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WILL HE BE THERE?

Mediating malaria, immobilizing science

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This paper focuses on an unsettling example of experimental labour – the Human Landing Catch (HLC). The HLC is a cheap and reliable technique to produce data on mosquito densities in a defined area. It requires only a human volunteer to sit over night with his legs exposed, a headlamp to spot mosquitoes, and a rubber tube and plastic cup to catch them as they come to feed on him. The HLC formed the central methodological and operational strategy for a malaria control that took place in Dar es Salaam, funded by the Bill and Melinda Gates Foundation. This paper analyses the epistemic and economic value of this experimental scenario by examining in detail the work it entails. In conceptualizing the different species of productivity associated with the HLC, of particular interest is the surprising fact that he is there. This paper argues that the interplay of mobility and immobility offers a way to rethink the value of research within interlocking circulations of capital, science, mosquitoes and men.

KEYWORDS: medical research; Africa; malaria; experimental value; post-socialism

The project is precisely a mass of active connections apt to create forms – that is to say, bring objects and subjects into existence – by stabilizing certain connections and making them irreversible. It is thus a temporary pocket of accumulation which, creating value, provides a base for the requirement of extending the network by furthering connections. (Boltansky & Chiapello 2005, p. 105)

Introduction

The red pickup truck comes for me at 9.30 pm. I squeeze into the back, next to the two Community-Owned Resource Persons (CORP) and a Tanzanian PhD student under the supervision of the principal investigator of the Urban Malaria Control Programme (UMCP). We set off into Dar es Salaam, preparing ourselves for a late night. The team must conduct, at the very least, 15 'spot checks' across the city. Our first stop is on the western edge of town, a 20-minute drive from my hotel on the peninsula. Where the electric lights grow few and far between, we turn off the tarmac and bounce along a network of washed-out mud roads. It quickly becomes too narrow to drive, so we get out of the car and make our way single-file through the back alleys, straddling streams, heaps of garbage and small garden plots. Around the corner of a house, we find a young man with his pants rolled up, a headlamp and a rubber tube in hand. Seeing us approach, he stands up, stretches and hands the student a form. The student picks up the netting-covered plastic cup on the ground near the man's feet. It is humming with mosquitoes. He makes a note on his

datasheet, pats the man on the back, and turns to leave. 'He's a good one, this guy', the student says, 'always here'. The visit is short; there is a lot more to do. Behind us, the man sits back down and readjusts his headlamp. We leave him there in the moonlight, rats running along the drainage ditches and radio playing in the street.

The investigative focus of the UMCP is the effectiveness of larval control in reducing the incidence of malaria in Dar es Salaam. The active agent on trial is *Bti*, a microbial insecticide. In contrast to DDT, *Bti* is safe for nontarget organisms and because it contains multiple toxins, its use is less likely to result in resistance. But while highly effective in killing mosquito larvae, with little residual activity, *Bti* must be re-applied on a weekly basis. To prove the effectiveness of *Bti* as a viable instrument of disease control, the principal investigator required up-to-date evidence of mosquito densities across the city. For this purpose, the Human Landing Catch (HLC) is considered the most reliable technique (Okumu et al. 2008). The key methodological advantage of the HLC is that mosquitoes are caught as they come to feed. Thus, in contrast to those captured by a light trap, the samples obtained can be deemed representative of disease transmission. HLC is also cheap and relatively simple; an aspirator (a mesh-covered glass vial attached to a rubber sucking tube), cotton wool, some rubber bands, a few plastic cups, a source of light and a human volunteer are the only necessary equipment. As most *anopheles gambiae* – the most common malaria vector – are nocturnal, HLCs perform their duties between sunset and sunrise. Customarily, the HLC is conducted within homes and can be reinforced or supplemented by a bed-net trap. But after decades of spraying homes with insecticide and covering beds with insecticide-treated nets, Dar es Salaam's mosquito populations, once domestic, now seek their hosts in the streets. Therefore, in the context of the UMCP, placing HLCs outdoors is the only way of collecting accurate evidence.

There are, however, considerable drawbacks to this method. Catching mosquitoes over night is both mentally and physically exhausting. Sitting in a chair, waiting for mosquitoes to land, sucking them off the legs into a tube and then blowing them into a cup demands patience, intensive focus, and above all, stamina. With catches going on in 268 routinely maintained sites in Dar's back alleys, supervision also poses a challenge. Hourly records of catches may reduce the possibility of data-fabrication, but random spot checks are still necessary to ensure volunteers stay at their posts. Because collectors differ in their attractiveness to mosquitoes and in their skill in catching them, even with vigilant surveillance estimates can be difficult to generalize.¹ Another obvious problem with the HLC is that it involves direct exposure to mosquito-borne infections. Precautions are taken – all volunteers are screened weekly for malaria and, when infected, treated with artemisin-based combination therapy. Because it involves placing the catcher in a compromising position, the HLC is restricted to men over 18 years of age. But particularly at a time when drug-resistant malaria is on the rise, becoming a target for mosquitoes poses what may seem unnecessary risks. But for the purposes of this paper, I would like, for the moment, to suspend the visceral discomfort the experimental scenario provokes and consider first its value. I use the term value, broadly to describe both the moral virtues of knowledge-production and the monetary costs of malaria control. Drawing on theoretical resources from anthropology, science and technology studies and economic sociology, this paper examines how political, economic, and scientific logics are inter-articulated through public health research practice.

The paper tracks these overlapping and countervailing forms of value across three sections and each of them conceptualizes the role of the HLC differently. It begins by

examining the HLC as a species of experimental subjectivity particular to the informal economy of Tanzania. In Dar es Salaam, the formation of the HLC's experimental subjectivity is in continuity with a post-colonial, post-socialist trajectory. I suggest that in the case of the UMCP, the practices of transnational knowledge production overlap with residual forms of civic identification. In the second section, I elaborate the collective character of experimental participation as technical work by linking the HLC to the particular investigative demands of the project. Of particular interest is the relationship between the HLC as knowledge-producer and the transformation of Dar es Salaam into a venue for disease management.

The third and final part of the paper considers how the value of the HLC's labour coincides with the organization of global health. Markedly out-of-step with current R&D trends, the UMCP investigates an environmental strategy associated with colonial governments. The malaria investigated here is defined by ecological and administrative specificity – relations that lie outside the current figuration of malaria as a threat to the global economy. My argument is that the HLC reanimates those relations and projects them on a future civic order. The theoretical consequences of immobility I leave for the conclusion where I briefly consider the HLC as a counterweight to the 'project form' of humanitarian engagement (Boltanski & Chiapello 2005). In presenting this particular account of these dynamics, I point to different alignments of knowledge, work, science and place and suggest how these shape the value of research.

Community-Owned Experimental Subjects

The first place to look for the value of the HLC is where money changes hands. On average, mosquito-catchers receive 3000 Tanzanian Shillings (TShs) – roughly \$2.45 (US) – for a night of collection. This sum reflects a moderate increase on what they might make from selling batteries, oranges, or phone cards – the activity that provides most catchers with their primary source of income. Of course, the payment of \$2.45 is strictly *not* a salary, but rather a 'minimal emolument' for volunteered and consented participation (Fillinger et al. 2008). Here, as in all biomedical research, the motivation of the subject provides an ethical anchor; the exploitative potential of putting the body to use is mitigated by the degree to which it is freely offered (Geissler, this issue). Monetary exchange – whether framed as compensation, reimbursement, or reward – must be kept ideologically distinct from the logics of accumulation; any disambiguation of the pragmatics of participation risks impugning the purposes of research.

Work in the social sciences has repeatedly shown that the trope of volunteerism lacks empirical traction in the context of clinical research (e.g. Geissler et al. 2008). In an effort to expand the conceptual repertoire of bioethics, scholars have situated participation within the social and political circumstances in which research is conducted. Kaushik Sunder Rajan's ethnographic work on the emerging Indian bio-industry is of note in this regard. Zeroing-in on clinical research conducted in Parel – once the hub of Mumbai's textile industry and now the home of a genome company, hospital and lab – Sunder Rajan excavates the collective identity of experimental subjects who were formerly mill workers. For Sunder Rajan, the integrity of the individual participant's consent is not of concern – indeed the trials conducted in Parel adhere to the highest ethical standards. The violence he identifies is structural, introduced through the specific colonial histories and political economies of Mumbai and exacted within the institutions in which work takes

place. In contrast to the social character of factory work, formalized through unions and materialized in the built environment of the mills, participating in trials is individual, placeless and (by ethical prescription) anonymous. As the Indian economy shifts from commodity-based to speculative capital, the working-class identity is:

under threat of erasure. This is ... because part of the evisceration of the industry involves pushing more and more workers into informal sectors of work, and therefore away from trade unions ... The structurally formed subject-position in Bombay is not one of shared social identification, but rather one of desperate individuation and alienation. (Sunder Rajan 2002, p. 169, p. 173)

The rise in contingent forms of labour has replaced a politically robust class-consciousness with thinly imagined human rights. For Sunder Rajan, the professional experimental subject is not an ethical aporia but an archetype of the disenfranchisement of the labourer under advanced capitalism.²

Following Sunder Rajan, the question we might ask is how the HLC tallies with the distinct economic realities of contemporary life in Dar es Salaam? Is being bait yet another expression of neo-liberal logics? Like Parel, Dar es Salaam is dominated by an informal economy (Tripp 1997). But though a flexibly configured economic landscape is characteristic of African urbanization (Simone 2004), Dar es Salaam's informal sector bears the distinct marks of a failed socialist project. Here, the informal economy does not merely denote unregulated economic activities, but rather the creation of resources through which people sustain the civic capacities formally articulated by the state.

Nyerere's political philosophy of *Ujamaa* drew heavily on a British tradition of welfare economics that recognized the state as the guarantor of equity, and thus the rightful distributor of key resources.³ He aspired to liberate Tanzania from the chronic underdevelopment to which it was condemned by colonialism by righting the imbalance between production and consumption, the needs of the countryside and those of the metropolis. The engine of modernity for Nyerere's independent state was thus not the formal urban sector. Rather, social progress would be the outcome of state-initiatives realized through the diligent participation of a self-reliant citizenry. To advance that vision, Nyerere pursued drastic policies, such as, 'villiginization' – the forced relocation of rural populations to organized sites of cooperative production.⁴ In the city, trade was heavily regulated; private industry and sideline employment, deemed contrary to the spirit of *ujamaa*, were persecuted (Lewinson 2007).

Nyerere's development strategy met with little success. His social policies alienated aid donors from the West. His efforts to restructure agricultural production disregarding heavy industry impoverished the country further (Pratt 1999). As economic crisis struck and structural adjustment measures were put in place, informal businesses became the primary source of household income. Locally organized groups took responsibility for public services that the state no longer could provide – such as waste removal, infrastructural upkeep and security. While counter to the official political ideology, the informal sector supported government institutions and thus mitigated their deterioration. As Mari Ali Tripp suggests, 'the resiliency of society and its ability to reproduce itself with considerable autonomy from the state is one of the reasons the entire fabric of society did not fall apart during the unprecedented hardship' (Tripp 1997, p. 5).

These civil resources would prove invaluable for the UMCP. The volunteer was not enrolled into the project as an experimental subject, rather he was first employed as a

member of the Community-Owned Resource Persons (CORPs), and in that capacity was delegated the responsibility of performing the landing catch. In the past, CORPs had been appointed by members living within Ten Cell Units (TCU) – a cluster of about 10 houses – to perform basic public health services and small-scale maintenance tasks, such as garbage collection, road cleaning and soap distribution. A feature of Nyerere's urban reforms, CORPs were intended to serve as an administrative bridge between citizens and the municipality. But like many national programmes they fell victim to the economic reforms in the 1980s. Though many continued to work on a volunteer basis, with little administrative or financial support from the city council, CORPs no longer functioned as a coordinated system.

Recruiting participants through this network offered considerable operational advantages for the UMCP. In ecological studies, access is of critical importance. Selected by street chairman, the CORPs guaranteed the project's acceptance among local residents. Their familiarity with the physical and social landscape enabled the research team to locate mosquito-breeding sites, many of which were occurring within private homes and gardens. Outsourcing the experimental work to the CORPs also minimized project costs. The mosquito collector received a compensation equivalent to that offered to a volunteer municipal servant for any odd job, like road cleaning (Chaki et al. 2009).

The use of a dormant social infrastructure within the research project raises some interesting questions about how to value the mosquito catcher's labour. Paid by the research project but enrolled as a CORP, the HLC's experimental role is embedded within a civic sociality. His labour falls partly outside the economy of transnational clinical research, even as it is sustained by it. How, then, do we understand the value of that labour at the intersection of different modes of economic rationality? Do we agree that \$2.45 is a fair compensation for the risks he sustains and, further, for his contribution to the project's outcomes?

In the following section, I begin to respond to these questions by widening the scope of analysis to the other forms of experimental work associated with CORPs. The heuristic value of the night mosquito catches lies in tracking the density of urban mosquito populations and, by extension, revealing the transmission rate of malaria. But within the UMCP, that task also serves to demonstrate the work of larval control – the size of the HLC's collection indicates whether the application of larvicide has been comprehensive, and, if not, the areas that have been missed. Those responsible for larval control and those enrolled to catch mosquitoes are kept separate in order to achieve evaluative rigour. However, they constitute the same volunteer municipal body. The aggregative function of these groups points to the particular relationship of experimental work and the production of knowledge in the context of the UMCP.

Indivisible Technicians

On any given night in Dar es Salaam, men can be found catching mosquitoes in a garden, on a curb, along a drain. These randomly selected sites serve to build a picture of urban mosquito transmission. But these locations also constitute key coordinates in the geography of the experiment. In this section, I will examine the HLC's location as part of a broader project transforming Dar es Salaam into a model city for larval control in Africa. I suggest that the civic epistemology of mosquito mapping resituates the value of experimental work as not only an index of disease but also as an instrument to experimentally format the city.

Because mosquito-breeding sites are bounded and easily located, cities are regarded as the most suitable environments for larval control. But to generate the conditions under which larval control is possible necessitates an ecological understanding of man-mosquito dynamics on fine spatial scales. Dar es Salaam encompasses a diverse range of habitats including sewage pools, cattle troughs, rain gutters, water buckets and ponds caused by poor drainage. And these are only the most identifiable sites – mosquitoes are highly associated with human activity and are just as likely to breed in footprints as they are in swamps. However, advances in Remotely Sensed (RS) imagery and Global Positioning Systems (GPS) have provided the necessary tools to identify and record these habitats. With these technologies, the UMCP research team produced a high-resolution map that related the minor ecology of each area to the spatial distribution of disease across the city.

While accurate, the maps were not practical. As with the HLC, larval control was delegated to a group of volunteers, selected by street chairmen, and enrolled into the project as members of the CORPs. Larval control is also highly demanding: locating and monitoring the diverse and shifting mosquito habitats that characterise Dar es Salaam make staying awake in a chair over night seem easy. Because they bore no relation to how the CORPs visualized the city, the maps produced did little to ease that task. To bridge these different understandings, the UMCP developed a protocol for 'participatory mapping', whereby each larval control CORP was asked to draw a sketch of the area for which he was responsible. Mosquitoes provided the cartographic anchor of these depictions; the CORP identified any potential breeding sites and habitats and related their position to features of the plot such as roads, drains, walls or houses. Knowing where to spray was only part of the problem: watchdogs, gates and intimidating owners were often enough to dissuade a CORP from even approaching a house, let alone asking if they could enter, check and spray any potential breeding grounds in their gardens. The guidelines for spraying stress the interdependence of ecological capacity and social knowledge:

To find all mosquito breeding habitats, you have first to know each and every square metre in your Mtaa [neighbourhood] . . . The only sure way to do this is to know who owns, occupies or uses which plot of land regardless of whether it is surveyed or unsurveyed. (Dongus et al. 2007, additional file, Guidelines for Larval Control)

With the help of a member of the research team, CORPs calibrated their sketch maps with a blown up aerial photograph of their area; boundaries – whether administrative, natural or socio-economic – were marked with non-permanent pens. The prints were laminated to protect them during intensive use in the field, and to encourage CORPs to adapt the map to their daily experiences and to new data from night mosquito catches.

Capturing the dynamic reality of the encounter between man and mosquito demands a flexible methodological format: tied to the demands of place, these technologies of spatial representation are subject to continual modification. The HLC mediates these adjustments. Night-catches render visible mosquito movements and reorient larval control activities to new breeding grounds. This finely tuned process of vision-and-revision stands in stark contrast to the geographic colonization of territory described in theories of the state-formation (e.g. Mitchell 2002). Dar es Salaam is here elaborated as an active network of relations, references and practices – the making of a mosquito map is embedded in the sociality of the city streets. The HLC sits as a sentinel

along that chain of designation; his night-catches reveal the slippage between scientific space and urban place.

Thus, though the work of the CORPs is highly physical, it also entails more immaterial, affective aspects. Their intimate knowledge of the field and its inhabitants generates the conditions for the cartographic liveliness critical to the generation of ecological knowledge. In terms of project value, one question we might ask is how that socio-technological praxis tallies with the work of the research team. This is a familiar question for the sociology of scientific knowledge: Steve Shapin explores the role of the 'invisible' technicians who designed, constructed, and operated Robert Boyle's foundational experiments (Shapin 1989). Shapin argues that the division between technical and analytical labours – and the difference in their value – was grounded in the status of the workers as servants and not gentlemen. In other words, while Boyle could pursue knowledge freely, the technicians were all 'remuneratively engaged to work at Boyle's request. That is they agreed to exchange a certain amount of autonomy and work for a certain amount of money' (Shapin 1989, p. 561). Once they entered into monetary exchange, their contribution was disconnected from the authority of science.

Though scientists now receive a wage, the division between menial and mental labour continues to have a bearing on contemporary scientific research. However, in Africa, the relationship of scientific assistants to the production of knowledge has a slightly different significance. Some of the earliest forms of colonial education were aimed at 'extending the arms and hands' of colonial medical officers (Hunt 1999). The colonial training and employment of spray-men, medical technicians, and volunteer health attendants was animated by logics of expansion (in volumes of patients, samples, analyses), socio-spatial access, divisions of labour, and hierarchies of scientific practice. After independence, these biomedical middlemen became central to large-scale social engineering projects aimed at eradicating inequity and establishing a strong nation state (Beinart et al. 2009).

In short, the CORPs bring together two epistemic conventions of scientific technicians. The first comprises that practical aspects of experimentation that are kept radically distinct from the truth these experiments produce; the second functions as a means of exerting geographic and demographic control. The alignment of research protocol and governmental practice is transformative; the CORPs work to make Dar es Salaam a typical African City, a neutral backdrop against which to diagnose and predict the effectiveness of larval control. But in so doing, they also render the city manageable as an object of control. Through the CORPs handy-work Dar es Salaam becomes a collaborative project, a site of development.

In the final section, I will elaborate further the economic forms of value that underpin that process of transformation. The UMCP encompasses a number of experimental modalities – it is a proof-of-concept, a demonstration of chemical efficacy, a test of cost-effectiveness, and a simulation of environmental management. As a pilot for a future policy, the UMCP's persuasive power depends upon the social and material connections it forges between test setting and site of intervention (Lezaun & Millo 2006). Those connections come about through the participation of the CORPs who, by the consistency of their practice, forecast the validity of the trial and close the gap between science and city. Between research pilot and public health programme, their work encompasses different techniques of calculation, configured around the resources brought to bear by malaria, international science, and the state.

Street-Level Malaria

Let me now return to the 'emolument' offered for a night's work in the chair. A competitive wage in Dar es Salaam, \$2.45 seems at odds with the millions of dollars in capital and material resources made available to the project – by the Gates and Melinda Foundation, USAID, the Wellcome Trust and the Swiss Tropical Institute. More broadly, the project sits squarely within the funding priorities of 'global health'; in 2009, the Global Fund awarded Tanzania \$680 million to expand malaria treatment and prevention. In the sections above, I discussed the mosquito-catchers' labour first, in terms of their experimental subjectivity, and, second as a scientific practice. Now, I want to explore how these practices participate in each other, and how their technical and ideational compatibility influences the way in which malaria is framed as an object of intervention.

In his analysis of how economics constitute markets, Michel Callon examines the technical devices that designate 'economic' phenomena from those that lie outside of calculation and are deemed 'social' (Callon 1998). These boundaries are not tightly maintained and are subject to constant 'overflow'. Malaria offers a provocative case study in how an entity becomes framed as 'economic' and, further, in the socio-technical consequences of that framing. An ancient disease, malaria is an externality with considerable *puissance*; the parasite has overturned battles, dispatched sovereigns, and relocated civilizations. It has shaped agricultural techniques, methods of building, and the planning of cities. Taking malaria into account was the founding goal of tropical medicine; often viewed as the benevolent aspect of colonialism, modern public health was (and continues to be) intertwined with the interests of international commerce (e.g. Anderson 2006). The international system of economic governance that emerged after World War Two reframed malaria as a threat to markets on a global scale. This transformation from situated illness to international pandemic took shape through epidemiological models that defined malaria not as a problem of social ecology, but as a probabilistic relationship between mosquitoes, malaria parasites and human hosts (Packard 2007). Second, that relationship was costed – in terms of worker productivity, school absenteeism, medical costs, cognitive ability, population mobility, trade and tourism – through a raft of social-technical algorithms and multiple regression analyses. Third, those costs have been aggregated, stabilized and projected. According to John Gallup and Jeffery Sachs, malaria costs African nations roughly \$12 billion annually in direct economic losses and many times more in reduced economic development – a 'growth penalty' which, for Sub-Saharan countries like Tanzania, is currently calculated at 1.3% per year (Gallup & Sachs 2001).

As an object of economic calculation – disarticulated into transmission rates and development indexes – malaria precipitates large-scale interventions. Local methods of control, such as improvements to infrastructure and strategies of environmental management, seem myopic pitted against an epidemic of such global proportions. But most of all they are criticized as inefficient: integrating disease control into social development programmes demands heavy investment with limited returns. In contrast, programmes that specifically target disease transmission on a global scale are expensive, but have far reaching potential. The failure of the Global Malaria Eradication Programme in the 1950s was not regarded as a problem of modelling, but was rather blamed on negative externalities – drug and insecticide resistance, the environmental movement, and philanthropic fatigue. When malaria returned to the centre stage of global health agendas

in the late 1990s, the strategy was to anticipate and neutralize these problems with the breadth of technological innovation and the sheer size of investment.

With the support of the Bill and Melinda Gates Foundation, international funding of malaria research and control interventions has quadrupled over the last few years – from \$249 million in 2004 to \$1.1 billion in 2008 (McCoy et al. 2009). The competing costs incurred by the disease and by its control, again, suggest that obliterating the pathogen is the only way to clear the balance sheet. Anything short of global eradication is a bad decision, for it means, to quote Melinda Gates, ‘that we will keep bearing forever the human costs of malaria, even as we keep paying forever the financial costs of trying to treat and control it’ (Melinda Gates, Malaria Forum, October 2007).

Funds bring with them their own calculative devices – performance indicators, accountability measures and systems of audit (Strathern 2002). The question, then, is how the work of the HLC renders malaria legible within these forms of valuation. To answer this question, we need to situate the UMCP within the technical trajectory of the disease as it has evolved in Tanzania and more specifically, Dar es Salaam. The city has a long history of malaria control, which sets it apart as a venue for intervention and, experimentation. Malaria has been a persistent feature of its urban landscape since the German colonial authorities introduced planning schemes to separate malaria-endemic native bodies from susceptible white ones. Under the direction of Robert Koch, the city became the site of the most extensive quinine treatment programme in colonial Africa. Following World War One, the British, introduced strict legal sanctions for the destruction of ponds and other sources of stagnant water, and, through the deployment of the Royal Army Medical Corps, carried out a wide range of vector-control strategies, including comprehensive drainage work, stream straightening, livestock surveillance, and eventually, larvicidal aerial spraying (Castro et al. 2004).

During independence, malaria control provided an arena for the extension of the newly established state (Gerrets 2010). Nyerere’s theoretical and political starting point was the link between economic inequality and disease. His plan for Tanzania’s development, outlined in the Arusha Declaration (1967), hinged upon restructuring the health sector on the basis of socialism and self-reliance (Marsland 2006). Inspired by China’s barefoot doctor programme, Nyerere created a network of rural centres, and ultimately relocated the rural population to facilitate access (Hsu 2007). Urban malaria control was successfully integrated into the general health services, owing in large part to the participatory mechanisms Nyerere put in place to decentralize health care. In 1971, the WHO East Africa Aedes Research Unit experimented with an integrated vector control programme in collaboration with the Dar es Salaam City Council. By 1973, the transmission rate of Dar es Salaam reached its lowest point in a century, ironically just at the moment when Tanzania’s deepening economic crisis made environmental management programme economically unfeasible.

Through the 1980s, Dar es Salaam’s experience mirrors that of Sub-Saharan Africa. As a result of the pressures of the IMF, spending on health was cut in half and pharmaceutical treatment became the sole anti-malaria intervention. Malaria parasites became drug-resistant and the density of *Anopheles* mosquitoes soared. In 1988, the city once again became the site of intervention, when the Government of Japan, interested in expanding its development aid portfolio, selected Tanzania as its key recipient and launched an integrated urban malaria control programme with an emphasis on mosquito surveillance. Over the course of eight years, the Japan International Cooperation Agency (JICA) donated

resources, equipment and technical expertise amounting to roughly \$21 million US dollars. Despite its success in rehabilitating drainage infrastructure, the programme never became sustainable. In an interview with one of the municipal directors, she attributed this failure to the architecture of the intervention. In accordance with Japanese Government policy, Japanese expert advisors rotated every two years, advising Tanzanian partners on the techniques of vector control, but neglecting its more managerial aspects such as data collection and analysis.⁵

By the time malaria had made its reappearance on the global health stage, it was already highly visible in Dar es Salaam. Though not sustainable as a programme in vector control, Japan's intervention had produced a detailed cartographic profile of the disease. Routine remote sensory images and aerial stereoscopic maps documented the city's ecology and epidemiology, already described by records dating back almost a century. In addition to its textual depth, Dar es Salaam's infrastructural and political landscapes – not to mention mosquito populations – had been profoundly shaped by repeated efforts at malaria control. Further, the prospect that by 2030 more than half of the Sub-Saharan African population will live in cities suggests a need for more malaria research conducted in urban settings. Dar es Salaam provided an ideal unit of analysis, a ready-made 'truth-spot' scalable to cities across the tropics (Gieyrn 2006).

The history of malaria research in Dar es Salaam and its metropolitan trajectory provided the key selling points for the project's principal investigator, an ecological biologist deeply committed to an integrated-approach to vector control. He managed to secure pilot-funds from the Bill and Melinda Gates Foundation – though the invention he led did not match the Foundation's innovation-focused profile. That support was, however, limited to one year, after which the programme's existence would depend on further *ad hoc* funding. Because larval control can take years to show an impact on transmission, sustainability was not only a long-term goal for the programme, but also a condition to demonstrate its effects. Thus, though the efficacy of *Bti* provided the justification for the study, its protocol emphasized the operational feasibility of implementing a large-scale, community-led larval control programme.

Ultimately what was on trial, then, was a system of management. But while potentially cost-effective, integrating the project into pre-existing municipal structures required a complex system of surveillance stretching across distinct spatial and administrative scales. For instance, CORPs responsible for the application of larvicide and those performing HLCs reported to separate Ward Supervisors, who provided weekly summaries of these reports to the Municipal Mosquito Control Coordinator (MMCC). Every month, the MMCC sent the aggregated forms with action notes to the City Mosquito Control Coordinator (CMCC). The CMCC, in turn, produced a written narrative of the programme's progress for the City Mosquito Surveillance Officers (CMSO). The importance of paper work to the surveillance system cannot be underestimated. Collection forms, Excel spreadsheets, data reports, and written feedback link the administrative layers of the hierarchy, formalise action plans and allow for an unambiguous assessment of performance (Riles 2006). This layered system of annotated exchange also extended the temporality of the research from project to programme:

Overall, the vector surveillance and management systems developed in Dar es Salaam allow timely collection, interpretation and reaction to field-collected entomologic data with reaction times at ward, municipal and city levels . . . Vector density patterns were

drafted into manuscript format figures within three weeks of their collection through these standard low-technology procedures, therefore serving as an instant monitoring and teaching tool. (Filing et al. 2008, p. 13)

The UMCP thus became a combination of operational programme, research project and training platform. As part of the infrastructure for malaria control, the HLC's value is calibrated not to the facts the project produced, but to its future. Between the research project and the system of public health management malaria appears both as an economic and sociopolitical entity – an obstacle to development and its vehicle. Three years into the UMCP the operational costs and the mosquito density have dropped dramatically, malaria transmission rates are down. The National Malaria Control Programme has now set itself the target of establishing similar programmes in five Tanzanian cities by 2013, but the country lacks the necessary financial resources to do so. Meanwhile, the CORPs have been allocated full time to the programme. The hope is that further funds will become available as the dream of eradication fades and the need to develop new ways to control malaria comes into sharper focus.

So what version of malaria does the work of the HLC produce? Processes of economization render unruly entities subject to management and subject to control (Callskan & Callon 2009). As an economic object, malaria is detached from its political histories and ecological specificities and costed as a parasitological exchange. What is striking about the HLC is that it reconnects the economics of malaria to its administrative practice – the mosquitoes he enumerates entangle the parasite in urban planning, in infrastructure, in community relations, and in local politics. Immobilized in his chair, the HLC enables other things to move – the population of mosquitoes, men and parasites, the contours of the urban landscape. These circulations are rendered visible but not static; the presence of the mosquito catcher enables an elastic response to the adaptability of the vector. Mosquitoes change their behaviour in response to human environments and public health interventions; each time the *Bti* is applied the dynamics of that parasitological exchange between men and mosquito and the landscape of infection is subtly adjusted. Dar's populations come into view as they move from homes to the streets. The situated, persistent work of the HLC also mediates the flow of knowledge between ecologists, volunteers and communities; an ancillary epistemic exchange that runs through the production of facts. In short, his work sediments scientific practice: his collection transforms city streets into project evaluations, experimental techniques into tools of control.

Conclusion: Place and the Project

This paper has explored the distinct orders of value involved in and generated by the HLC. I tried to locate the act of being-bait both in the economy of Tanzanian society and within the relevant protocols of scientific research. I have also suggested how the stationary volunteers of this malaria control project affected the direction and meaning of the experiment. Rendering Dar es Salaam visible for intervention demands civic commitment. The administrative intimacy of the experiment yields a productive overflow – as a pedagogic instrument, a catalyst of community action, and a rationale for urban planning. Finally, I have suggested that the extensibility of the project – its capacity for growth through use – opens a space for politics in global health research (Miyasaki 2004).⁶ In the words of Hassan Mshinda, the head of Tanzania's Commission for Science

and Technology: 'Unlike cutting-edge molecular biology, semi-field ecological studies and open-field research can be undertaken in any African setting, and constitute an immediate opportunity for malaria-afflicted nations to regain their roles as stakeholders, decision-makers, and eventual owners of this technology' (Mshinda et al. 2004).

Though they form a central part of malaria control in Dar es Salaam, environmental strategies have for the most part been committed to the dustbin of pre-World War Two history (WHO 2008, p. 9). Today, methods that entail this sort of logistical complexity and are bound to specific institutional and geographical topographies run counter to the dominant economic rationale of malaria control, and to the ideological underpinnings of global health. The emphasis of Euro-American policy on emerging diseases has shifted public health from a problem of population management to one of surveillance – in the interests of establishing networks of information exchange, projects circumvent sovereign states, pursuing partnerships between non-governmental organizations, charities and private industry (King 2002). The universalizing project of global health resonates with the epistemic imperatives of science. Indeed, we are accustomed to thinking of scientific significance as a feature of its mobility; reliable knowledge is that proved to hold true regardless of time or place (Latour 1983). The dislocation of science from national institutions amplifies the itinerant character of knowledge production.

Boltanski and Chiapello (2005) identify 'the project' as the archetype of the new spirit of capital – a social order and economic practice that privileges flexible, mobile and temporary forms of labour.⁷ In contrast to the top-down hierarchical organizations associated with industry, projects render capital fluid. Assembling disparate groups of people for short periods of intense connection, these 'pockets of accumulation' operate as an *encounter*. The logic of the encounter is that 'not being integrated once and for all into an institution or environment, it presents itself as an action to be formed, not as something that it is already there' (Boltanski & Chiapello, p. 110). The links made through projects are continually suppressed to pursue other forms of connection made available in the 'networked' world. Those unable to join and profit from the shifting array of projects are excluded from the flows of capital. Boltanski and Chiapello critique the normative imperative of mobility and its ideological associations with liberation. Immobility, they argue, serves a critical but often hidden function of cultivating social links – the values – upon which capital relies but is incapable of producing. Only if some stay put, can others move.

The value of the HLC lies in its peculiar balance of circulation and emplacement. Despite its collaborative potential, within the 'global public' health landscape, the UMCP was a discrete *project* within the global public health landscape, funded by international donors and limited in time. Yet the presence of the mosquito catcher, night after night, embeds the resources of international science into the administrative practices of the municipality. He provides a platform to integrate and entangle mobile resources into fixed, stable institutions (Kelly et al. 2010). His immobility provides the possibility for future movement. His is a precarious position – in the sense of being financially insecure and physically dangerous, but also one 'offering potential for new subjectivities, new socialities and a new kind of politics' (Gill & Pratt 2008, p. 3). The capacity of the HLC to *be there* produces value by forming connections between the world as an object of description and the capacities of those who inhabit it. That epistemic intimacy takes considerable commitment. Once a week, at six in the evening, he will find his way to one of the four sampling locations in his neighbourhood, roll up his pants, and wait.

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NOTES

1. When it began, the UMCP area only covered 4% of the overall city region. However, those areas were the most highly urbanized, home to at least a quarter of the population.
2. Rajan's reading of the experimental subject follows Marx's understanding of prostitution, which he regarded as 'only a specific expression of the general prostitution of the labourer' (Marx 1964, p. 133n).
3. The literal meaning of ujamaa is family-hood. For Nyerere, its use meant that 'for us socialism involves building on the foundation of our past, and building also to our own design ... by emphasizing certain characteristics of our traditional organization, and extending them so they can embrace the possibilities of modern technology' (Nyerere [1967] 2002, p. 133).
4. As a symbolic gesture of shared purpose, he moved the government from Dar es Salaam to Dodoma, a less cosmopolitan, but more appropriately 'African', town for the nation's capital.
5. This organizational structure did not sit well with Tanzanians' sense of autonomy, an ethos which had attracted Japan to Tanzania in the first place (Ampiah 1996).
6. In information technology, extensibility refers to software programmes that can extend the system's capacity through use. Hirokari Miyazaki ethnographically elaborates the term in reference to the relationship between hope and knowledge he sees at work in indigenous Fijian gift-giving (2005). Miyazaki focuses on the temporal scheme of giving and how the expectation of reciprocity becomes an engine of social life; here, too, I want to argue that the value of the programme is linked to future civic capacity.
7. Boltansky and Chiapello contrast the ideology of the project to the inspirational, domestic, reputational, civic and commercial justifications of capitalism. These explanatory frameworks – which they describe as 'cities' – link forms of accumulation with normative conceptions of the social order (pp. 23–25).

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