and nail, in concert with other agents.[8] Cosmopolitical worlds are structured by relations of *reciprocal capture*, a dual process of identity construction where each agent has an interest in seeing the other maintain its existence.[9]

My tale of unrequited insect love explores the conditions of capture where relations are contingent and not always reciprocal. Tracing actions oriented to the care of beings and things, often across species lines, I consider how agents come to be enlisted in the production of common worlds, and how they escape. I regard *Ectatomma ruidum* ants as agents of cosmopolitical assembly, conscious beings who become involved with other creatures through relations of reciprocity, kinship, and accountability.[10] Exploring the fleeting whims of these ants, I also consider sentiments about the distribution of surplus that are beyond rational calculus. Drawing on my own original historical research, bio-behavioral experiments, and ethnographic observations I offer a theoretical, normative, and ethical proposal for being and becoming with others in an era of excess.

Interested Others

Certainly I am not the first human to have fallen in love with *Ectatomma*. Dr. O. F. Cook, of the U.S. Department of Agriculture, became infatuated with this insect during a 1902 expedition to the eastern highlands of Guatemala. At that moment the boll weevil, an insect invader from Central America, was beginning to devastate cotton harvests in the United States. Cook discovered that *Ectatomma* ants were attracted to extra-floral nectaries on cotton plants—glands on the leaves, stems, and flowers that secreted a nutritious liquid. These nectaries were inducing ants to patrol cotton crops and kill boll weevils. *Ectatomma* ants have "taken a step toward the domestication of the cotton plant," according to Cook. "They have at least adopted it, and show an instinctive interest and attraction for it in preference to other plants." [11]

The boll weevil (*Anthonomus grandis*)[12]

Imposing the language of late 20th century biology on Cook's findings, this relationship between *Ectatomma* and the cotton plant is a facultative symbiotic association. Symbioses, in the eloquent prose of Lynn Margulis and Dorion Sagan, involve "the co-opting of strangers, the involvement and infolding of others."[13] Facultative associations are contingent, and non-necessary links—in this case meaning that the plant can live without the ant, and vice versa. The Q'eqchi' speaking Mayans of Guatemala, who Cook encountered during his expedition, were certainly also aware of this symbiotic relationship. They referred to *Ectatomma* as "the animal of the cotton."[14] Ants, cotton plants, and the Q'eqchi' were enfolded in a common cosmopolitical world. Entangled in relations of mutual use and exploitation, each of these agents had cause to be interested in the continued existence of the others.

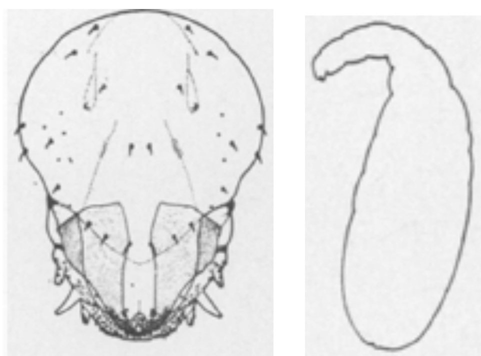
Cook desired to enlist some of these entangled beings, from a cosmopolitical world in Central America, in the protection of the cotton plantation economy in North America, an endangered world. Working to recruit allies—humans and multiple other species—he began building an expanding network to stabilize his ideas and proposed interventions. Becoming a gatekeeper for other agents, an obligatory point of passage, Cook was establishing himself as the central node in a project of entrepreneurial *interessement*, to deploy a keyword from actor network theory. "*Inter-esse*" means being in between or interposed. Like many other scientific entrepreneurs before and since, Cook was interpreting the interests of other species to incorporate them into the dreams and schemes of humans.[15]

The findings from Dr. Cook's expedition to Central America were greeted with much fanfare. *The Houston Post* heralded, on its front page: "Enemy of the Boll Weevil: Big Red Ant Found in Guatemala Which Lives on the Cotton Pest." The honorable Jas. Wilson, then Secretary of Agriculture, brought Cook's discovery to the attention of President Teddy Roosevelt. In the coming months the U.S. Congress made a special appropriation of $250,000 for continued investigations into cotton diseases, the study of weevil parasites, as well as the inspection of cotton products. The following year $45,000, from a special fund of the Secretary, was reserved "for work with Guatamalan ant and other possible emergences."[16]

In July of 1904, Dr. Cook arrived at the Department of Agriculture field station in Victoria, Texas, with about 4,000 *Ectatomma* ants, in 89 distinct colonies, that he had collected in Guatemala. The colonies were divided up for study at a host of laboratories around the country.[17] While Dr. Cook traveled to Washington, to articulate his vision to established Department of Agriculture priorities, a host of men set about studying the needs and interests of this insect. They described the slaying of the boll weevil with intimate attention to detail: "The ant's mandibles are large enough to grasp the weevil around the middle and pry apart the joint between the throat and the abdomen. The long, flexible body [of *Ectatomma*] is bent at the same time in a circle to insert the sting at the unprotected point, where the weevil's strong armor is open."[18] A preliminary outline for work with the ants included studies of adaptability to various soil conditions, the rate of egg deposition, the production of queens, and the conditions of mating. They set out to answer a series of questions: Are stores of food gathered in special galleries? Will ants collect weevils resting quietly in squares? Can the production of queens be forced?[19]

Being in between

In trying to optimize the productive capacity of *Ectatomma* colonies, in working to increase the usefulness of this species to humans and its integration into economic systems, Dr. Cook set about studying every life stage of the organism (with considerable help from his wife).[20] Mrs. Cook became captivated by the young larvae of the ants—small and plump grubs, like white sausages with distinct heads. Stout antennae and papillae frame the hard plates of their heads, allowing them to blindly taste and grope their way through the world. Seeds, dead insects, and animal matter, she noted, were collected by adult foragers and brought to the legless and seemingly helpless young. "With mouth parts adapted for eating out the soft interior tissues of insects," Cook reports that the larvae of *Ectatomma* have "long, flexible necks [enabling] them to reach inside and clean out the sections of boll weevils laid by the workers carefully on the fat stomachs of their baby sisters."[21]



The larvae of *Ectatomma* (Wheeler and Wheeler 1952)

Departing from the social world of Dr. and Mrs. Cook, and the other U.S. Department of Agriculture agents who were interested in the enemies of the boll weevil, affords an opportunity to consider the countervailing interests at play within *Ectatomma* colonies. Adult ants are only able to eat solid food in concert with their anatomically flexible youngsters. With ultra-thin waists, called petioles, adults cannot move solid foods into the digestive organs of their own abdomens. The larvae of ant colonies are thus agents of *interessement*—they are obligatory points of passage for solid food that stabilize networks of adults living together in the same nest or colony.[22] The embodied differences of adults and the larvae thus keep them interested in one another.

With a conjoining of diverse body parts, with an intermingling of mutual utility and perhaps pleasure, adult workers and larval ants often eat solid food together. Chopping up the food with their mandibles, adults position manageable tidbits within reach of larvae. Ingesting bits of food, and excreting enzymes to predigest other solids, the larvae break the food down into chemical components. Larvae of many ant species generate nutritious liquids that adults, in turn, drink.[23]

An adult *Ectatomma* forager carrying a larvae[24]

Human social worlds, according to a classic definition from sociology, involve collaborating and doing things together.[25] They are communities of practice and discourse engaged in collective action.[26] Fluid exchanges of material and semiotic elements, a discourse of sorts, structures the social worlds of ants.[27] While much of the literature about humans is preoccupied with the roles of entrepreneurs, agents that are viewed as being central in the construction of common worlds, it is clear that a multitude is involved in the coproduction of ant worlds. Caring for other beings and things, adults and larvae enfold each other into intra-specific ensembles.[28]

Parallax

Fast-forwarding past nearly 100 years of history, from Cook's discoveries in Guatemala to my own first contacts with *Ectatomma* in Panama, and then rewinding back again, produces a parallax effect—bringing dimensions of entangled social and cosmopolitical worlds into sharp relief. President Teddy Roosevelt helped create the nation of Panama in 1903, supporting separatist insurgents and initiating a naval blockade against Columbia. On the heels of this military action the United States took over the construction of the Panama Canal, a defining feature of the landscape where I later encountered *Ectatomma*. Early visitors who toured the Canal experienced "stereoscopic visions", in the words of Ellen Strain, where tourism doubled as a mode of time travel. Learning to view the landscape through hand-operated stereoscopes, containing a pair of photographs that used the parallax effect to produce three-dimensional illusions, visitors came to view Panama "as the ideal tourist object with its natural wonders—tropical fruits, luxuriant vegetation, the Rio Grand River, fresh water springs, and scenic bays—and its combination of an intriguing past, an exotic present, and a bustling future which lies ahead."

Barro Colorado Island, an "open air biological laboratory" where I later studied *Ectatomma*, was created in the 1920s. This man-made island emerged when a small hill-top was surrounded with water during the damming of the Chagres River to fill the Panama Canal. As a scientific object, this island became imagined as a place that contained the mysterious secrets of nature's past, an exotic field site for adventures in the present, and a place where new discoveries might unlock future possibilities. The field station (which came to be known by the island's initials, BCI) quickly became a site of pilgrimage for aspiring scientists who wished to become tropical biologists.[29] Visiting BCI became "a rite of passage," in the words of Pamela Henson, Historian at the Smithsonian Institution Archives. "A field trip to the tropics [was] a route to fame for young North American naturalists."[30]

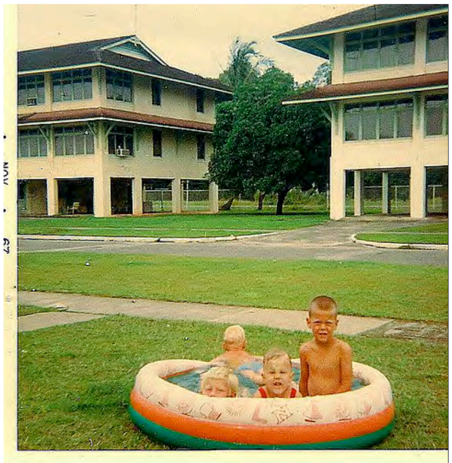
Certainly many of these researchers appreciated what Donna Haraway calls "the foolishnes of human exceptionalism." In the same historical era when Martin Heidegger began asserting that "the animal is poor in world", biological scientists were exploring the rich worlds of organisms on BCI. The historical archives of BCI are full of accounts by young men whose lives and careers were transformed by being and becoming with other forms of creaturely life. Surprising behaviors by monkeys, ants, amongst other critters, captured the imagination of visiting researchers, prompting them to script particular species into accounts of ecological interdependency.[31] Biologists were becoming aware of interspecies collaborations "in a contact zone where the outcome, where who is in the world, was at stake."[32] As BCI became a key site for studying tropical ecology, certain categories of people were excluded from the social world of this new science. Social separation was naturalized among humans even as ecological interdependencies were discovered.

An architecture of apartheid initially separated men from women and whites from "coloreds" on BCI. "The first women to conduct field work in the tropics encountered many of the well-known barriers to professional women," writes Pamela Henson, "as well as the challenges of dealing with unfamiliar environments and cultures."[33] Disputes about whether or not grounds keepers of "white descent" had the privilege of using the white toilet, the same toilet used by researchers, were among the contentious subjects animating the correspondence among founders of the biological station.[34]

Barro Colorado Island, with its sharply divided social worlds, was a microcosm of the Canal Zone—a place of U.S. military operations that was off-limits to Panamanian citizens who did not carry a special pass. Gamboa, the nearest town, was designed by the U.S. government "to reflect and facilitate a system of industrial relations based on a rigid class and racial hierarchy…with a sharply segregated workforce divided by a dual wage system into 'gold' (white/U.S.) and 'silver' (non-white/non-U.S.)." Even after the dual wage system was abolished in 1948, segregation was "a powerful institutional and cultural force." The architecture of many buildings, the clinic, for example, contained separate entrances, waiting rooms, examination rooms, physicians offices, and overnight quarters for "silver" and "gold" social categories.[35]

Whites, in the gold category, came to call themselves "Zonians." A third generation Zonian, who masquerades under the anonymous username of killbyte, has posted photographs on Flickr and snippets of text that offer candid views of a social world united by doing fun things together amidst a military occupation: "I am indeed part of a small, privileged group that belong to a dwindling, elite club that will never exist again. Yes, perhaps it was an experiment in US colonialism - they made sure we retained our

US heritage by importing everything cultural that made us feel like US citizens, but we were distinct enough in the sense that we could go into the rain forest & use it as our own private playground. The jungle swimming holes were amazing!"



The Smithsonian Tropical Research Institute began administering Barro Colorado Island in 1946. By 1997, when I made my own pilgrimage to BCI as an undergraduate research assistant, the entitlements of white Zonians were rapidly dwindling. Still, some measures of distinction and segregation were in place. My U.S. passport continued to grant me privileges—like entry to the old Officer's Club on Clayton Army Base. My citizenship also facilitated my initial access to BCI. A 40 minute boat ride separated the Smithsonian's living laboratory from Gamboa and it remained inaccessible to ordinary Panamanians who could not afford to pay for a day-long guided nature tour. In the 1990s, local historical memories were haunted by the 1989 U.S. invasion of Panama that deposed President Manuel Noriega (who was formerly a long-time CIA "asset") and killed some 3,000 civilians.[36] Future uncertainties also loomed large on the horizon. The U.S. was slated, in accordance with international treaties, to give the Canal Zone to the nation of Panama on December 31st, 1999. But, telegraphic messages from powerful political factions in Washington signaled that the foretold transfer of sovereignty might not come to be.

Parasites

As specters of warfare and political uncertainty haunted past and future horizons, I took up residence within the architecture of U.S. hegemony in Panama—a system characterized by a near-monopoly on military, economic, and political power (Sanchez 2002). Living in an insular world of expatriate scientists on Barro Colorado Island, I found a multitude of tenacious parasites. The word parasite is polysemic in French—meaning "noise" in addition to biological or social freeloader.[37] For Michel Serres, whose monograph, *The Parasite*, celebrates the productive and creative nature of noise, "the parasite doesn't stop...making thousands of noises or filling space with its swarming and din...it runs and grows. It invades and occupies."[38] On BCI I encountered ecological scientists whose imaginations had been captured by a diversity of literal parasites: woody liana vines, mycorrhizal symbionts, wild fruit flies and their fungal companion species, as well as a queer gender-bending bacteria called *Wolbachia*.[39]

Outwardly a single goal, "to increase understanding of the past, present, and future of tropical biodiversity and its relevance to human welfare", united the scientific endeavors on BCI. Certainly some research projects at the Smithsonian facilities were directly related to U.S. strategic interests in the region. Others were parasitic. Ecological scientists from all corners of the globe, U.S. citizens and foreign nationals, had invaded the infrastructure of U.S. empire. Appropriating existing facilities, these scientists were exploring the whims of their own curiosity.

Laboring as a quasi-insider in the shadows of military installations, in the midst of failing imperial ambitions, I began to understand how oblique powers and unexpected contingent events were mediating research agendas.[40] While some projects on BCI were imagined as "pure research", my own work in Panama had a clear relation to U.S. geostrategic interests. If Cook's search for enemies of the boll weevil was directly in the service of the cotton industry, the project that initially brought me to Panama, about the community of ants living in the leaves that littered the forest floor, was indirectly in the service of the citrus industry. I volunteered on a study of the little fire ant (*Wasmania auropunctata*), an "invasive species" from Central America that had become common agricultural pest in the southern United States. In Florida and other southern states, these tiny ants were taking up residence on the leaves and fruit of citrus trees. Fruit pickers were demanding premium wages to work in infested groves, because the ants can deliver a painful sting—especially after getting inside of the worker's clothes.[41]

The Little Fire Ant (*Wasmannia auropunctata*)[42]

The little fire ant is a cosmopolitan insect, ranging over many different countries, free from national limitations or attachments. Spreading in ecosystems disturbed by humans, this ant has become a parasite in agricultural schemes to form the world.[43] Hitching a ride in shipments of produce, nesting in rolled leaves or dead sticks or almost anywhere, this nomadic species has taken up residence in West Africa, Melanesia, Polynesia, and islands throughout the tropical Americas. Following the introduction of the little fire ant to the Galapagos Islands, it drastically reduced and even extinguished the populations of every other ant species it encountered, including two endemics found nowhere else on the planet.[44]

My role in studying the "community regulating factors" of the little fire ant in Panama, was to place tuna fish baits at marked spots on the ground, to collect the ants that showed up in vials of alcohol, and identify them under the microscope back in the lab. While gathering data in tangles of underbrush, dripping with sweat from the sweltering heat, I became familiar with the habits of *Ectatomma*—a frequent visitor at the tuna fish baits. *Ectatomma* was one of the largest ants foraging on the forest floor and I came to easily recognize it with my naked eye.

One day, while walking the trails of BCI to the research plots on my daily commute, an unusual sight arrested my attention. I watched two *Ectatomma* workers, one carrying another, exit out of a colony entrance and make a bee-line towards the entrance of another colony several meters away. When the pair reached the other entrance, they disappeared inside.[45]

In the era when I made this observation, the late 1990s, the genetic determinism of E. O. Wilson's sociobiology held sway among ant experts. In the ideal ant colony (at least according to the ideals of Wilson and his followers) there is a single queen and all of the workers are sisters: non-reproductively viable females.[46] Sociobiologists have asserted that "the colony is a superorganism." Nests of ants have been "analyzed as a coherent unit and compared with the organism in the design of experiments, with individuals treated as the rough analogues of cells." In an encyclopedic tome published in 1990, simply titled *The Ants*, Bert Hölldobler and E. O. Wilson speculated that "natural selection can produce selfish genes that prescribe unselfishness."[47]

As an undergraduate, majoring in anthropology and biology, I became fascinated by behaviors of *Ectatomma ruidum* that did not fit with the prevailing consensus. Carefully observing ants in the field, I speculated that they were embedded in endlessly expansive networks. If ant colonies were to be understood as superorganisms, my observation of workers moving among colonies suggested that the cells were running wild. My love of *Ectatomma* developed from these initial surprising observations. Later, while watching different colonies on separate occasions, I observed the transfer of food, larvae, and even winged queens amongst distinct nests. Putting up a barrier around one focal colony, I let the ants collect all the tuna fish they wanted for an hour. After removing the barrier, and the bait, I watched as tuna fish was redistributed. Ants exited the focal colony and carried it into the nests of neighbors. Minutes after watching tuna entering one nest, I watched as it was carried out again to an even more distant nest.

The social world of BCI was like a summer camp—this community of aspiring scientists worked hard and played hard. Once a year, island residents would dress up in fancy hats and dresses for Derby Day, a race involving cane toads and dung beetles. Even as I marveled at the excesses of the modern world system—watching cruise ships and massive cargo vessels pass through the canal, a stone's throw away—I became absorbed in the world of *Ectatomma*.

Ontological Amphibians

When I later discovered Cook's writings, buried in the annals of science, I realized that his imagination had been captured by some of the same social behaviors that I later observed in this insect. Cook found that neighboring *Ectatomma* colonies were not hostile to one another. "The power of ants to distinguish at once between members of their own and of other colonies has long been recognized as one of the most remarkable refinements of instinct," wrote Cook in 1905. Whereas most ants exhibit open violence to individuals from different colonies, he found that neighboring *Ectatomma* nests were not actively hostile towards one another. "Members of two colonies will forage on the same cotton plant or tree trunk with no signs of animosity," he reports. "Stranger ants introduced into captive colonies for observation have not been attacked. They usually receive little attention; if they enter the burrow they are likely to be brought out and carried to the boundary of the enclosure, but are released without injury."[48]

Cook understood these unusual social dynamics amongst neighboring *Ectatomma* nests in the context of what he thought was a distinctive breeding system. In his mind, *Ectatomma* colonies did not exhibit the typical mode of reproduction for ants. Generally, tales of romance amongst ants orbit around nuptial flights where young ant queens and wasp-like males mate in mid-air. The queens usually return to earth, where they rip off their own wings and excavate a new nest. Cook observed male and female *Ectatomma* mating inside of nests.[49] Like me, he also observed the transfer of worker ants, larvae, and queens amongst distinct nests—a mode of colony foundation that he termed "swarming."[50]

In the pages of *Science*, one of the most prestigious journals then and today, Cook argued that *Ectatomma*'s swarming behavior was one feature that made it an exceptional animal species with a "highly developed social system."[51] He penned a loving 55-page monograph wherein he suggested that *Ectatomma* are not actually ants, but "*keleps*":

> To avoid in some measure the misapprehension likely to be caused by calling it an ant it seems desirable to introduce with the insect its distinctive Indian name, *kelep*. In the minds of the natives of Guatemala the *kelep* is not a kind of ant, but an independent animal not to be associated with ants. The more we learn about it the more this aboriginal opinion appears justified, not alone because the *kelep* is a beneficial insect, but because it has a different mode of existence and a different place in the economy of nature.[52]

Cook's dramatic pronouncements quickly caught the attention of William Morton Wheeler, who was perhaps the most prominent early 20th century ant biologist and then the curator of invertebrate zoology at the American Museum of Natural History. Writing a series of critical salvos in *Science*, Wheeler railed against Cook's claims and asserted that *Ectatomma* is unequivocally a member of the ant family (Formicidae) and an unexceptional member of the "relatively unplastic" Ponerinae sub-family:

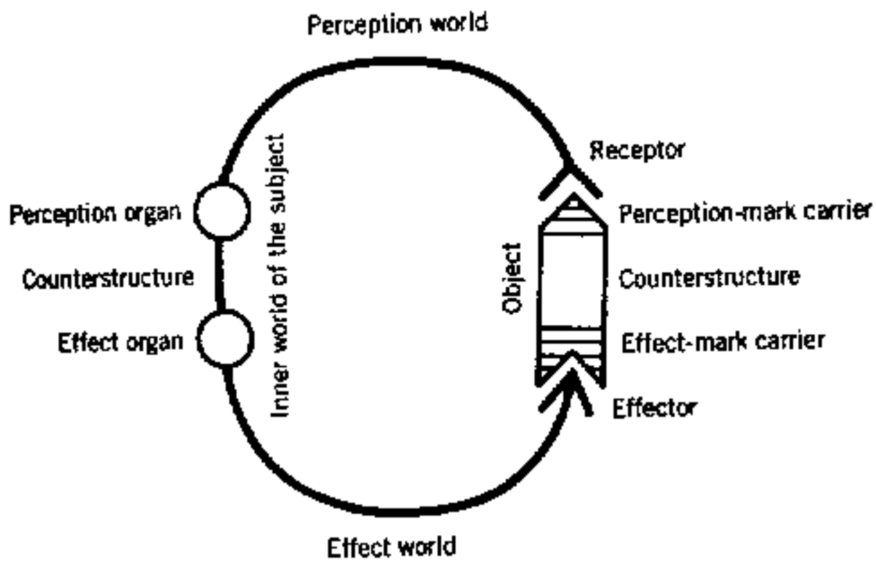
> Dr. Cook evidently wishes to make us believe that the *kelep*...is really a creature *sui generis* which the advanced systematist would do well to regard as the sole representative of a distinct family, the Kelepidae. Here he shows admirable self-restraint, for it might just as well be made the type of a new phylum (Kelepta) or subkingdom (Kelepozoa). At any rate, it is clear that the *kelep* rises to a dignity analogous to man, whom certain theological taxonomists regard as a poor, though upright primate physically, but as belonging psychically to an entirely different order of being.[53]

Leaving aside this dispute about *Ectatomma*'s taxonomic status, I would like to engage with the suggestion that this species might be accorded a dignity analogous to the human.[54] This debate of yesteryear offers a fresh point of entry into the latest literature about human exceptionalism, an issue that still preoccupies our species more than 100 years later. Peter Sloterdijk, a neo-Heideggerian German philosopher, is one of the most vocal human exceptionalists alive today. Asserting that *Homo sapiens* is really a creature *sui generis*, Sloterdijk suggests that the distinctive feature of human existence is our "amphibious" nature. Sloterdijk maintains that animals "move around in an ontological cage" while human beings are constantly "switching from one element to another. The human being is a moving animal which longs to change elements and to go somewhere else. It is an ontological amphibian."[55]

Elsewhere I have poached Sloterdijk's phrase, "ontological amphibian", like a trespasser on a private hunting reserve of the elite literati, I have exceeded his original text through reading, "running it" the way one might run right past the command to stop from a red traffic light.[56] I argue that *Ectatomma* ants are figural amphibians that constantly move among worlds. If chefs "poach" pears, using red wine and honey to intensify and transform the flavor of the fruit, in poaching "ontological amphibians" my wine is Isabelle Stengers' cosmopolitics and my honey is Michel Serres' notion of the parasite.[57] If ontological amphibians are parasites, constantly getting inside the worlds of others, these nomadic creatures are also often escaping into the cosmos, into the unknown beyond particular worlds.

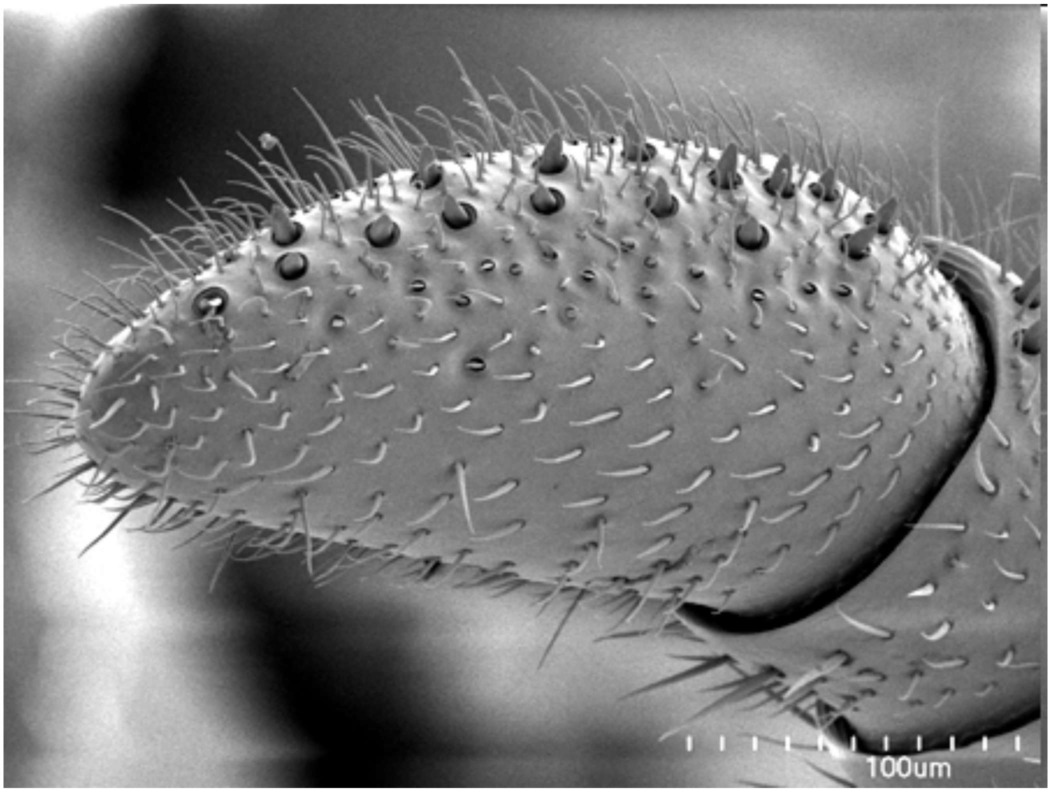
Grasping the World

Peter Sloterdijk understands the ontological cages of animal as closed "environmental worlds", or *umwelten*. Jacob von Uexküll, an Estonian biologist who was a contemporary of Cook and Wheeler, coined the word *umwelt* to refer to the phenomena an organism can perceive and also act upon. The German preposition '*Um*' denotes a ring, an enclosure, a surrounding.[58] Conscious beings are thus all enclosed within a phenomenological bubble, a world of perception and action. "Figuratively speaking," writes Uexküll, "every animal grasps its object with two arms of a forceps—receptor, and effector." Worlds (*welten*), then, are constructed by the tentative grasp of each creature.[59]



If von Uexküll forced his readers to look at familiar places with non-human eyes—the eyes of jackdaws, bears, and moths among other creatures—this disorientation attained the strongest figurative force with his description of the tick, according to Giorgio Agamben.[60] "The whole rich world around the tick," writes von Uexküll, "shrinks and changes into a scanty framework—her *umwelt*." Ticks are blind bloodsuckers that, according to von Uexküll, only attend to three cues: sunlight, butyric acid (a component of mammalian sweat), and warmth.[61] The poverty of the tick's world "guarantees the unfailing certainty of her actions." The three perceptual cues of the tick generate three distinct activity patterns: sunlight = crawl up, butyric acid = drop, warm hairy membrane = suck.[62]

In contrast to the impoverished *umwelt* of the tick, the world of *Ectatomma ruidum* is wealthy. This ant species has well developed compound eyes and can remember complex patterns of shadow and light.[63] Like many other insects, *Ectatomma* can see the polarity of light, a sensorial dimension to which *Homo sapiens* and most other mammals, are blind.[64] In addition to compound eyes, all ants have a pair of antennae, sensory organs that might be called (following Eva Hayward) fingeryeyes: components of a sensorial-ontology, a haptic epistemology, where knowledge comes from touching, tasting, smelling, groping, and reaching.[65] Covered with hair-like sensory organs (*sensillae trichoidea*), the antennae of *Ectatomma* enable them to detect a diversity of chemical compounds, humidity and heat.



Scanning electron micrograph of an ant antennae (Roberto Keller/AMNH)

A blog that is all about ants, called Archetype, has scripted a series of embodied exercises to help humans understand what it is like to grasp the world with antennae. While gazing at this Scanning Electron Micrograph, which is a picture of the sensors on the tip of an ant's antennae, I invite you embrace the spirit of Natasha Myer's work. Myers is an ethnographer who has chronicled dances performed by molecular biologists. I invite you to act out the exercises from the Archetype ant blog:

> Extend your arms forward with the palms of your hands facing down. Your *sensillae trichoidea* (Latin for hair-like sensory organs) will occur in the greatest number where your thumbs are. This arrangement is particularly suited to smell whatever is in front of your head....in addition to sensing various chemical compounds *sensillae* are involved in sensing humidity and heat. The most common *sensillae trichoidea* covering the hard and otherwise numb exoskeleton of adult ants (and Arthropods in general) are of the mechanoreceptor or tactile type, that is, the sense of touch. If you want to know what it feels like to have an insect sense of touch just gently brush the hairs on your arm.[66]

Some arthropods that use antennae to grasp the world, like ticks, perform a relatively narrow set of behaviors in response to information that they glean from touching, tasting, smelling, groping objects, and other beings. In contrast, social insects, like bees and ants, demonstrate "excellent learning capabilities", in the words of Zhanna Reznikova, a Russian biologist who studies ant behavior. Ants encode complex memories in "mushroom bodies", structures inside their brain that are shaped like mushrooms. "The quantity of neurons does not make the cleverest organism," Reznikova argues. "Memory sits comfortably in mini-brains."[67] *Ectatomma* ants have the capacity for time-place learning, they associate specific feeding places with different times of day.[68]

Ectatomma ants communicate with each other by releasing chemical pheromones, through mutual groping and tactile stimulation with antennae, as well as by making chirping noises—produced by rubbing, or stridulating, parts of their exoskeleton. If the *umwelt* is an ontological cage for some organisms, where stimuli trigger predictable responses, certainly there are species, like *Ectatomma*, that take advantage of surprising encounters. Ontological amphibians grasp the world with provisional maps (subject to revision) of shifting entanglements.[69] Specific limits of *umwelten*, the rings that enclose creatures in phenomenological worlds, structure the gaps in the gaze of creatures across the species interface. Agents locked in reciprocal capture, who inhabit common cosmopolitical worlds, can grasp each other—even if they can't always hold on, even if there are disjunctures in their interests.

<u>Cutting the Network</u>

If memory sits comfortably in the mini-brains of ants, they are probably not holding on to recollections of their individual sisters, the members of their colony. Insects are generally thought to be incapable of recognizing each other as individuals. With upwards of 300 ants in an *Ectatomma* colony, it is highly unlikely that each colony member recognizes one another. A colony scent, "a complex Gestalt of hydrocarbons" on the cuticle of their exoskeleton, is instead learned by ants. This odor is largely independent of genetic factors and is instead thought to be spread through shared food exchange and grooming.[70] As Cook noted in his 1905 report, most ant species vigorously defend the boundaries of their colony—killing intruders from different colonies of the same species on contact. For most ant species the stranger is the enemy "with whom there is the real possibility of a violent struggle to the death."[71]

Ectatomma is different than most ant species—it is exceptional, in fact. Workers will sometimes stand in their nest entrance, and occasionally bite or drag away other ants that are trying to get inside. But often the nest entrances stand empty. "Guard" ants also sometimes stand aside, letting members of neighboring nests, or even ants from colonies several hundred yards away, pass unmolested. Once inside, these neighbors have access to caches of food.

While volunteering on BCI in 1997 I began excavating *Ectatomma* colonies and keeping them in transparent test tubes in the Smithsonian labs. Inside of these nests adults spent much of their time grooming themselves and others. Introducing ants from other colonies, I found that they were often bitten at first, pulled around the chamber by resident ants. With time, I found that the strangers were sometimes adopted—enlisted into the social world of the colony. They began doing things together with the other ants—grooming the adults and caring for the larvae.

In the field I found that *Ectatomma* ants sometimes become captured by multiple social worlds. Marking individual adults with paint, and gripping their hind leg with a pair of steel forceps, I positioned them at the entrance of colonies that were not their own. Almost unfailingly, when released, the ants went inside. On follow-up visits to these same nests, I found marked ants foraging for food and bringing it back to their new home.

In the midst of these casual observations as an undergraduate I found a series of studies about "thievery" amongst neighboring *Ectatomma* colonies by Michael Breed, a senior behavioral biologist who subscribes to the dominant paradigms of sociobiology.[72] Breed found that individual "thief ants" use chemical camouflage to gain access to neighboring colonies. "Thief ants have reduced quantities of cuticular hydrocarbons on their surface," Breed reported, "and their cuticular hydrocarbon profile is intermediate between the hydrocarbon profile of their own colony and the colony from which they are stealing."[73]

By the time I began reading Michael Breed's papers about thievery, my own observations of *Ectatomma* colonies had already led me to suspect that there was more to the story than "stealing." At the time I speculated that they might be engaged in altruism rather than thievery. In 1997 I began collaborating with Bill Wcislo, a newly hired Smithsonian Staff Scientist who specializes on bees and other social insects, to design an experiment about the colonial boundaries of *Ectatomma*. Bill has a mop of curly hair, glasses, and, like me, is a big fan of Gregory Bateson. Together we designed an experimental manipulation to address a basic question: "Do *Ectatomma ruidum* workers regularly enter the nests of neighbors?"[74]

During experimental trials I spent close to 150 hours in the field—staring at small holes in the ground, squatting on my knees, waiting for something to happen. In short, during all this waiting and watching I found that *Ectatomma* ants do regularly enter the nests of their neighbors. I also discovered that ants from distant nests—from more than 300 meters away—can readily enter experimental colonies.[75] If conventional models of the ant colony resemble "a hub, or star, network in which all lines…radiate from a central point along fixed lines," I began to imagine that *Ectatomma* ants are entangled in something like a "distributed, or full-matrix, network in which there is no center and all nodes can communicate directly with all others."[76]

Marilyn Strathern astutely observes that the power of Actor Network Theory (ANT) also presents a foundational problem: "theoretically networks are without limit." Cutting the network, using one phenomenon to stop the flow of others, is what makes this analytic useful in the eyes of Strathern.[77] My study of *Ectatomma ruidum* also found that individual ants in colonies are always cutting the network, making high-stakes and potentially arbitrary distinctions between who is enemy and who is ally.[78] Rather than a categorical rejection of all non-kin, I found a nuanced pattern of graded recognition, where the frequency of hostility increased over topographic distance.[79]

If Hölldobler and Wilson speculated in 1990 that "natural selection can produce selfish genes that prescribe unselfishness," after more than two decades of searching, with genomic technologies of ever increasing sophistication, a gene for altruism has yet to be found. Departing from the notion of superorganism, I suggest that *Ectatomma* colonies might be understood as ensembles of individuals—these associations are composed of conscious agents who are entangled with other beings through relations of reciprocity, accountability, as well as kinship. The notion of *ensemble* is borrowed from Paul Kockelman, who in turn, has purloined William James' ideas about the self—the sum total of things we call our own. Selfhood involves what constitutes part of the ensemble. In human realms the self-as-ensemble includes one's clothes and house, one's ancestors and friends, one's nail clippings and excretions, one's body, soul, thoughts, and ways of being in the world. Actions oriented to the care of beings and things enlists them in the ensemble.[80] "To care for others is to care for one's self," writes Deborah Bird Rose in a related vein. "There is no way to disentangle self and other, and therefore there is no self-interest that concerns only the self."[81]

<u>Excess</u>

Feeding nestmates, with fluid exchanges of material and semiotic elements, enfolds individual adult ants into ensembles. Stephen Pratt, who studied communication behavior in *Ectatomma* in the 1980s, described the sharing of liquid food in this species with loving attention to detail: "Droplet-laden foragers returned immediately to the nest tube and, after a few seconds of excitation behavior, either stood still or walked slowly about the nest with [their] mandibles open and mouthparts usually retracted. They were generally approached within a few seconds by unladen workers who gently antennated the clypeus, mandibles, and labium of the drop-carrier, using the tips of their antennae. The carrier then opened its mandibles wide and pulled back its antennae, while the solicitor opened its mandibles, extruded its mouthparts and began to drink. During feeding, the solicitor continued to antennate the donor, who remained motionless. Usually the solicitor also rested one or both front legs on the head or the mandibles of the donor."[82]

William Morton Wheeler's exchanges with O. F. Cook in the pages of *Science* were only a small fraction of his writings about ants. Wheeler developed an elaborate model of the origin and continued functioning of insect societies based on his observations of exchanges of liquid food. He coined the term *trophallaxis*—deriving from the Greek words for "nourishment" and "interchange"—to describe this behavior in 1918.[83] Assuming that the proximate cause of certain behaviors was genetic, Wheeler argued that "the origin of the behavior of individual ants *within the context of the colony* could not be explained in terms of individual inheritance. Mutual feeding relations were the true and necessary cause of social forms of life."[84]

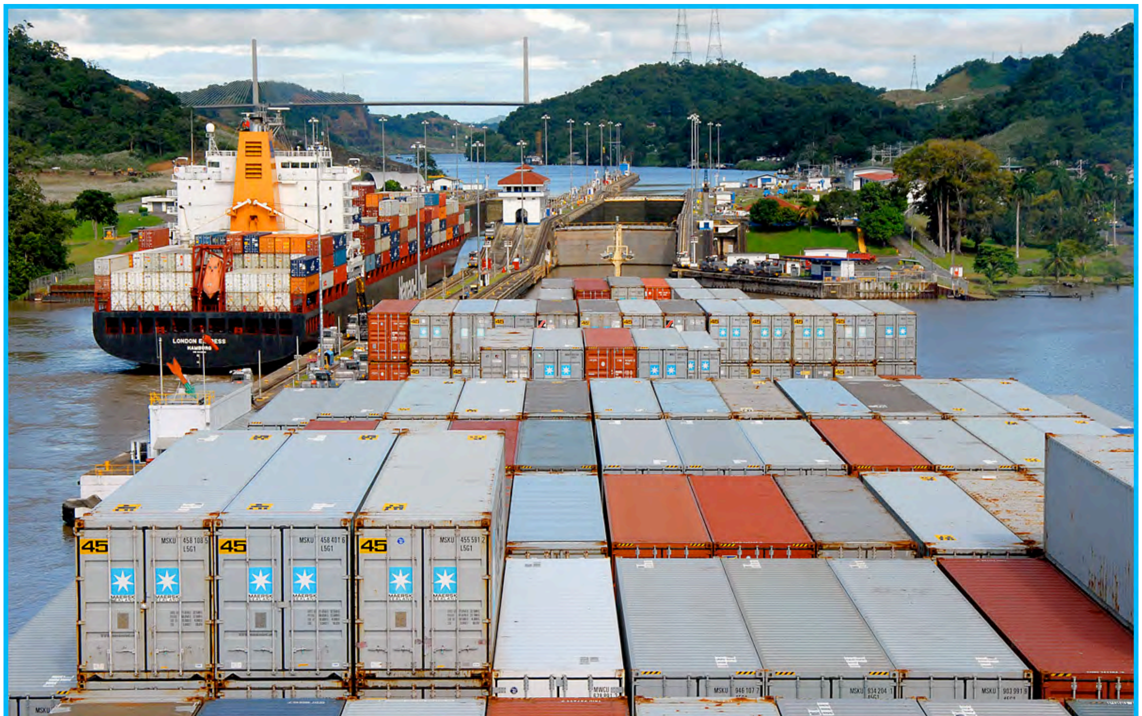
At least since the time of Wheeler's writings about *trophallaxis*, biologists have drawn analogies between the productive capacities of human societies and those of social insects—comparing the ability of human workers to earn wages to the ability of ant workers to collect food; comparing the collective wealth of a nation to the amount of energy stored in nests with caches of food or in the bodies of workers; comparing systems for producing commodities to systems for reproducing new ant queens.[85] These comparisons have been grounded in economic models of rationality and scarcity.

Wheeler based his model of ant society on the work of Vilfredo Pareto, an Italian economist from the early 20th century, who in his early work, assumed that human beings act rationally in pursuing their economic ends.[86] Later in life Pareto studied celebrations of great occasions, jubilees, graduation ceremonies, religious ecstasies, and excesses of all kinds.[87] Pareto suggested that human proclivities for these excesses were evidence of what he called "residues", forces which were distinct from instincts or biological drives, at least in his own original texts.[88] But, in William Morton Wheeler's hands, Pareto's work on "residues" was inflected with functional evolutionary explanations. Wheeler suggested: "The residues of the common man condemned him to a life that was functionally similar to the ant's."[89]

As I became interested in trophallaxis, I found myself paging forward from the work of Pareto to Georges Bataille—the librarian, surrealist, pornographer, and writer who argued that the exhaustion of excess is fundamental to the stability of societies. Bataille's basic premise is quite straightforward: "the energies of the laborer are not completely exhausted (utilized) in the labor process itself. Surplus value represents the measurable portion of the worker's productive capacity which does not return to him or her as a wage. There is, however, another surplus, an unmeasurable excess, which does not return to the production process but is expended 'unproductively' ."[90] Humans are compelled to destroy this surplus, according to Bataille, through large-scale festivals or wars.

Returning to Panama in 2008 with a "Science and Society" postdoctoral fellowship from the National Science Foundation, I found that "The Canal Zone" had become "The Reverted Zone." At a moment when reports of scarcity and global financial crises were looming large on the international stage, I beheld the excesses of the modern world system as massive cargo vessels and cruise ships passed nearby at dizzying speeds.

Initially I intended to conduct an ethnography of science in Gamboa. In my grant application to the National Science Foundation, I wrote: "The Smithsonian scientists lay claims on shared everyday technology and basic scientific infrastructure: telephones, high-speed internet access, a library, taxonomic reference collections, paved roads, office space, conference facilities, a scanning electron microscope, and air-conditioned laboratory space...[I will study] how assemblages of technology and infrastructure can both connect and separate social worlds. Villagers living on the edge of protected forests in central Panama do not have access to electricity, running water, and other basic infrastructure." As I inhabited this architecture of informatics and science, an infrastructure that enabled continued U.S. hegemony after the end of direct military occupation, my attention began to wander beyond strictly human worlds. I found myself spending long hours watching *Ectatomma*.



Cargo ships in the Panama Canal[91]

Joan Fujimura suggests that the Science Wars were "not about science versus antiscience, not about objectivity versus subjectivity, but about authority in science: What kind of science should be practiced, and who gets to define it?"[92] With this in mind I sought out a collaborative alliance with Bill Wcislo, the Smithsonian Staff Scientist who supported my undergraduate studies of *Ectatomma*. I told Bill about my first book, *Freedom in Entangled Worlds*, an ethnographic study of political collaborations in the Indonesian-occupied territory of West Papua. This project explored the construction of fleeting coalitions with unexpected allies and the multiple dreams that tug at the imagination of people who inhabit political borderlands.

Bill brought me up to speed about developments in the study of *Ectatomma* including new studies of thievery by Michael Breed. Needling at the basic tenants of sociobiology, I said: "Breed's characterization of these exchanges as thieving has always seemed hasty to me, perhaps neighboring colonies can become allies." Making a quick interdisciplinary translation and conceptual imposition, Bill said: "Nobody has ever demonstrated reciprocal altruism among distinct ant colonies. Lets see if you can." And after thinking a moment, he added: "I would never suggest this as a project to a biology postdoc. It won't involve any new techniques or fancy toys." Together Bill and I began to design an experiment that would speak to timely concerns in both of our disciplines.

Michael Breed's study of thievery was restricted to watching solid food move amongst nests above ground. Bill and I decided that further studies should focus on the exchange of liquid food, trophallaxis, in laboratory colonies. This would enable us to know if thievery was taking place or if gifts were involved, what Bill glossed as reciprocal altruism.

As I began collecting *Ectatomma* colonies for this experiment I visited a festive space, a place where the value-added excess of late capitalism is routinely consumed. I found a lively patch of ant nests in the leaf litter of a huge *Pseudobombax* tree and in the plastic litter left behind by human picnickers. In a fragment of forested land next to a waterfall in El Giral, a small farming community about an hour outside of Panama City, I uncovered six *Ectatomma* nests among packaging of two brands of chocolate chip cookies—Choki's and Creamas Cuky—a super sized Cheetos bag, and some discarded wrappers of Papitas, a cheese flavored snack. Amidst a left over cardboard case of Miller Genuine Draft, as well as Balboa and Panama brand beer cans, I discovered a red bottle cap, A Product of the Coca Cola Company, with a cryptic message printed inside: SIGUE PARTICIPANDO (Keep participating).

After having a picnic of my own in El Giral with friends—Daniella Marini, an Argentinean Masters student in Yale's Forestry Program, and Jesus Hernandez-Montero, a bat specialist from Mexico—I enlisted their help in observing and recording the transfer food amongst *Ectatomma* nests. In the shadows of human surplus, in this place where the excess fructose corn syrup and grain from North America and elsewhere was being expended in celebrating minor occasions and jubilees, we found certain species of non-humans flourishing. Distinct nests of *Ectatomma* were exchanging small insects, crumbs left by picnickers, as well as small protein-packed snacks from *Cecropia* plants called Müllerian bodies. Worker ants exited the entrance of one colony and marched, usually unmolested, into the entrance of another colony.

After unearthing three colonies in El Giral I transported them, in a U.S. government vehicle, back to the Smithsonian laboratories in the Reverted Zone. There I assembled an experimental apparatus out of found objects and specialized equipment—plastic tubs, petri dishes, dental cement, aquarium tubes, a slippery substance called fluon, and a Sony digital video camera. In working to produce an experimental matter of fact, that members of distinct *Ectatomma* colonies exchange liquid food via *trophallaxis*, I embedded certain assumptions in this apparatus—namely that these ants would come to regard my assemblages of plastic and plaster as "a nest" and that their behavior in such a nest, exposed to the light of day, is analogous to what they do underground.[93] After attaching two nests to a common foraging arena, and giving the ants a week to adjust to their new circumstances, I let the paired colonies interact.

Inside this experimental apparatus I duly observed and recorded *trophallaxis* amongst the colonies I collected from El Giral—workers holding drops of sugar water opened their mandibles, retracted their mouthparts, and fed workers from another colony who gently antennated the donor's clypeus, mandibles, and labium. When I paired the colony I collected from El Giral, with one from nearly 10 miles away in the Canal Zone, I initially observed aggression amongst the ants—biting and dragging each other around the foraging arena. After growing accustomed to each other, after about a week, these unrelated ants started venturing into each others colonies, and eventually feeding each other with *trophallaxis*.

These observations do not yet constitute a scientific fact—at this point there is a sample size of two paired colonies. If these observations can be replicated in other colonies, then it will be clear to the peers of Michael Breed that *Ectatomma* workers are not just engaging in thievery, as he suggested. Painting individual ants with a unique color code, and tracking their social interactions over long periods of time, would let us gather data that speaks to Bill Wcislo's hypothesis—that members of distinct *Ectatomma ruidum* colonies engage in reciprocal altruism. Finding that individual ants seem to be rational economic actors, like a long list of other animals—lions, crows, and baboons, for example—would certainly be of interest to many biologists. Perhaps, though, these creatures don't have good economic sense. Further research with *Ectatomma* might reveal that their gifts of liquid food might happen according to fleeting whims, sentiments about the distribution of surplus that escape rational calculus.

<u>Becoming with significant others</u>

If ants are part of ensembles with their own kind, if individuals are enfolded into relations of care through fluid exchanges with their peers and with their larvae, perhaps they also care for other species of beings and things. The lives of *Ectatomma* ants are entangled with plants that secrete sugary liquid offerings, phloem-sucking leafhoppers that exude honeydew treats out of their anus, and caterpillars that communicate with the ants in high-pitched stridulatory sounds.[94] Using a particularly clever trick some *Ectatomma* sniff out the pheromones of other ants, smaller species like *Pheidole*, and follow their chemical trails to sources of food.[95] To play with Heidegger's language, *Ectatomma* workers are captivated (*benommen*) by other beings and are open to possible becomings—new kinds of relations emerging from nonhierarchical alliances and symbiotic attachments with other agents.[96]

"The species of *Ectatomma* are widely distributed, enterprising ants," wrote Dr. O. F. Cook in *Science*. "The *kelep*, instead of being a rare 'archaic' curiosity, is decidedly the dominant and most abundant insect of the Guatemalan cotton fields."[97] Cook's work also offers ample evidence that *Ectatomma* ants are not trapped within the cage of a particular environmental world. In a separate *Science* article, he wrote: "the insect is not, like some of the members of its class, confined to a single plant."[98] Since Cook's time, other investigators have found this ant tending the extra-floral nectaries of many other plant species: for example, on woody liana vines (*Dioclea elliptica*) in the canopy of a low-land Amazonian rainforest of the upper Orinoco and on saplings of a tree in the legume family (*Stryphnodendron microstachyum*) on the Caribbean slope of Costa Rica.[99]

Wandering within the *cosmos*, the riotous diversity of the rainforest, individual *Ectatomma* ants form *political* articulations with particular individual plants. Building cosmopolitical worlds—together, tooth and nail, with other organisms—ants form stable, but contingent, relations against the backdrop of the unknowable beyond.

***Ectatomma* tending an extra-floral nectary of an understory plant (*Inga* sp.)**

Diverging values and obligations structure ambivalent relationships between ants and plants—cosmopolitical articulations characterized by mutual utility and mutual exploitation. Douglas Altshuler has found that the presence of my favorite ant species has certain positive effects for *Psychotria limonensis*, a common shrub in the forest understory of Central America. *Ectatomma* foragers increase the rate of pollination for this species—likely because they startle pollinators, like butterflies, making them move to other plants. Ants also serve the interests of *Psychotria* by defending the plant from herbivorous insects and preventing the loss of ripening fruits. The cosmopolitical world of *Psychotria* also includes fruit eating birds—tanagers, manakins, and neotropical migrants—that eat ripe fruits and disperse the plant's seeds. Even if both *Psychotria* and *Ectatomma* have cause to be interested in the continued existence of each other, the ants do not always act in the best interest of the plant and its avian companions. Ants scare off fruit-eating birds. After fruits ripen, the continued presence of ants thus does not serve the assumed interest of the plants in seeding new territory.[100]

While jealously guarding their plants from flighty interlopers, *Ectatomma* ants remain open to overtures from other entrepreneurial agents—creatures that work to enlist them in competing cosmopolitical worlds.[101] "Adding insult to herbivory," in the words of Philip J. Devries, *Ectatomma* ants sometimes welcome leaf-eating caterpillars to feast alongside them on plants with extra floral nectaries. These caterpillars have noise-making organs that attract *Ectatomma* and other sorts of ants. The sounds made by the caterpillars average at 1,877 hertz, which would be audible to human ears if they were not so very faint. Their repertoire ranges from simple "bub … bub …" sounds to fancier noises such as "beep ah ah ah beep" and "biddup … biddup … biddup." Caterpillar calls summon ants to their defense against predatory wasps and parasitic flies. As a reward for responding to the summons, the caterpillars secrete a liquid gift—a nutritious liquid that is significantly higher in amino acid concentrations than the plant nectar. *Ectatomma* ants tend the caterpillars "with greater frequency and fidelity" when compared to the plant.[102]

A leaf-eating caterpillar (*Thisbe irenea*) and *Ectatomma* hovering around a nectary.

Perhaps Lori Gruen's notion of entangled empathy might help explain why ants have greater fidelity for caterpillars rather than plants. Entangled empathy is not a mere instinctual response, but involves a commitment to the well being of others—an awareness of others interests and a motivation to satisfy those interests. Gruen is developing her ideas about empathy to understand multispecies entanglements—specifically her own interactions with chimpanzees. Exporting these ideas beyond our own situated perspectives, the embodied *umwelt* of primate vision, contains the danger of imposing anthropomorphic assumptions on other worlds. Even still, Gruen's work prompts me to ask: Do ants perceive the interests of the plants they protect? Do they recognize plants as beings in the world? Quite possibly not. Are ants aware of the caterpillars' interests and are they motivated to fulfill them? Quite possibly yes. With intriguing sounds, and an anatomical structure similar to ant larvae, it seems plausible that these caterpillars appear to *Ectatomma* as beings (cute baby insects) that demand empathetic regard.

Gruen's work also offers a point of entry to one of the central ethical questions of our time: how should we love in a time of extinction?[103] The agency of *anthropos*—the ethical and reasoning being that Enlightenment Europeans conjured as their inheritance from classical Greece—has recently been scaled up to embrace and endanger the whole planet. In the Anthropocene, the era of excess when humans have become a geomorphic force, our species has been figured as the agent driving climate change and the large-scale destruction of ecological communities. In this context, Deborah Bird Rose and Tom van Dooren have asked: "Given that creatures who are so vividly present in our imaginative lives are nonetheless on the edge of loss, what hope could there possibly be for the countless other creatures who are less visible, less beautiful, less a part of our cultural lives? What of the unloved others, the ones who are disregarded, or who may be lost through negligence? What of the disliked and actively vilified others, those who may be specifically targeted for death?"[104]

Escape

With these questions in mind I ventured beyond the realm of the Smithsonian Tropical Research Institute, a social world of ecological scientists where my own love for *Ectatomma* was unremarkable. I began living as an ethnographer in the City of Knowledge—formerly Clayton Army Base, the one-time command/control/intelligence center of the U.S. Military's Southern Command. My temporary residence was an army barracks that had been converted into a backpacker hostel. Here the landscape of empire had become a picturesque spot of refuge for road-weary travelers on the gringo trail.

The City of Knowledge is now a suburban enclave populated by middle-class Panamanians, indigenous Kuna, staff of international organizations, and a few remaining white Zonians. Here transnational institutions of governmentality and medicalization have begun to inhabit the infrastructure left behind by the U.S. military: The Red Cross, the Nature Conservancy, the United Nations, and the Organization of American States are among the new resident organizations. On an evening bicycle ride in misty rain, I found many other residents engaged in the pursuit of physical fitness. An aerobics instructor was screaming out chants at the top of his lungs to a group of women doing exercises on big inflatable balls inside a huge Kiwanis Club gymnasium. A pair of men, pitcher and batter, were at work in a nearby cage. Joggers, and many other bikers, hailed me with smiles, nods, and lifted eyebrows—recognizing me as a fellow recreator and a possible neighbor.

I found *Ectatomma* ants foraging in the shadows of abandoned satellite dishes, collecting dead insects under electric lights, and living in an expansive network of nests in neatly manicured lawns. Few of my fellow humans were articulate about the ants living in the grass, all around them. More than one of my interlocutors looked at me as if I were a little off, for initiating a conversation about insects. Only after living in the Reverted Zone for several weeks, did I discover some housewives and grounds keepers periodically going around their lawns with boxes of powdered poison, sprinkling it on ant nests.

Ectatomma is flourishing in the Anthropocene. Quick to exploit emergent opportunities, never just sticking to one world, these ants are constantly moving amongst different beings and are open to possible becomings in multiple worlds. Occasional attempts to senselessly poison them aside, this species is proliferating largely beyond the purview of human dreams and schemes. These amphibious creatures are perhaps comfortable with their status as "unloved others", anxious to escape from fleeting encounters with humans into the cosmos, into the unknown beyond anthropocentric worlds.

Over a century ago Cook's love of *Ectatomma* stemmed from a desire to enlist this ant species in the production of a common world. Working to embody what Donna Haraway would now call lively capital, Cook tried to stabilize an agro-industrial world with a motley array of lively beings, in which commerce and consciousness, ethics and utilities were all in play.[105] Ultimately his project failed. He "planted" dozens of *Ectatomma* colonies in the cotton fields of Texas during the summer of 1904. But by March 1905 Cook was not expecting any of the few remaining ants to survive beyond the month.[106] Governing the life of this species—"making live" (*faire vivre*)—proved to be beyond his capacity to care. He could only let the ants die (*laissez mourir*). As Cook failed to serve the interests of the ants under his care, the media raged with allegations of financial mismanagement, and his supervisors were forced to respond to "sore questions."[107]

The world of *Ectatomma*, like all organisms, is thus not endlessly expansive. If members of this entrepreneurial species are always cutting the cosmos—forming ensembles by caring for other beings and things—there is certainly a limit to their world-forming practices.

Sharing this planet with a multitude of species that are not trapped in ontological cages, amphibious agents that are remaking the world, we must refuse the soporific seductions of a return to Eden.[108] We must refuse the cosmopolitan illusion of Immanuel Kant that there might ever be a final peace.[109] While working to contain cosmopolitan nomads, creatures like the little fire ant that are irredeemably destructive, I suggest that we should learn to better embrace species like *Ectatomma*, cosmopolitical amphibians that are good for humans to live with in common worlds. Being with this species responsibly might involve an openness to possible becomings from a respectful distance. If touching significant others, in Haraway's words, generates lively becomings with certain species of companions, "flesh-to-flesh and face-to-face", then ethical engagements with other sorts of critters demands tactful politeness.[110] Composing common worlds with other amphibians might involve enacting new sorts of loving gestures, making tactful cosmopolitical proposals that leave room for the possibility of escape.

[1] Raffles, Hugh. *The Illustrated Insectopedia: Insect Love from A-Z*. New York: Pantheon/Vintage, 2010; Kosek, Jake. "Ecologies of Empire: On the New Uses of the Honeybee." *Cultural Anthropology* 25, no. 4 (2010): 650-78; Zerner, Charles. "Stealth Nature: Biomimesis and the Weaponization of Life." In *In the Name of Humanity: The Government of Threat and Care*, edited by Ilana Feldman and Miriam Tictin. Durham: Duke University Press, 2011.
[2] Haraway, Donna. *When Species Meet*. Minneapolis: University of Minnesota Press, 2008, p. 21.
[3] Here I am in dialogue with Raymond Corbey and Annette Lanjouw who kindly invited me to an Arcus Foundation conference devoted to "Rethinking the Species Interface", where I presented an earlier draft of this paper.
[4] Heidegger, Martin. *The Fundamental Concepts of Metaphysics*. Bloomington: Indiana University Press, 2010, p 201; cf. Agamben, Giorgio. *The Open: Man and Animal*. Stanford: Stanford University Press, 2004, p. 51.
[5] Sloterdijk, Peter. *Spheres Volume 1: Microspherology*. Cambridge: The MIT Press, 2011.
[6] Isabelle Stengers has kindly shared a draft of Cosmopolitics II with me. This book will be published by the University of Minnesota Press in Fall 2011. (Book VII: 64)
[7] Stengers, Isabelle. "The Cosmopolitical Proposal." In *Making Things Public: Atmospheres of Democracy*, edited by Bruno Latour and Peter Weibel, Cambridge: MIT Press, p. 995.
[8] Latour, Bruno. *Politics of Nature*. Cambridge: Harvard University Press, p. 455.
[9] Stengers, Isabelle. *Cosmopolitics I*. Minneapolis: University of Minnesota Press, 2010, 35-6; also see: Haraway, Donna. *When Species Meet*. Minneapolis: University of Minnesota Press, 2008, p. 35, 42.
[10] Kockelman, Paul. "A Mayan Ontology of Poultry: Selfhood, Affect, Animals, and Ethnography." *Language in Society* 40 (2011): 1-28.
[11] "Enemy of the Boll Weevil", *Houston Post*, May 28, 1904, National Archives II, College Park, Maryland, Microfilm Publications M864, Records of the Division and Bureau of Entomology, 1863-1934.
[12] http://teamneem.com/Insects.html
[13] Margulis, Lynn, and Dorion Sagan. *Acquiring Genomes: A Theory of the Origins of Species*. New York: Basic Books, 2002, p. 205.
[14] Cook, O. F. "An Enemy of the Cotton Boll Weevil." *Science* 19, no. 492 (1904): 863.
[15] Callon, Michel. "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay." In *Power, Action, and Belief: A New Sociology of Knowledge?*, edited by John Law: Routledge & Kegan Paul, 1986; Latour, Bruno. *Science in Action*. Cambridge: Harvard University Press, 1987; Star, Susan Leigh, and James R. Griesemer. "Institutional Ecology, 'Translation,' and Boundary Objects: Ameteurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939." *Social Studies of Science* 19 (1989): 387-420.
[16] "$250,000 for Cotton Investigations", July 20th, 1904; "Memorandum Concerning Allotment of Boll Weevil Appropriation, Fiscal Year Beginning July 1, 1905", National

Archives II, College Park, Maryland, Microfilm Publications M864, Records of the Division and Bureau of Entomology, 1863-1934.

[17] W. H. Hunter to L. O. Howard, July 14, 1904, National Archives II, College Park, Maryland, Microfilm Publications M864, Records of the Division and Bureau of Entomology, 1863-1934.

[18] "Enemy of the Boll Weevil", *Houston Post*, May 28, 1904, National Archives II, College Park, Maryland, Microfilm Publications M864, Records of the Division and Bureau of Entomology, 1863-1934.

[19] W. H. Hunter to L. O. Howard, July 20, 1904, National Archives II, College Park, Maryland, Microfilm Publications M864, Records of the Division and Bureau of Entomology, 1863-1934.

[20] M. Foucault, *The History of Sexuality* (New York, 1978), 139.

[21] Cook, O. F. "The Social Organization and Breeding Habits of the Cotton-Protecting Kelep of Guatemala." *Technical Series of the U.S. Department of Agriculture, Bureau of Entomology* 10 (1905): 46.

[22] If initial ideas of *interessement* had an anthropocentric and entrepreneurial bias (Collins and Yearley 1992: 313), they still have the potential to do new work as we study contact zones where species meet as well as intra-specific relations. Collins, H. M., and Steven Yearley. "Epistemological Chicken." In *Science as Practice and Culture*, edited by Andrew Pickering. Chicago: University of Chicago Press, 1992.

[23] "Larvae of at least some ponerines, myrmicines, and formicines donate small quantities of apparently nutritious liquid from their mouthparts to the adults." Holldobler, B. and E. O. Wilson (1990). The Ants. Cambridge, Harvard University Press, p. 348; Cassil, D. L., J. Butler, et al. (2005). "Cooperation during prey digestion between workers and larvae in the
ant, *Pheidole spadonia*." Insectes Sociaux **52**: 339-343.

[24] Image from http://pbertner.wordpress.com/2011/01/22/noahs-ark-shipwrecked-on-the-kanuku-mountains/

[25] Social worlds involve collective action—they are classically defined as people "doing things together." Becker, H. (1986). Doing Things Together: Selected Papers. Evanston, Illinois, Northwestern University Press, p 21.

[26] Clarke, A. (1998). Disciplining Reproduction: Modernity, American Life Sciences, and "the Problems of Sex". Berkeley, University of California Press, p. 15; Strauss, A. (1978). "A Social World Perspective." Studies in Symbolic Interaction **1**: 119.

[27] Here I am in dialog with the work of Karen Barad, Donna Haraway, and Eva Hayward.

[28] Kockelman, P. (2011). "A Mayan Ontology of Poultry: Selfhood, Affect, Animals, and Ethnography." Language in Society **40**: 1-28.

[29] Star, S. L. and J. R. Griesemer (1989). "Institutional Ecology, 'Translation,' and Boundary Objects: Ameteurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939." Social Studies of Science **19**: 387-420; Callon, M. (1986). Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay. Power, Action, and Belief: A New Sociology of Knowledge? J. Law, Routledge & Kegan Paul.

[30] Henson, P. M. (2002). "Invading Arcadia: Women Scientists in the Field in Latin America, 1900-1950." The Americas **58**(4): 577.
[31] Rose, D. B. and T. van Dooren (2011). "Unloved Others: Death of the Disregarded in the Time of Extinctions." Australian Humanities Review **50**: 11.
[32] Haraway, D. (2008). When Species Meet. Minneapolis, University of Minnesota Press, p. 244.
[33] Henson, P. M. (2002). "Invading Arcadia: Women Scientists in the Field in Latin America, 1900-1950." The Americas **58**(4): 578.
[34] Zetek to Barbour, May 5th, 1927, Smithsonian Institution Archives, Washington D.C., RU 134, Box 1, Folder 12 of 12.
[35] Ventocilla, J. and K. Dillion (2010). Gamboa: A Guide to its Natural and Cultural Heritage. Panama, The Smithsonian Tropical Research Institute, pp. 25; 124.
[36] http://en.wikipedia.org/wiki/Panama_Invasion
[37] Wolfe, C. (2007). Introduction. The Parasite. M. Serres. Minneapolis, University of Minnesota Press, p. xiii.
[38] Serres, M. The Parasite. M. Serres. Minneapolis, University of Minnesota Press, p. 253.
[39] Tim Choy (et al.) have written about the "mycorhizal sociality" of matsutake mushrooms. Currently I am writing about *Wolbachia* as part of a collaborative writing project—an edited book called "The Multispecies Salon." Choy, T., L. Faier, et al. (2009). "A New Form of Collaboration in Cultural Anthropology: Matsutake Worlds." American Ethnologist **36**(2): 380-403.
[40] Garcia Canclini, N. (2005). Hybrid Cultures: Strategies for Entering and Leaving Modernity. Minneapolis, University of Minnesota Press.
[41] See Wikipedia entry on Wasmannia (Smith 1965; Spencer 1941)
[42] http://www.antweb.org/specimen.do?name=casent0178173&shot=p&project=allantwebants
[43] Cosmopolitans (a la Immanuel Kant) are dangerous nomads, in the eyes of Isabelle Stengers—they are irredeemably destructive or tolerant without attachments to common worlds.
[44] Clark, D. B., C. Guayasamin, et al. (1982). "The tramp ant *Wasmannia auropunctata*: autoecology and effects on ant diversity and distribution on Santa Cruz Island, Galapagos." Biotropica **14**(3): 196-207.
[45] Later I found an article by Stephen Pratt describing the "kidnapping" of young workers by *Ectatomma* ants from neighboring colonies.
[46] There is considerable deviation from this ideal type. In many species, *Ectatomma* included, colonies can have multiple queens. Workers can also lay eggs—some which are eaten by other adults and others which develop into larvae. The males—with wings, small heads, and a waspy look—take little part in colony life other than mating. Shik, J. Z. and M. Kaspari (2009). "Lifespan in Male Ants Linked to Mating Syndrome." Insectes Sociaux **56**: 131-134.
[47] Holldobler, B. and E. O. Wilson (1990). The ants. Cambridge, Mass., Belknap Press of Harvard University Press, p. 2, 179. See also Sleigh (p. 168-9) on Wilson fitting into

military and industrial schemes. Sleigh, C. (2007). *Six Legs Better: A Cultural History of Myrmecology*. Baltimore, The Johns Hopkins University Press.

[48] Cook, O. F. (1905). "The Social Organization and Breeding Habits of the Cotton-Protecting Kelep of Guatemala." *Technical Series of the U.S. Department of Agriculture, Bureau of Entomology* **10**: 14.

[49] Cook, O. F. (1906). "Please Excuse the Kelep." *Science* **23**(579): 188.

[50] "Swarms of honeybees are often gentle, sometimes confused," writes Jake Kosek. "I have even seen a swarm return to a hive that it previously left—a collective behavior that is not supposed to happen." For an account of how swarming has been appropriated by pentagon strategists, see Kosek's article: Kosek, J. (2010). "Ecologies of Empire: On the New Uses of the Honeybee." *Cultural Anthropology* **25**(4): 650-678. For a more recent account on the possibilities of reclaiming this ambivalent form, see: Kirksey, S. E., C. Schuetze, et al. (2011). "Poaching at the Multispecies Salon." *Kroeber Anthropological Society Papers* **99/100**: 129-153.

[51] Cook, O. F. (1905). "Cotton Culture in Guatemala." *Yearbook United States Department Agriculture* **1904**: 485.

[52] Cook, O. F. (1905). "The Social Organization and Breeding Habits of the Cotton-Protecting Kelep of Guatemala." *Technical Series of the U.S. Department of Agriculture, Bureau of Entomology* **10**:7.

[53] Wheeler, W. M. (1905). "Dr. O. F. Cook's 'Social Organization and Breeding Habits of the Cotton-Protecting Kelep of Guatemala'." *Science* **22**(570): 707.

[54] In his 55-page monograph Cook wrote: "To call it a wasp or a bee would not misrepresent the practical facts more than to call it an ant. In reality the *kelep* represents a fourth category of social Hymenoptera, as distinct from the other three as they are from each other" (1905:7). In the pages of *Science* he made a more modest claim: "It becomes apparent that the Poneridae with which he is acquainted must be very different from the kelep. After observing colonies of *Ectatomma* and *Odontomachus*, both in nature and in captivity, I am ready to follow Mayr and Ashmead in assigning these genera to separate families, as unlike, indeed, as rats and rabbits. Whatever may be true of other Poneridae or Odontomachidae, it seems that the species of Ectatomma are widely distributed, enterprising ants" (1904: 611). Looking back on this dispute, with the aide of emergent genomics technologies, it seems that Cook has now been vindicated. *Ectatomma* was pictured on the cover of *Science* in 2006. An article revealed that genetic and fossil evidence suggests that *Ectatomma* is in its own subfamily of ants, not in the Ponerine subfamily as Wheeler vehemently maintained. Cook, O. F. (1904). "Professor William Morton Wheeler on the Kelep." *Science* **20**(514): 611-612. Cook, O. F. (1905). "The Social Organization and Breeding Habits of the Cotton-Protecting Kelep of Guatemala." *Technical Series of the U.S. Department of Agriculture, Bureau of Entomology* **10**: 1-55; Moreau, C. S. (2006). "Phylogeny of the Ants: Diversification in the Age of Angiosperms." *Science* **312**: 101-104.

[55] ten Bos, R. (2009). "Towards and Amphibious Anthropology: Water and Peter Sloterdijk." *Environment and Planning D: Society and Space* **27**: 74.

[56] Certeau, M. d., L. Giard, et al. (1998). The Practice of Everyday Life. Minneapolis, University of Minnesota Press, 171; Kirksey, S. Eben "Ontological Amphibians", *American Anthropologist* (under review).
[57] Matsutake Worlds Research Group (2010). Thoughts for a World of Poaching. **2011**. *Cultural Anthropology* website: http://www.culanth.org/?q=node/364; Kirksey, S. E., C. Schuetze, et al. (2011). "Poaching at the Multispecies Salon." Kroeber Anthropological Society Papers **99/100**: 129-153.
[58] ten Bos, R. (2009). "Towards and Amphibious Anthropology: Water and Peter Sloterdijk." Environment and Planning D: Society and Space **27**: 74.
[59] "Uexküll begins by carefully distinguishing the *Umgebung*, the objective space in which we see a living being moving, from the *Umwelt*, the environment-world that is constituted by a more or less broad series of elements that he calls 'carriers of significance' (*Bedeutungstrager*) or of 'marks' (*Merkmaltrager*), which are the only things that interest the animal. In reality, the *Umgebung* is our own *Umwelt*, to which Uexküll does not attribute any particular privilege and which, as such, can also vary according to the point of view from which we observe it. There does not exist a forest as an objectively fixed environment: there exists a forest-for-the-park-ranger, a forest-for-the-hunter, a forest-for-the-botanist, a forest-for-the-wayfarer, a forest-for-the-nature-lover, a forest-for-the-carpenter, and finally a fable forest in which Little Red Riding Hood looses her way." Agamben, G. (2004). The Open: Man and Animal. Stanford, Stanford University Press, pp. 40-1; von Uexkull, J. (1992 [1934]). "A Stroll Through the Worlds of Animals and Men: A Picture Book of Invisible Worlds." Semiotica **89**(4): 323.
[60] Agamben, G. (2004). The Open: Man and Animal. Stanford, Stanford University Press, p. 45.
[61] Since von Uexküll's work on ticks in the early 20th century, biologists have discovered that they can attend to other stimuli, like "assembly pheremones" that are secreted by an individual tick that draw other members to a food source. Oliver, J. H. (1989). "Biology and Systematics of Ticks (Acari: Ixodida)." Annual Review of Ecology and Systematics **20**: 418-419.
[62] von Uexkull, J. (1992 [1934]). "A Stroll Through the Worlds of Animals and Men: A Picture Book of Invisible Worlds." Semiotica **89**(4): 325.
[63] Schatz, B., J.-P. Lachaud, et al. (1999). "Spatio-Temporal Learning by the Ant *Ectatomma ruidum*." The Journal of Experimental Biology **202**: 1897-1907.
[64] Holldobler, B. and E. O. Wilson (1990). The Ants. Cambridge, Harvard University Press, p. 367.
[65] Hayward, E. (2010). "Fingeryeyes: Impressions of Cup Corals." Cultural Anthropology **25**(4): 577-599.'
[66] Keller, R. (2009) "Homology Weekly: Sensillae Trichoidea", Archetype blog, Available on-line: http://roberto.kellerperez.com/2009/01/homology-weekly-sensillae-trichoidea/
[67] Reznikova, Z. I. (2007). Animal intelligence : from individual to social cognition. Cambridge ; New York, Cambridge University Press, pp. 79-80.
[68] Schatz, B., J.-P. Lachaud, et al. (1999). "Spatio-Temporal Learning by the Ant *Ectatomma ruidum*." The Journal of Experimental Biology **202**: 1897-1907.

[69] Here my thoughts are departing from the conversation between Isabelle Stengers and Bruno Latour about "the factishes that create and are created by our practices in particular" (Stengers 2010: 36). Perhaps all conscious subjects build epistemological architectures, edifices of factishes, to mask the unknowable beyond. The German preposition "Um" denotes a ring, an enclosure, a surrounding (ten Bos 2009: 75). I regard this distinctive ring of phenomenological worlds as an unstable architecture of factishes—a provisional map, subject to revision. Stengers, I. (2010). Cosmopolitics I. Minneapolis, University of Minnesota Press; ten Bos, R. (2009). "Towards and Amphibious Anthropology: Water and Peter Sloterdijk." Environment and Planning D: Society and Space **27**: 1-11.

[70] Animal intelligence : from individual to social cognition. Cambridge ; New York, Cambridge University Press, p. 365.

[71] Balakrishnan, G. and C. Schmitt (2000). The Enemy: An Intellectual Portrait of Carl Schmitt. New York, Verso, p. 108.

[72] Breed, M. D., P. Abel, et al. (1990). "Thievery, Home Ranges, and Nestmate Recognition in Ectatomma ruidum." Oecologia **84**: 17-121; Breed, M. D., L. E. Snyder, et al. (1992). "Acquired Chemical Camouflage in a Tropical Ant." Animal Behaviour **44**(519-523); Breed, M. D., T. McGlynn, et al. (1999). "Thief Workers and Variation in Nestmate Regognition in a Ponerine Ant, *Ectatomma ruidum*." Insectes Sociaux **46**: 327-331.

[73] Breed, M. D., T. McGlynn, et al. (1999). "Thief Workers and Variation in Nestmate Regognition in a Ponerine Ant, *Ectatomma ruidum*." Insectes Sociaux **46**: 327.

[74] The methods I adopted in the field were simple: A total of 953 ants from 94 different nests were used in 71 experimental trials. The introduced ants were taken from three different types of nests—*home*, *near*, and *far*—and were all then introduced into the *home* nests …For the purposes of this study, *near* nests are defined as the closest nest to the focal *home* colony which actively responded to a food (rice or tuna) bait placed near their entrance. These nests were usually less than 1 m distant. *Far* nests are defined as being greater than 300m from the *home* nest, which is many times beyond the foraging range of an individual nest…Ants were uniquely marked with spots of Testors® enamel on their pronotum and gaster. After allowing time for the paint to dry (> 20 min), the ants were introduced to the *home* nest by gripping their right hind tarsus with a pair of bent tip steel forceps, placing their head in the colony entrance, and releasing…During the introductions, and for a 2 hour time period after the introductions, I continuously observed the home nest, scoring the behavior and interactions of the introduced ants in several categories: exiting, bit while exiting, bit near the nest, and re-entering the home nest.

[75] A large majority of the painted ants stayed in the nest for the entire 2 hour observation period. I introduced a total of 225 home, 266 near, and 258 far ants in paired trails. Of these ants, 209 home ants (92%), 225 near ants (84%), and 191 far ants (74%) remained in the nest for the entire two hour observation period.

[76] Hardt, M. and A. Negri (2004). Multitude: War and Democracy in the Age of Empire. New York, The Penguin Press: 56-7.

[77] Strathern, M. (1996). "Cutting the Network." The Journal of the Royal Anthropological Institute **2**(3): 522-523.
[78] Balakrishnan, G. and C. Schmitt (2000). The Enemy: An Intellectual Portrait of Carl Schmitt. New York, Verso; Buck-Morss, S. (2000). Dreamworld and Catastrophe: The Passing of Mass Utopia in East and West. Boston, The MIT Press; Kirksey, S. E. (2012). Freedom in Entangled Worlds. Durham, Duke University Press.
[79] Out of the 953 ants introduced during the test trials, no home ants, 9 near ants, and 30 far ants were pulled out of the nests by resident ants, dragged away by their legs or antennae. Running statistical tests on these data, I found that these results were highly significant ($p<0.001$, three way interaction). I also found highly significant paired interactions for all three groupings: home vs. far ($p<0.001$), near vs. far ($p<0.001$), and home vs. near ($p<0.01$). While I was observing these nests I also recorded the numbers of unmarked ants (not manipulated during the experimental trial) that were dragged out of the nest by guards. More unmarked ants were dragged away (67 in total), than the combined total of ants I introduced from the home, near, and far nests.
[80] Kockelman, P. (2011). "A Mayan Ontology of Poultry: Selfhood, Affect, Animals, and Ethnography." Language in Society 40: 13.
[81] Rose, D. B. and T. van Dooren (2011). "Unloved Others: Death of the Disregarded in the Time of Extinctions." Australian Humanities Review **50**: 27.
[82] (Pratt 1989: 327).
[83] Sleigh, C. (2007). Six Legs Better: A Cultural History of Myrmecology. Baltimore, The Johns Hopkins University Press, p. 248, n. 4.
[84] Sleigh, C. (2007). Six Legs Better: A Cultural History of Myrmecology. Baltimore, The Johns Hopkins University Press, 79.
[85] Sleigh, C. (2007). Six Legs Better: A Cultural History of Myrmecology. Baltimore, The Johns Hopkins University Press, 169.
[86] Sleigh, C. (2007). Six Legs Better: A Cultural History of Myrmecology. Baltimore, The Johns Hopkins University Press, 86.
[87] Millikan, M. (1936). "Pareto's Sociology." Econometrica **4**(4): 327.
[88] Millikan, M. (1936). "Pareto's Sociology." Econometrica **4**(4): 324-337.
[89] Sleigh, C. (2007). Six Legs Better: A Cultural History of Myrmecology. Baltimore, The Johns Hopkins University Press, 86.
[90] Brenkman, J. (1979). "Introduction to Bataille." New German Critique **16**: 62.
[91] http://www.oil-electric.com/2011/08/panama-canal-expansion.html
[92] Fujimura, J. H. (1998). "Authorizing Knowledge in Science and Anthropology." American Anthropologist **100**(2): 347.
[93] Shapin, S. and S. Schaffer (1985). Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life. Princeton, N.J., Princeton University Press, pp. 14, 112.
[94] DeVries (1990). "Enhancement of Symbioses Between Butterfly Caterpillars and Ants by Vibrational Communication." Science **248**(4959): 1104-1106; Blüthgen, N., M. Verhaagh, et al. (2000). "How Plants Shape the Ant Community in the Amazonian Rainforest Canopy: The Key Role of Extrafloral Nectaries and Homopteran Honeydew." Oecologia **125**(2): 229-240.
[95] (Perfecto and Vandermeer 1993)

[96] Deleuze, G. and F. Guattari (1987). A Thousand Plateaus: Capitalism and Schizophrenia. London, Athlone Press, pp. 241–242; Kirksey, S. E. and S. Helmereich (2010). "The Emergence of Multispecies Ethnography." Cultural Anthropology **25**(4): 546.

[97] Cook, O. F. (1904). "Professor William Morton Wheeler on the Kelep." Science **20**(514): 611.

[98] Cook, O. F. (1904). "An Enemy of the Cotton Boll Weevil." Science **19**(492): 864.

[99] de la Fuente, M. A. S. and R. J. Marquis (1999). "The Role of Ant-Tended Extrafloral Nectaries in the Protection and Benefit of a Neotropical Rainforest Tree." Oecologia **118**(2): 192-202; Blüthgen, N., M. Verhaagh, et al. (2000). "How Plants Shape the Ant Community in the Amazonian Rainforest Canopy: The Key Role of Extrafloral Nectaries and Homopteran Honeydew." Oecologia **125**(2): 229-240.

[100] Altshuler, D. (1999). "Novel Interactions of Non-pollinating Ants with Pollinators and Fruit Consumers in a Tropical Forest." Oecologia **119**: 600-606.

[101] Callon, M. (1986). Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay. Power, Action, and Belief: A New Sociology of Knowledge? J. Law, Routledge & Kegan Paul; Latour, B. (1993). We Have Never Been Modern. Cambridge, Havard University Press; Kockelman, P. (2011). "A Mayan Ontology of Poultry: Selfhood, Affect, Animals, and Ethnography." Language in Society **40**: 1-28.

[102] DeVries 1990 Enhancement of Symbioses Between Butterfly Caterpillars and Ants by Vibrational Communication. Science 248(4959):1104-1106.
DeVries, P. J., and I. Baker 1989 Butterfly Exploitation of an Ant-Plant Mutualism: Adding Insult to Herbivory. Journal of the New York Entomological Society 97(3):332-340; http://www.phschool.com/science/science_news/articles/when_ants_squeak.html
http://www.bigsiteofamazingfacts.com/do-caterpillars-scream-to-protect-themselves-and-what-sounds-do-they-make

[103] Rose, D. B. and T. van Dooren (2011). "Unloved Others: Death of the Disregarded in the Time of Extinctions." Australian Humanities Review **50**.

[104] Rose, D. B. and T. van Dooren (2011). "Unloved Others: Death of the Disregarded in the Time of Extinctions." Australian Humanities Review **50**; Rose and van Dooren 2011; Kirksey, S. E. and S. Helmereich (2010). "The Emergence of Multispecies Ethnography." Cultural Anthropology **25**(4): 546.

[105] Haraway, D. (2008). When Species Meet. Minneapolis, University of Minnesota Press, p. 46.

[106] Weber, N. A. (1946). "Two Common Ponerine Ants of Possible Economic Significance, Ectatomma tuberculatum (Olivier) and E. ruidum (Roger)." Proceedings of the Entomological Society of Washington **48**(1): 6.

[107] If biopower has become, in the words of Rafi Youatt, "a form of ecologically distributed power that involves interventions in human and nonhuman lives" (2008: 409) then some of Foucault's original insights ring as true as ever: "It is not that life has been totally integrated into techniques that govern and administer it," he wrote, "it constantly escapes them" (1978: 143). Youatt, R. (2008). "Counting Species: Biopower and the

Global Biodiversity Census." Environmental Values **17**: 393-417; Foucault, M. and R. Hurley (1978). The History of Sexuality. New York, Pantheon.

[108] Haraway, D. (2007). Speculative Fabulations for Technoculture's Generations: Taking Care of Unexpected Country. (Tiernas)Criaturas/(Tender)Creatures. P. Piccinini. Vitoria, Egileak**:** 100-107.

[109] Stengers, I. (2005). The Cosmopolitical Proposal. Making Things Public: Atmospheres of Democracy. B. Latour and P. Weibel. Cambridge, MIT Press.

[110] Here I am inspired by the work of Matei Candea and Augustin Fuentes, who both write about "waiting together" with other species. Candea suggests that certain species demand "inter-patience," from humans, rather than straightforward "inter-action" (Candea 2010:249). Candea, M. (2010). "I Fell in Love with Carlos the Meerkat: Engagement and Detachment in Human-Animal Relations." American Ethnologist **37**(2): 241-258. Fuentes, A. (2010). "Naturalcultural Encounters in Bali: Monkeys, Temples, Tourists, and Ethnoprimatology." Cultural Anthropology **25**(4): 600-624; Candea, M. (2011). "We Both Wait Together: Poaching Agustin Fuentes." Kroeber Anthropological Society Papers **100**(1): 148-151.