Forthcoming 2012, The Journal of the Royal Anthropological Institute

THE EXPERIMENTAL HUT:

HOSTING VECTORS

ANN H. KELLY

London School of Hygiene and Tropical Medicine

ABSTRACT

In southeast Tanzania, ten canvass huts raised on wooden foundations occupy a plot of cleared rice field. Designed to simulate malaria transmission on the domestic scale, the experimental hut is constructed in the fashion of indigenous homes (complete with villagers, paid to spend the night) but is structurally modified to render mosquito behaviours visible. The experiment's domestic camouflage provides the setting for multiple, and reciprocal, hostings: between parasite, mosquito and man, and between villagers, volunteers and scientists. This paper explores the valences of hospitality when the 'home' becomes a site of experimentation, and the cosmopoltian encounters these experiments entail.

Just after sunrise, a teenage boy opens the door of the hut at the bottom of the hill. Though no different in size and shape from the homes clustered above it, the hut is constructed from canvass panels hung from a steel pipe framework and raised on a wooden plinth. He steps out onto the platform and swiftly latches the door behind him. In his arms he cradles four plastic cups, each covered in netting, around his neck dangles a rubber tube. He steps down into the trench dug around the hut's raised foundations and makes his way around to where a large mesh box hangs from a west-facing window. Examining the box from all angles, he presses his face against the mesh and occasionally taps its sides. He puts one end of the rubber tube in his mouth and threads the other through a twisted cloth sleeve at the top of the box. He manoeuvres the tube around the trap. Minutes pass. Stepping back and crouching down, he blows the contents of the tube into one of the plastic cups then stops the opening with a clump of cotton wool pulled from his pocket. He then resumes his search craning and darting like a bird. Finally, after taking one last long look, he picks up his cups and walks around the hut to the mesh-box hanging from the window on the hut's east side.

The boy is one of ten residents of Lupiro, a rural village in southeast Tanzania, who have volunteered to collect – and attract – mosquitoes as part of a malaria vector control research project. Four nights a week, for a period of two months, he and another volunteer will be randomly allocated to 'sleep' in one of four experimental huts. Recently constructed by entomologists based at the Ifakara Health Institute (IHI) – an internationally renowned field station and laboratory located roughly 30 miles west across the river – the huts, while a novelty in Lupiro, recuperate an archetype of entomological research largely abandoned during the era of DDT.[i] First designed by British entomologists working in Kenya in the 1940s, experimental huts have been

used for decades to study mosquito behaviour on the scale of the household. A stage upon which to observe natural phenomena, they bridge the distinct empirical terrains and methodological registers of the laboratory and the field.[ii] Under controlled insectary conditions, entomologists can scrutinize mosquito biology (how, for instance, the frequency of blood-feeding impacts metabolic rates and reproductive development), while the field-like features allow researchers to delineate interspecies interactions. The experimental hut is a controlled, yet *uncontained*, setting – 'a semi-field' – where entomologists can apply microbiological insights to natural landscapes. Its mimetic design is also evaluative: the hut provides a framework to prototype disease control strategies, such as insecticide-treated bed nets or walls.

The hut's architecture, therefore, must enact a difficult balance between pinpointing mosquito behaviour and typifying local conditions. This dual objective makes for an uncanny domicile. The hut's metal roof is overlaid with thatch; its canvass walls are lined with interchangeable mud panels. Raised a meter off the ground, its steel scaffolding feet are submerged in oil-filled trays (Figure 1). It is, on one hand, an impersonation of a village home, an abstraction of the *oikos*. On the other hand, however, the experimental hut must concretize – or, in Roy Wagner's terms, *expersonate* – the domestic character of malaria transmission: it renders the parasitic exchange between mosquito and man vivid (Wager, this issue). The experimental site thus fuses a generic scientific space and a specific inhabited place. It is a boundary, a trading-zone (Galison 1997: 803-44), *a threshold* where insect and human behaviours meet and are transformed into elements of a malarial dynamic.[iii]

How might we think through the anthropological significance of this eclectic experimental format? What bearing does 'the home' – the built environment of entomological science – have on the circulation of parasites between mosquitoes and

men? Elsewhere I have analyzed the affordance of *the domestic* as a site to generate facts (Kelly, forthcoming). In this article, I shift focus from the inductive capacity of the experimental hut – i.e. the ways in which it develops the human-mosquito blood relation for the ends of investigation – to the biopolitical engagements it sets in motion. To explore the hut as an instrument of interspecies management, I draw on the concept of hospitality. Hospitality denotes here a frame of action to respond and relate to the other, a gesture that both encompasses and upholds difference (c.f. Berking 1999). The concept signals an exceptional moral order: the reciprocal obligation to respect the stranger and honour the guest transcends law and politics (c.f. Dikeç et. al 2009). It is also fraught: hospitable relations hang on a fragile balance of domination and dependence, exploitation and parasitism (Herzfeld 1987). These conceptual resources and others further elaborated in this issue offer considerable mileage for an analysis of the encounters prompted by these experiments and the patterns of interaction they delineate. I examine the hospitable format of the model hut in four instances.

The first section details the materials, techniques and logics of hut construction, and how these are modified to match the ecological and cultural specifications of the places in which experiments are conducted. Following Caroline Humphrey (1988) and Andrew Shryock (this issue), I am interested in how the variable architecture of the hut differently expresses the intentions and inclinations of their inhabitants. I indicate how experimental space is manipulated to create a hospitable effect, although in my case the guests are not human (cf. Delapace; Ladwig; da Col, this issue). The guest situation prompted by the experimental hut is particularly perilous, for one bite from an infected mosquito could be fatal. But it is also reciprocal – the parasite completes its life cycle by moving between man and mosquito – both species are

hosts. I suggest that the domestic camouflage of this peculiar trap creates a space to recognize this reciprocity and transform its lethal potential into an exercise in restraint. That the by-product of this transformation is to kill the mosquito does not extenuate its hospitable character. Rather, I interpret the hut's restrained killing exercise as a practice in cosmopolitical conviviality enacted within the struggle for survival.[iv]

The second section returns to the experiments conducted in Lupiro. Here, hospitality offers a way to understand the work of the experimental subjects – the hut's 'sleepers' – within the broader aim of medical entomological investigation: the global reduction of malaria cases. Scientific validity is typically a scalar property: experiments are designed to project outcomes produced in restricted spaces onto the wider world (Lezaun and Millo 2006). In the experimental hut, projection takes place through the involvement of the sleepers, who not only are party to the malarial situation, but are also expected to embody the future users of the control methods piloted by the test. I suggest that in extending the experimental protocol to villagers – inviting them into the house of science – the hut reframes scientific universality within the political topography of Tanzania. Within the inherently asymmetrical conditions of scientific practice in Africa, the hut reconfigures the researcher as guest and the volunteer as host. If hospitality evokes a higher form of relating that "transcends the political and moral systems in which we live" (Shyrock 2009: 32), the hut generates relations between experimental practice and research setting that supersede those cultivated by traditional research ethics, belonging instead to a specific geography and temporality of wellbeing. Configured as part of a national space, the hut demonstrates how to kill mosquitoes by cultivating the people who will do it.

Inevitably, embedding malaria research in the village entangles investigative practices with the socio-materiality of everyday life. In the third section, the focus will move to the transgressions arising in these experimental intersections. Built on the outskirts of the village, poised between laboratory and field, the hut gives rise to ambivalent relations and creative appropriations between sleepers and scientists. Returning to the embodied task of capture, I ask what happens when the residents of Lupiro no longer act as volunteers inhabiting a scientific experiment but rather *as if* they were at home or, perhaps more accurately, at a hotel. Here, we will see how the scalar properties of hospitality break down when the affective dimensions of the house and the experiment coincide (cf. Candea, this issue). The conflict between scientific protocol and everyday life raises unsettling questions about how the uncanny double character of the hut "englobes" Tanzanian and indeed African populations as bioavailable, experimental subjects (Hertzefeld 1987).[v]

Finally, in the conclusion I return to the hut's makeshift form and its consequences for the demarcation of the spaces of disease. At the heart of these multiple hostings – between researchers, sleepers and mosquitoes – is hospitality's obverse – the parasite, in the form of the *plasmodium* microorganism. The malaria parasite underscores the temporality of the guest-host situation articulated by the hut: the parasite continually, and rapidly, adapts to maximally exploit both man and mosquito for its own reproductive needs. The modularity of the hut – its inherent incompleteness – anticipates the pace of the parasite's evolution, while the intimate topography of the experiment shadows its movement, keeping this invisible 'prey closest to hand' (Fausto, this issue). Ultimately, I suggest that the modes of hospitable thinking and being set in motion by the hut offer a fresh take on the corporality of dwelling – as

both an activity and a place "constituted and undone through relations between bodies" (Diprose 2009: 83).

Enter Mosquito

> Among the animals, with their smaller *Umwelt* horizons, the celestial bodies are essentially different. When mosquitoes dance in the sunset, they do not see our big human sun, setting six kilometers away, but small mosquito suns that set about half a meter away. The moon and stars are absent from the sky of the mosquito.
>
> Uexküll 2001: 108

Extending semiotic analysis to ecology, Jakob von Uexküll sought to articulate the discrete ways in which animals experience the environment.[vi] The behaviour of insects perhaps goes farthest in the theoretical implications of that proposal: as Hugh Raffles (2010) exquisitely illustrates, the intricate and intimate ubiquity of invertebrates overwhelms our analogical imaginations. Insects evoke a truly *other* world, crawling, teeming and swarming within our own.[vii] Thus, when Uexküll describes mosquitoes "dancing in the sunset", his concern is not with the physiological mechanisms of flight, but rather with the features ('marks') of the environment that constitute the mosquito's *umwelt* or atmosphere – e.g. the viscosity of the cooling air, the odours emanating from the field – and how these perceptions relate to its capacities (c.f. Uexkull 1957: 10-11; Buchanan 2008: 24). Medical entomologists are familiar with this empirical challenge, since the manner in which insects negotiate their surroundings – where and when they choose to rest, why they

might go into this house and not the next – has profound consequences for human beings. The shared susceptibility of both species to pathogens, their biological communicability, expands the horizons of mosquito phenomenology to the dynamics of these interactions. Recreating the world of the mosquito thus demands empirical attention to the specific places *where species meet*.

Because mosquitoes' human hosts tend to sleep indoors, *where*, more often then not, is in the home. Slipping through keyholes and hovering above doorframes, mosquitoes exemplify the mutuality of domestication (cf. Cassidy 2007); their host-seeking behaviour has shaped, and been shaped by, agricultural techniques, animal husbandry, and the planning of cities. To delineate the environment of the mosquito, one would need to look to the organization and construction of human settlements, which is where A.J. Haddow, a British entomologist and the pioneer of experimental hut design, began his field research in Kenya in the 1940s. Yet he quickly realized that the furnishings, utensils, clothes and other personal belongings found in village homes gave mosquitoes too many places to hide (Haddow et al. 1942). To facilitate collection, Haddow measured the height and width of a rural Kenyan house and employed local workers to build six replicas that conformed to the average size. The models, constructed out of mud, reeds, and papyrus stems looked like typical homes in all ways but one – their interiors were kept free of 'clutter'. Inside Haddow's hut there was only a white sheet that doubled as a bed and a backdrop, making it easier to see dead mosquitoes on the floor.

Over the years, several advances have been made in hut design, in an effort to satisfy the dual requirements of simulation and collection. Around the same time when Haddow was refining his building techniques, entomologists working in West Africa developed detachable window traps to monitor the house-frequenting habits of

mosquitoes. Fitted to the windows of experimental huts, these traps enabled researchers to assess the number of mosquitoes repelled by insecticide after entering. To capture those escaping through the eaves, mesh strips were fixed between the inside of the roof and the top of the walls. The placement of light apertures could also help confuse mosquitoes trying to leave, without hindering those carried into the huts by the wind (contrary to Uexküll's claim, moonlight has been found to have dramatic effects on mosquito flight and feeding patterns).[viii] Raised on concrete pillars and surrounded by moats, huts were kept free of scavengers who might remove dead or dying mosquitoes from the ground before they could be collected.[ix] To allow mosquitoes to enter and to leave in numbers and at times most similar to those in local dwellings, researchers would pilot huts with a variety of openings before building a complete set. Experimental architectures came to vary widely. In the Gambia, where doors are left ajar as a gesture of trust, investigators fit the doorframes with small wooden blocks to leave a gap of four centimetres for mosquitoes to enter during the night. In South Sulawesi, Indonesia, where the dead are stored for months in the uppermost reaches of the house, models were built with a loft and a walkway to facilitate the collection of mosquitoes from the extended roof.

The subtle structural workings of experimental hut design convincingly substantiate Alfred Gell's (1996) claim that animal traps could be exhibited as art. Gell developed his argument from a suspicion of aesthetic theory, and in particular of the distinction between art objects and artifacts on the basis of their functionality. To challenge this distinction, he explored the symbolic complexity of traps, artifacts built both to reflect the form and behaviour of the pray and to model the behaviour of the hunter. Beyond being "lethal parodies of the animal's umwelt" (ibid. 27), traps sediment the complex aims and relations between man, animals and their

environment.[x] Experimental huts complicate this predator-prey semiotics, because, to some extent, they must also entrap humans, but I will return to this point later. What I want to take from Gell is that, as a trap, the experimental hut "embodies a scenario, which is the dramatic nexus that binds these two protagonists together, and which aligns them in time and space" (ibid. 29).

So what is the scenario here? The designer of the hut is not a hunter in the sense of luring animals in order to eat them. His purpose is to learn more about the behaviour of mosquitoes; the hut nuances his understanding of how their world relate to our own. Unlike a mousetrap, where what humans know about the habitat and behaviour of mice is materialized in its very form, the experimental hut's design is recursive. Its detachable windows and movable baffles provide only a momentary resting place to observe and record the evolving specificity of mosquito movement (Figure 2). That investigative latitude is also reflected in its construction. Across the methodological literature, semi-field trialists contextualise experimental outcomes with detailed accounts of the use of cheap, easy-to-manipulate materials, or the time and the number of labourers involved in building their huts. The hut's heuristic value belongs not only to its mimetic accuracy – how much it looks like a village home – but to its workable format and material versatility as well (cf. Rapley 1961). This architectural vernacular allows for an evidentiary expansion from model to home, but the wiggle room between the two suggests that these extensions are subject to revision and adjustment. Like any other architectural structure, these experimental buildings "do not just sit in climates but modify them" (Humphrey 1988: 17); the trap, no matter how subtle, disturbs the mosquito's domestic journey – the pattern of its movement can only ever be approximated.

Might not this empirical impulse describe an exercise in hospitality *par excellence*? As a cultural practice, hospitality provides a structured format to deal with potentially dangerous others; "it imposes order through an appeal to the sacred, makes the unknown knowable...it does not limit the conflict altogether but places it in abeyance" (Pitt-Rivers 1968: 24). The hut is designed just so: to welcome the invading mosquito inside and to satiate it with a sacrificial blood meal. Its open eaves, mesh baffles, screened windows and raised floors regulate the encounter of human host and mosquito guest; these modular controls render the mosquito visible, remove its strangeness and temper the threat it poses. The mosquito's movements are restricted by the spatial dimensions of the house, expressive of the scientific intentions of its hosts (cf. Shryock, this issue).

Whether or not we grant hospitality the theoretical latitude to describe relationships with nonhumans (cf. Candea and Da Col, this volume), the fact that the purpose of the invitation is to observe the mosquito and, to better do so, kill it, certainly negates the experimental hut's conviviality. But the death of one mosquito, or even a few, is not what is at stake here. The true protagonist of this scenario – the guest at the centre of these multiple hostings – is the *plasmodium* microorganism, the unforeseen and invisible traveller, the dangerous parasite to the encounter of human and mosquito. It is in structuring that risk of the mosquito transmitting the parasite that the hospitable capacities of the hut take shape. The aim of the trap is not to sever our connection to the mosquito, but on the contrary, to create a framework to recognize and respond to our primordial histories, our co-evolution, our inextricably connected worlds. In *When Species Meet,* Donna Haraway develops the concept *response-ability* as an ethical comportment for engaging with nonhumans. She argues that response emerges out of our ongoing mutual entanglement with others; it entails

recognition of (following Uexküll) a diversity of life-worlds. That recognition, however, does not remove the possibility of death; "it is a question of learning to be 'polite' in responsible relation to always asymmetrical living and dying and nurturing and killing" (Haraway 2008: 42).

Killing mosquitoes politely? In contrast to the more companionable species – puppies, horses, even rats – mosquitoes have no "face" to inspire meaningful exchange. Mosquitoes are a nuisance, they cannot be cuddled or trained; the only thing to *do with* them is to kill them. How to re-think responsibility in relation to the more 'pesky' species is a question Uli Beisel (2009) raises in her review of Haraway's book. More to the point, she asks: how to think of an ethical response to a species responsible for nearly one million deaths per year? Her suggestion is to shift the question from how to kill mosquitoes to how to "diminish populations" (ibid. 25). She proposes that the responsible way to go about this task is "not getting lost in hasty engagements" but rather recognizing the behavioural specificity of mosquitoes and respecting their adaptive capacity (ibid. 27). In other words, we must learn to kill patiently – a response that entails both awareness of the victim (what Haraway would describe as curiosity, 2008: 7) and personal restraint. Patience is, as Matei Candea puts it "action turned in on itself, intention intent of self-suspension" (Candea 2010:249). The experimental hut's provisional character materialises precisely that commitment; it traps mosquitoes to articulate their dynamic and ecologically-entrenched character. In providing a protected place *where* species can meet the hut creates a framework to cultivate control and politeness over those engagements.

At the end of the paper, I will elaborate the consequences of placing the conflict between man and mosquito in abeyance for global public health. At this point, I want to explore further the scale of this response. How could we translate the restraint

exercised in the huts into an approach to malaria control? In what ways does this trap contain the interests of Lupiro, Tanzania, or, even further, global health policy? In exploring the connection between the embodied task of capture and the efforts to control disease, hospitality becomes again important.

Sleepless Sleepers

> It appears that access to most experimental venues (and especially those located in private residences) was achieved in a highly informal manner, through the tacit system of recognitions, rights, and expectations that operated in the wider society of gentlemen.
>
> Shapin 1988: 398

In the summer of 2009, a group of model huts were erected outside Lupiro to pilot new household insecticides. Made out of canvass and fitted with removable mud-panels these huts were more mobile than their predecessors: they could be set up and disassembled in less than thirty minutes. To avoid restricting research to a single site near the Ifakara Health Institute, these collapsible canvass huts could be set up closer to villages, and thus, enable a more comprehensive picture of vector behaviour in the region. Rendered mobile, these huts were more permeable, not only to the variability of mosquito behaviour, but also to the diversity of human habitation.

To project an accurate picture of malaria transmission, experimental huts require human bait, preferably of the local variety. Like a thatch roof or wooden doorstops, sleepers uphold the hut's representational validity. But volunteers also serve as witnesses: their complaints of mosquito annoyance, for instance, are frequently reported in research papers to substantiate the effectiveness of an insecticide. The

experiments that took place in the Lupiro huts enhanced this corroborative role. Rather than merely attracting mosquitoes, sleepers were trained to collect them. Routine capture involved aspirating mosquitoes with a rubber tube, something that takes considerable patience and sustained focus. Mosquitoes were sucked from the walls, floors, baffles, bed nets and window traps and then blown into one of two plastic cups: one for the dead, the other for the living. Because entomological observations in the huts are principally made to determine the effect of an insecticide, the collector must note the situation and the state in which each mosquito was captured.

From sunset to sunrise the sleepers aspirated in shifts of forty-five minutes, taking fifteen minutes at the end of each hour to eat and rest. Collection was exhausting, but the work did not end there. Each morning, with a radio blaring to keep them awake, the volunteers counted and identified the mosquitoes that had been caught the previous night (Figure 3). Initially the process took hours, involving lengthy discussions over whether a certain female was unfed, pregnant, or blood-fed, but in a few weeks sleepers were highly proficient at this tasks, and by the end of the summer they insisted they could tell the difference between an *anopholine* and a *culicine* by how their legs felt after being bitten.

There are clear financial and logistical advantages of training villagers to perform the routine work of collection, but the inclusion of the volunteers in the running of experiment also entails epistemic returns. The huts not only model mosquito behaviours but also evaluate the viability of interventions – in this case, insecticides that will ultimately have to be purchased and applied by local users.[xi] When conducted in villages *with villagers* the experiments could better represent the application of their findings, as stated in the research proposal: “experimental huts

facilitate different research groups to adapt and determine the impact and acceptability of these new technologies within the household and its immediate vicinity" (Moore 2008: 4). Entangling the portable huts with local conditions, actors and domiciles served to increase the applicability of findings.

The capacities of domestic spaces to discipline scientific communities have long been a focus of attention. In his analysis of the 17th-century science in England, Steven Shapin showed how the credibility of experiments was bolstered by the qualities of the private houses in which they took place, including the social status of those who lived in them. The venue solved the critical problem of trust when only a limited number of people could witness an experimental phenomenon; authoritative claims hinged on the successful transit of individual observations into collective belief, and the gentleman's private residence provided an ideal witness-stand precisely because only gentlemen were admitted. Conventions of hospitality were reserved for those of quality – "Noble Descent", Shapin quotes Robert Boyle as saying, gives "the Gentleman a Free Admittance into many Companys, whence Inferior Persons (tho never so Deserving) are...excluded (Shapin 1988: 387). The norms of the genteel private sphere secured the career of experimental knowledge as it moved from concrete material setting to generic truth.

The model hut reverses this exclusivity, opening the experimental domain to all sorts of people – local residents, famers, their children and passers-by. The spontaneous, contingent and undifferentiated inclusion of proximate (and not only 'proper') people produces credibility of a different order. Extending the experiment to the village creates the conditions for its actualization; involvement of potential uses ensures the applicability of knowledge. Here, the demonstration is not merely a

display of virtuosity (Collins 1988), but an occasion for publics to involve themselves in the technology through intimate and embodied action (Marres 2009).

Further, the pragmatic character of the experiment – its imbrications with social space – re-distributes scientific expertise. A biographical note on the PhD student working on the huts illustrates this point. When he was ten, his rural village in northern Kenya became the site of a series of experimental hut trials. Though he was initially thought to be too young, he hung around until the researchers let him volunteer as a 'sleeper'. His ability to grasp the purposes and procedures of research made an impression, and the research team funded his secondary and university education. In 2009, he was awarded the American Society of Tropical Medicine and Hygiene's Young Investigator Award.[xii]

This transformation from sleeper to scientist is extraordinary. However, as the aim of the experimental hut is to create increasingly place-specific formats, supporting and strengthening local investigators is a priority. The pedagogic potential of the hut speaks to a commitment different from the notions of public good typically associated with transnational research (Kelly, 2011). When conducted in places like Lupiro, the value of bioscientific activity is elaborated in terms of an ethical imperative: to respond to health crisis, to lift populations out of poverty, to set nations on the road to progress. The relationship constructed between western science and these places is one of knowledge-producer and recipient, respectively. It is a gift extended to the distant needy; produced somewhere, delivered elsewhere (Kelly et al. 2010). Volunteers participate in exchange for this potential gift. In the meantime, they might be offered some form of compensation, a nominal payment for placing their bodies at risk. [xiii]

In contrast, the semi-field research depends upon both a more concrete and extended form of reciprocity. Generating appropriate interventions that keep pace with the vicissitudes of human and mosquito behaviours depends upon a continued engagement with a place over time. In a register of hospitality, this exchange between researchers and volunteers – though perhaps always asymmetrical – entails the promise of return (Delaplace, this issue): both of the scientists to Tanzania and of Tanzanians to future scientific experiments. These emplaced and continued connections reconfigure the experiment's claim to contribute to the global malaria effort across scales – from the hut to the village, to Tanzania and beyond. Recasting volunteers as participant publics creates the conditions for management of disease within a "set of mutually congruent social boundaries, each of which reproduces the moral implications of all others" (Hertzfeld 1988: 78). The hut balances the global imperatives of techno-science with the local demands of wellbeing, pursing policies and practices that are adjusted to place. Though clearly its foundations are temporary, the experimental hut creates an intimate format to understand and respond to the landscape and to feel at home within it. [xiv]

In the next section, I explore how the experimental hut's social static or 'liveliness' (Allerton this issue) interferes with this scalar imaginary. For though the hut is built to address the problems posed by public health, inhabited spaces introduce materials and substances to be consumed and exchanged, and in so doing impose their own affects and significances (cf. Da Col and Candea, Humphrey this issue). The strangeness of that affective tenor is the subject of the next section. The experimental hut is only an impersonation of a home, which is, as James Boon argues, "an exaggeration with questionable variants: the too-average case, the lowest common cross-cultural denominator" (Boon 1990:48). Built by scientists but inhabited by locals and located

on their own land, these are homes that belong to no one. Who, then, is the guest and who is the host? Who can exact demands and of what kind? Returning to the embodied task of capture, I consider the mood this 'standard-average' generates and its' bearing on the moral virtue of the experiment.

Captive Spaces

> In the house itself, in the family sitting room, a dreamer of refuges dreams of a hut, of a nest, or of nooks and corners in which he would like to hide away, like an animal in its hole.
>
> Bachelard, 1994: 30

Leaving aside the potential benefits of research, we are confronted again with the experimental hut's rather macabre logistics: African villagers enrolled to act as mosquito-bait. Reading reports of A.J. Haddow's research the exploitation of the volunteer seems blatant. His experiments were focused on the impact of human odour on mosquito-feeding behaviours; a trial design that involved counting the number of insects drawn into huts containing either "washed or unwashed natives" (Haddow 1942: 91). But as a place to sleep, one could do worse. Raised off the ground, volunteers sleep undistributed by other invaders such as ants, chickens or rats. The disease risks to which sleepers are exposed are ostensibly no greater than those involved in sleeping at home; today, in accordance with ethical standards, volunteer sleepers are provided with bed nets and screened regularly for malaria parasites.[xv]

However, Lupiro residents took some convincing before researchers could even gain access to the land upon which to construct experimental huts. First, there was

considerable confusion over who actually owned the individual plots; ultimately, the research team had to pay rent many times over. Then, there was the issue of the rice harvest: farmers were not about to sacrifice their crop for the interest of entomological research, so experiments had to be put off until the crop was brought in. Only after months of negotiations (which included building a well and two outhouses for the village) did the project finally get underway. The following summer, the project was expanded: six more huts were built in Lupiro and five in another village in the Kilombero valley where a different mosquito species was present. As opposed to the previous summer, setting up the huts and enrolling volunteers posed few problems; tensions only began to surface once the experiments got underway. Two weeks into the experiments, the principal investigator started receiving complaints – first relayed by fieldworkers working for the Institute and then from villagers themselves – that the sleepers were entertaining women (who were not their wives) in the huts during the late-night collections. The volunteers dismissed these accusations as misplaced anxieties about experimental activities, or alternatively, covert demands for greater compensation. The arguments became heated, huts were damaged and the researchers became increasingly concerned that experiments were not be carried out according to protocol. For a few weeks research was brought to a halt, while extensive meetings with the villagers took place. The upshot of these discussions was that some fieldworkers were assigned to different sites and further village facilities – a few more outhouses and another well – would be built on site. Research started again with little incident.

Rumours of clandestine and unsuitable nocturnal behaviours are familiar tropes of scientific work in Africa, and belong to the history of colonial and post-colonial research and intervention (White 2000). The common theme of these rumours – often

centring on the theft of body parts or vampirism – is the role of local labour in those activities, and the transformations suffered by those who engaged with foreign technologies. The experimental hut, too, introduces a new space of material exchange between *Mzungu* (white person) and *Mtanzania* (Tanzanian). Critically, these exchanges were formatted within a space that is particularly charged in Tanzania: the construction of a new *domestic* unit was a central dimension of post-independence national policy.[xvi] Julius Nyerere's *Ujamaa* programme (family-hood) emphasized the homestead as a unit of democratic order, linking social development to the modernist norms of the nuclear family (Lal 2010). These bare, quasi-domestic spaces are stripped of that historical significance and social texture: the experimental is a double that estranges the original, subverting the conventions of the domestic.

But further, the techniques of mosquito collection and capture themselves are transformative. Enter the hut during the day, and you will the find trappings of domestic life: a bed with flower-print sheets, a coke bottle, a radio, an exercise book from a high school maths class, a few t-shirts. Come at night, and you will encounter an intimacy of an entirely different sort. This is when the dramas of collection unfold, when its inhabitants are suspended in the "time-structure" of the trap (Gell 1996:27). A single mosquito enters from above, hums in the air. The mosquito *smells* heat from a distance; it thinks with her skin. A volunteer follow its trajectory – his movements are imperceptibly slow. The room gains gigantic proportions; nooks and latches become refuges, the distance from the mattress to the floor impossibly vast. The hut, now trap, is charged with "complex intentionalities" (ibid. 29) – the dreams of mosquitoes captivate the sleepers. As one volunteer commented after counting his collection: "the mosquitoes travel far for this house, they like me and they do not know that I will catch them."

The hut is a between-space; its foundations are, quite literally, up in the air. Its structure is poised between laboratory, field and home, but its liminal character comes to life in the task of capture. The patience, expectation and punctuated intensity of collection suspend the sleepers in an awareness dictated by the dispositions of the mosquito. The sleepers' co-presence with the mosquitoes recalls a commitment to cosmopolitical engagement; a process that must be embodied through acts of 'shared suffering' (Harraway 2009: 69). [xvii] While perhaps collection does not imply the same degree of empathy, becoming-bait is an altered state of co-existence – an unruly vitality that supersedes the protocols of scientific realism and domestic decency. In the early hours of the morning the conventions of experimental participation become particularly fragile – scientists depart and sleepers become their own masters.

Conclusion

> Places in which the to and for of life unfolds, built, modified, moved or abandoned in accord with the changing circumstances of their inhabitants, houses have a dynamic, processual characteristics encapsulated in the world 'dwelling.'
>
> Carsten and Hughes 1995: 1

In this article, I have described the forms of hospitality that operate between the multiple inhabitants of the experimental hut. I propose that these domestic experiments, in playing host to mosquitoes, force us to form relationships of (troubled) coexistence, and thus refine the dialectic between preservation and peril that these relationships entail. I have also pointed to the reciprocal, if not

asymmetrical, hosting of scientists and villagers under the hut's corrugated roof and suggested how that reciprocity is extended across time and scales. Finally, I have described the social texture of experimental practice – the fracas that ensures after the huts are erected – to find new relations of meaning and encounter. So what of the parasite, the instigator of these multiple hostings?

Malaria is an ancient disease – the outcome of a primordial interspecies encounter. Entangled with the evolution of mosquito species and the human race, malaria has multiple chemical and behavioural guises; it is multiply implicated in the environments we inhabit and the ways in which we inhabit them. Scientists are only beginning to come to grips with the complex repertoire of genetic resources and selection pressures through which adaption operates (Mackinnon & Marsh 2010). The experience of drug resistance underscores the pace of *plasmodium* evolution; all mass-distributed drugs have failed within a decade. The parasite's extraordinary capacity to reproduce is tied to its subtle persistence: parasites withhold virulence to continue their life cycle without killing its hosts (da Col, this issue). In Nigel Clark's words, "pathogens, we might say, play on the terrain of the exorbitant: they are the gift that keeps on giving" (ibid. 2007:63).

The parasite, continually becoming outside, within and through *ourselves* challenges our notion of what constitutes disease. Malaria is not a stable disease category or somatic condition, but rather a transient situation, a continually reassembling convergence of mosquitoes, parasites and man. The experimental hut's renders the malaria situation coextensive with the material processes of investigation – fostering practical-ontological coordination (Mol 2002). The huts' modular makeshift aesthetic – its collapsible walls – is intended to preserve the dynamism of the malaria vector; contextualized by a dwelling, its object of inquiry is the

particularity of change. A perpetual prototype, the hut is 'a recursive, material anticipation of the future' (Pottage 2010: 73). This is a future in which the parasite will return, in a different place and in a new guise. The small, basic and incomplete dimensions of the hut provide a framework for delay: a hospitable space to cultivate an awareness of the vitality of the vector.

REFERENCES

Bachelard, G. 1994. [1957]. *The Poetics of Space*. (Trans. Jolas, M.). Boston: Beacon Press.

Beisel, U. 2010. Jumping hurdles with mosquitoes? *Environment and Planning D: Society and Space*, 28: 46–49.

Berking, P.H., 1999. *Sociology of Giving*. Sage Publications Ltd.

Boon, J. 1990. *Affinities and extremes: crisscrossing the bittersweet ethnology of East Indies history, Hindu-Balinese culture, and Indo-European allure*. Chicago, IL: University of Chicago Press.

Bidlingmayer, W. L. 1964. The Effect of Moonlight on the Flight Activity of Mosquitoes. *Ecology* 45(1): 87-94.

Buchanan, B. 2008. *Onto-Ethologies: The Animal Environments of Uexkull, Heidegger, Merleau-Ponty, and Deleuze*. New York: SUNY Press

Candea, M. 2010. I fell in love with Carlos the Meerkat: engagement and detachment in human animal relations. *American Ethnologist* 37(2): 241-258.

Carsten, J., & Hugh-Jones, S. 1995. *About the House: Lévi-Strauss and Beyond*. Cambridge: Cambridge University Press.

Cassidy, R. 2007. Introduction. Domestication Reconsidered. In *Where the wild things are now: Domestication Reconsidered* (eds) R. Cassidy & M. Mullin, 1-27. Oxford: Berg Publishers.

Collins, H. 1988. Public Experiments and Displays of Virtuosity: The core-set revisited. *Social Studies of Science,* 18 (4): 725-48.

Dikeç, M., Clark, N. & Barnett, C., 2009. Extending Hospitality: Giving Space, Taking Time. *Paragraph*, 32(1), 1-14.

Diprose, R., 2009. Women's Bodies between National Hospitality and Domestic Biopolitics. *Paragraph,* 32(1), 69–86.

Gell, A. 1996. Vogel's Net: Traps as Artworks and Artworks as Traps. *Journal of Material Culture*, 1: 15-38.

Galison, P. 1997. *Image & logic: A Material Culture of Microphysics*. Chicago: The University of Chicago Press.

Haddow, A. J. 1942. The mosquito fauna and climate of native huts at Kisumu, Kenya, *Bulletin of Entomological Research*, 33: 91-142.

Hansen, K. T. (ed) 1992. *African Encounters with Domesticity*. New Brunswick, New Jersey: Rutgers University Press.

Haraway, D.J. 2007. *When Species Meet*. Minneapolis, MN: University Of Minnesota Press.

Henke, C.R. 2000. Making a Place for Science: The Field Trial. *Social Studies of Science,* 30: 483–511.

Kelly, A.H. et al. 2010. 'Like Sugar and Honey. The embedded ethics of Larval Control Project in the Gambia. *Social Science & Medicine* 70: 1912 – 1919.

Kelly, A.H. 2011. Will He Be There? Mediating malaria, immobilizing science, *Journal of Cultural Economy*, 4: 1, 65 - 79

Kelly, A.H. forthcoming. Entomological Extensions: Model Huts and Fieldworks in Edwards J. & M. Petrovic-steger. (eds.) *Recombinant Knowledge: Or How Strathernian Concepts Travel.* Cambridge: Cambridge University Press.

Kohler, R. E. 2002. *Labscapes and Landscapes.* Chicago, IL: University of Chicago Press.

Kucklic, H & R., Kohler. 1996. Introduction, Science in the Field, *Osiris*, 11:1-14.

Kull, K. 1998. Semiotic ecology: different natures in the semiosphere. *Sign Systems Studies,* 26: 344-371.

Lal, P. (2010). Militants, Mothers, and the National Family: Ujamaa, Gender, and Rural Development in Postcolonial Tanzania. *The Journal of African History,* 51:1 20.

Latour, B. & Woolgar, S. 1979. *Laboratory Life: the Social Construction of Scientific Facts*, Los Angeles, CA: Sage Press.

Lezaun J. & Millo, Y. 2006. Regulatory experiments: genetically modified crops and financial derivatives on trial *Science and Public Policy*, 33(3): 179–190

Mackinnon, M. J., & Marsh. K. 2010. The Selection Landscape of Malaria Parasites. *Science,* 328 (5980): 866-871.

Marres, N. 2009. Testing Powers of Engagement Green Living Experiments, the Ontological Turn and the Undoability of Involvement. *European Journal of Social Theory,* 12(1): 117 – 133.

Mol, A. 2002. *The Body Multiple: Ontology in Medical Practice*, Durham/London: Duke University Press.

Moore, S. 2008. Replacing DDT: Rigorous Evaluation of Spatial Repellents for the Control of Vector Borne Diseases. Global Health Grant Proposal, The Bill & Melinda Gates Foundation.

Pitt-Rivers, J.A. 1968. The Stranger, the guest and the hostile host: Introduction to the study of the laws of hospitality. In *Contributions to Mediterranean sociology: Mediterranean Rural Communities and Social Change,* (Ed, Peristiany, J.G.) Paris: Mouton & Co.

Pottage, A. 2010. Charismatic Prototypes. In *Prototyping Prototyping: A Pre Conference Publication.* (Ed, Kelty, C.) http://anthroposlab.net/studio/episode/03/

Raffles, H. 2010. *Insectopedia*. New York: Random House.

Rapley, R.E. 1961. Notes on the construction of experimental huts. *Bulletin of the World Health Organization,* 24: 659-663.

Sharr, A. 2006. *Heidegger's Hut.* Cambridge MA: MIT Press.

Shapin, S. 1988. The House of the Experiment in Seventeenth Century England. *Isis,* 79(3): 373- 404.

Shryock, A., 2009. Hospitality Lessons: Learning the Shared Language of Derridaand the Balga Bedouin. *Paragraph,* 32(1): 32–50.

Stengers, I. 2005. The Cosmopolitical Proposal. In *Making Things Public, Atmosphere of Democracy.*(Eds, Latour, B. & P Weibar, P.). Cambridge, MA: MIT Press.

Von Uexküll, J. 1957. [1934]. *A Stroll Through the Worlds of Animals and Men: A Picture Book of Invisible Worlds*. (Ed. and trans. Schiller, C.). New York: International University Press.

Von Uexküll, J. 2001. [1936]. An Introduction to Umwelt. Excerpted from *Niegeschaute Welten,* 11-17. Berlinö S. Fischer Verlag. (Trans G. Brunow). *Semiotica* 134 (1): 107-110,

White, L. 2000. *Speaking with Vampires: Rumor and History in Colonial Africa*. Berkeley CA: University of California Press.

[i] While the advent of insecticides catalyzed experimental hut research, the effectiveness of DDT in killing or repelling mosquitoes obviated the need for these studies. The subsequent failure of the eradication campaign (including the realization of DDT's harmful ecological effects), and, ultimately, the reemergence of malaria on the global health agenda, led to the rebirth of medical entomology and with it the restoration of the experimental hut as a research technology.

[ii] How specific localities matter for science has been an enduring theme in Science Technology Studies (Henke & Gieyrn 2008). Critical to these discussions as been the distinction between the laboratory, designed to strip experimental objects of their quotidian associations (Latour & Woolgar 1979), and the field, where particularities of place enhance the representative character of findings (Kuklick & Kohler 1996). A semi-field device, the model hut presents a provocative case of the methodological compromises required to produce accurate *and* applicable knowledge.

[iii] Robert Kohler's history (2002) of laboratory and field practices illuminates the role the built environment of science – vivaria, marine stations, biological farms, greenhouses – plays in bridging the experimental gap between controlled settings and the complexity of the outside world.

[iv] Isabelle Stengers (2005) defines the cosmos as the possible unknown, composed of diverse, multiple and comingled entities. Cosmopolitics entails a commitment to complex cohabitation – a continually learning from and engaging with that multiplicity.

[v] I thank Ian Whitmarsh for making this connection: "Baudrillard wrote that America needs Disneyland to conceal the fact that the whole country is Disneyland. Do the scientists need the experimental hut to hide the fact that all of Tanzania is an experimental hut, in the eyes of global health?" (Commentary to AAA panel, "Spatial Imaginaries in the Circuits of Science and Medicine: Mapping Technoscience Through Public Spaces", November 20th, 2010).

[vi] I am in debt to the editors of this special issue for their inspiring suggestion to take up Uexküll to explore the isomorphism between the mosquito's perceptual world (*merk-welt*) and the features of the experimental hut.

[vii] Hugh Raffles' *Insectopedia* (2010) follows Uexküll's lead to theorize the insect's "time world and space world" (2010: 315-318). While Raffles chronicles that world in its own right, what concerns me here is the way in which being-insect is articulated by the concerns and techniques of public health.

[viii] Collections made in model huts were found to increase with the moon's elevation (Bidlingmayer 1964).

[ix] There are some other exquisite examples of the efforts to keep the interspecies encounter intimate: in Nepal, entomologists electrified window traps by rigging their wooden frames to an automobile ignition coil – a device, nicknamed the 'monkey-buzzer'.

[x] The hut's inscription of mosquito behaviour conveys an ecosemiotic concern with "the formation of nature, the designing and building of the environment using the human (linguistic, aesthetic, etc.) forms" (Kull 1998: 350-351).

[xi] In the case of insecticides, universal acceptability is of upmost importance, as the use of the intervention in one house, will drive mosquitoes to one that is not treated, putting those residents at risk. In other words, it must be a collective intervention.

[xii] See an interview with Fredros Okumu: http://www.malariaworld.org/blog/e-interview-fredros-okumu-kenya-1981

[xiii] Any payment is strictly not a salary, but rather a compensation, reimbursement, reward, or minimal emolument, for volunteered and consented participation. This gift, returned to the hosts of research, comes to an end with the completion of a particular research project.

[xiv] The links established by the hut between scientific activity and the realities of daily existence resonates with Adam Sharr's account of Martin Heidegger's small mountain cabin (which the philosopher called "die Hütte"). He suggests that the hut's simple design and sparse interior facilitated an emotional and intellectual intimacy with the vitality of a place: for Heidegger, it was "a refuge against—but simultaneously with—the elements" (2006:65). But unlike Heidegger's hut – a *retreat*, often off limits to visitors and family – these canvass models are prodigiously public.

[xv] In The Gambia, where experimental hut trials have been conducted since the 1980s, former sleepers recalled their experiences with considerable fondness, as a privileged time to get away from the troubles of family life.

[xvi] The domesticity was also a critical site of intervention for colonial government and missionaries, focusing on all aspects of the domestic realm from the role of women to the shape of the houses (Hansen 1992). These interventions were intended to have a civilizing effect, a legacy which continues to shape global public health efforts to change household behaviours.

[xvii] Her example also comes from the world of research: she describes a Zimbabwean scientist, who stick his arms in a tsetse fly cage to learn what his laboratory guinea pigs feel when they are subjected to the biting flies.