

The Power and Limits of Numbers: An Ethnography of a Survey on Background Radiation and Health

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Abstract: By considering the characteristics of quantitative and qualitative work as epitomised in survey work and ethnographic fieldwork, this article explores the 'performative contradiction' of their understanding in anthropology and amongst my interlocutors in south India. The epistemological rationale for qualitative research was deemed inconsequential when compared to the strategic uses of, and empowerment that quantitative research was seen to provide, particularly when it came to accounting for the effects of ionising radiation on health. Such concerns arose with respect to a coastal rare earths sandmining company and a nuclear power plant under construction less than 30 kilometres away from their homes. Significantly, surveys were welcome if they were done not *on* them, but *for* or *by* them – that is, the collation of statistics that they could operationalise according to their own agendas which were, firstly, to provide evidence as to the hazards of ionising radiation, and secondly, with respect to curtailing further expansion of the nuclear industries in the region. Their views encouraged me to think elliptically about the methodology I adopted, such that I decided to pursue an ethnography of a survey conducted by them. This entailed a consideration of the substantive and auratic characteristics of numerical data as well as contextualising the rationale, processes and consequences of tactical survey work with what may be called a reflexive, discursive and engaged approach to quantitative research.

Keywords: methodology, ethnography, survey, radiation, nuclear power, south India

Introduction

'Numbers are required, not reasons.'

(Daniel, Kanyakumari District, 2006).

Ethnographic research entailing participant-observation amongst various groups of people is now a long-established convention in anthropology. Its methodological merits are numerous, enabling a multi-perspectival, contextual, fluid and flexible approach, ideally accompanied by what may be called a 'deep cultural immersion'. Based on long-term fieldwork, it enables a means of appreciating and accommodating processual change, contradiction, serendipity, and the articulation of meanings and power. Albeit not able to circumvent institutional and geopolitical inequalities between the ethnographer and 'informants' (Clifford and Marcus 1986, Marcus and Fischer 1986), the approach is still recognised as comparatively more sensitive to the complexities of research on social phenomena than quantitative studies (James *et al*, 1997). By comparison, surveys as the prime vehicle of quantitative social methodologies, imply the production of extensive yet 'thin data' with minimal contextual material. Discussing the social sciences in general, Shulamit Reinharz describes this practice as a 'ritual of survey empiricism' entailing the objectification of life worlds where research is deemed as 'something that was done to an issue or a population, rather than an investigative undertaking into which one threw oneself existentially' (1984:50,64).

But what if people who are the subject of study do not appreciate the epistemological rationale for favouring the qualitative over the quantitative? What if they view nuanced, multi-layered and less objectifying representations of people as of little significance? Indeed, some may even prioritise quantitative practices of collating numerical data to support their views, and with which to make particular claims. It cannot be assumed that indigenous populations operate in a context that is remote from the influence of modernist conventions to do with statistics and surveys developed in the west.¹ There is a need then to examine the use of survey and numerical research practices amongst groups in a manner that does not then nullify their agency or objectives for self-empowerment.

In 2006, I was conducting ethnographic research on perceptions and representations of nuclear issues near a large-scale nuclear power plant project under construction and around coastal regions of Tamil Nadu in southern India, an area reputed to contain 'the

¹ Precedents of indigenous groups using modern technologies and methodologies may be seen with the example of the Kayapo people who used video technologies to throw light on the plight of threats to their habitation (Turner 1992). In this article, we have an instance of town-dwellers coming together with those from rural and coastal communities in south India to collate data.

world's highest level of natural radioactivity in a densely populated area' (Forster *et al*, 2002:1).² Amongst my interlocutors, the ethical rationale for qualitative research was deemed inconsequential when compared to the strategic uses of, and empowerment that quantitative research on pertinent issues to do with health and the environment was imagined to enable. It appeared to be an instance of a 'performative contradiction' as Martin Jay developing Habermasian ideas puts it – that is, 'whatever is being claimed is at odds with the presuppositions or implications of the act of claiming it' (1993:29). This disjuncture between claims and their presuppositions manifest itself through methodological prioritisation where, for instance, anthropological arguments about the virtues of participant-observation that enabled a qualitative appreciation of people's lives were seen as less beneficial when compared to statistical data that surveys could deliver. It would seem a *volte face* of earlier proposals on the disjunctions between western methodologies such as survey, and their distortion of indigenous 'cultural' interpretations (Stone and Campbell 1984) and forced me to reassess my assumptions since a 'culture of surveys and statistics' certainly existed in the coastal district in which I was working. My aim in this article is to account ethnographically for what may be described as an 'indigenous survey', a statistical methodology that was pursued by local residents to challenge the assumptions of state-sanctioned nuclear authorities regarding public health and the environment.³ In this article, I consider how people in south India sought to resist highly toxic industrial developments through a knowledge strategy that emphasised, firstly, systematic procedure rather than cultural interpretations, and, secondly, one that was not entrenched in distinctions about the west and non-west as is apparent in some of the literature in development studies.⁴ With this in mind, I begin with a discussion on the discourse of statistics, before accounting for its implications for survey protagonists in this south Indian region, and the main contexts, processes, findings and effects of the survey conducted by them.

² This discussion which is also widely prevalent in policy-orientated circles elsewhere (see Watson 2007). Yet, as will be made evident in the processual account, reflexive approaches could not be altogether overlooked even by my interlocutors.

³ The account is not exactly an investigation in 'mixed methods,' see for instance, articles in the *Journal of Mixed Methods Research*, and other studies in the wake of Ann Oakley's (1974) critical use of quantitative data. Rather it provides an ethnographic portrayal of tactical survey work pursued by my interlocutors. Conventionally, surveys in the social sciences are done on people, rather than by the people under consideration. This is not to overlook participatory or rapid rural appraisals that have been influential in international development and amongst non-governmental organisations (NGOs) and activists (see Chambers 1983). Such participatory approaches have been with a view to incorporate local knowledge and views in development plans and programmes.

⁴ On the disjunctions between interpretations and practices as they apply to surveys on people, see for instance Ratcliffe (1976), Stone and Campbell (1984), and Bhattacharya (1997).

The Discursive Web of Statistics

Statistics have become an instrumental part of apprehending and controlling the world (Hacking 1990), and as Michel Foucault (1991) has elaborated, they also play a crucial part in governance (see Miller and Rose 2008). Terming it an instance of a 'statistical gaze', Gyan Prakash noted how in the colonial Indian context officials tried to spread the 'net of statistics' as widely as possible in order to collect as much information as possible about the populace (1999:135). The statistical gaze continued into the governance of the modern nation-state, where science was authorised with a special status to lift postcolonial India out of its economically depressed state into one where high levels of economic growth, standards of living, employment, and the manufacture of goods and services could be realised. In order to do so, 'the state itself had to be conceived of as a technical institution, as an expression of the nation's will to achieve a quantum leap in its technological capacity' (Prakash 1999:191). Its administration had to continue with statistics through census, surveys and their influence on developmental programmes in another instance of what Jonathan Murdoch and Simone Abram (2002) have described as 'rationalities of planning'.

Despite the implications of Foucauldian analyses and state ideals for a totalising mesh of governance, the survey protagonists that I worked with in south India felt that statistics provided by government and related authorities where available were unreliable (see Murdoch and Abram 2002). Even with their authoritative address they were seen to be manipulated, and at other times, merely incompetent. Equally difficult were diachronic comparisons of radiation-related illnesses such as data on cancer. By virtue of the available records of deaths in the district, certain diseases were, as one person put it, 'not notifiable because they are not communicable. Cancer is included here. So records are poor'. He informed that pre-1950s records on cancer statistics as a base line to compare later data after the sandmining companies had been established in three villages on the Malabar coastline straddling the states of Tamil Nadu and Kerala - Alwa, Chavara, and Manavalakuruchi. These records, however, lay only with the Department for Atomic Energy, a governmental authority which oversaw all nuclear authorities in India and to which the public had little access.

Statistics then were less a part of a discursive regime than a 'discursive web' replete with gaping holes and flimsy, gossamer traps. Paralleling Thomas Blom Hansen's (2001) observations on the constitutive split of the sublime and profane aspects of the state, the sublime imaginaries of statistics wrestled with their more profane collation and usage. Conscientious residents around the nuclear industries wanted to collate numerical data for themselves, particularly to do with the percentage of cancer incidents in the region, and

the degree of ionising radioactivity in a region of high natural radiation. As the public received information sporadically, not systematically, it meant that any effort to campaign for better health and safety conditions and any related compensation could not proceed far as it would be based on speculation, rumour and insubstantial data. Concerned residents felt that they had to operationalize the logic and authority of science and statistics in order to prove that there was a compelling link between radiation and health problems, a relation that was consistently denied by state authorities. This initiative could be argued as another instance of 'returning the gaze', and thus 'disciplining the state', enshrined in recent legislation, the Right to Information Act (RTI Act, 2005, Webb 2010). With the establishment of the RTI Act, applications to state agencies can be made for information in the interests of greater transparency and accountability. However, the nuclear authorities have been placed outside the act's remit due to the status they hold in 'national security' discourse.⁵ Survey protagonists, whose details are provided below, could not then avail of legislation for increased transparency enshrined in the RTI Act and had to develop another self-resourced strategy with which to collate and disseminate information on radiation and radiation-related afflictions such as cancer for themselves.

The overriding consensus was that surveys had to be not done *on them, but for or by them* – that is, the tactical collation of statistics and 'facts' that they could apply to their own agendas. This way they could at least ensure that the data acquired was not manipulated for the sake of public presentments, and thus could aspire to raise the 'profanity' of statistical data wherever available to the idealised levels of a just, impartial and transparent representation.

Why did statistics carry such sublime resonance? Recalling Weberian analysis of the rational bureaucrat functionary (Weber 1968), statistics as part of 'scientific rationalities' are both abstracted as universals and yet contingent on particular politicised contexts (Abram 2005). Here, we have an example of members of local communities adopting scientific rationalities otherwise associated with state or institutional structures, firstly in a bid for self-empowerment and therefore a consequence of subjective rationales; and, secondly, where they subscribe to an objective discourse that seemingly transcends self-interest so that, as Eeva Berglund observes in another case study, 'the less obviously political they are and the more 'commonsensical' they appear, 'facts'...seem to speak for themselves, providing the grounds for objectivity' (2001:847).

⁵ These nuclear authorities may include the Department of Atomic Energy who oversee the work of other authorities such as Indian Rare Earths Limited, the company responsible for sandmining in the region. In an unprecedented move, in 2012 Dr S.P. Udayakumar appealed and managed to get the Nuclear Power Corporation of India Limited to release one of the two reports requested under the RTI Act, the site evaluation report for the Koodankulam Nuclear Power Plant (see Kaur 2012).

For these dual purposes – of interest and interest-independence - statistics were part of a powerful discourse such that even those who would not immediately identify themselves as officials were not immune to its seductive grip in understanding and acting in the world. This engagement with the discourse of science and statistics was both subjectively formed and objectively framed, and enabled a means of managing the uncertainties and risks of high levels of radiation in the locality. Moreover, it enabled people to imagine themselves negotiating with the nuclear authorities about curtailing further expansion (see Strathern 2000:8).⁶

There were primarily two interrelated reasons for the aggrandised status of numerical data – one which may be described as substantive that was about the acquisition of ‘hard’ knowledge; the other which may be described as auratic in the imagined effects of concretising the nebulous nature of ionising radiations and its effects on the body.

On the first more substantive level, it was fine to base talk on hearsay and impressions, as one person argued – ‘in this village there is a high incident of this and that’ – but that is not enough to make a ‘scientific’ or fact-based argument to convince others about the health hazards of ionising radiation. ‘Scientific’ was seen as an authoritative word that implied hard data, neutrality, rigour and fact, in contradistinction to the soft underbelly of rumour or impression. The circumstances constituted, in Kohso Sabu’s (2011) terms, ‘information warfare’ where the call for, collation and distribution of information becomes crucial in the advance for effective protection from ionising radiation and for supporting residents’ resistance against the expansion plans of nuclear authorities in the region. Statistics generated by local researchers rather than through the parachuting of state officials into the region was of a premium. Power-knowledge need not just be a discursive means of disciplining bodies (Foucault 1980, 1988), but also in light of the biopolitics of managing populations, a means by which particular communities could invert their dynamic and redirect the stamp of authority associated with the correlates of science and statistics to their cause.⁷ In the process, aspects of *discourse* could be siphoned into *tactics*, which can form the basis for critique and resistance (de Certeau 2002).

On the auratic level, numbers mattered – not simply in terms of counting, but also as a form of accounting; not simply in the abstract sense of quantity, but also in the way that figures become *figurative* in the qualitative sense, in the effort to negotiate perceived and actual hazards to do with the effects of ionising radiation on the body. Numbers took on a

⁶ On a comparison between uncertainty and risk, Asa Boholm observes: ‘The concept of risk can be understood as a framing device which conceptually translates uncertainty from being an open-ended field of unpredicted possibilities into a bounded set of possible consequences’ (2003:167).

⁷ See also Petryna (2002) on the biopolitics of radiation in the Ukraine.

luminous aura as they gave form to the hazy spectre of radiation – an invisible, odourless presence, locally termed *kathir veechu* (literally meaning ray application), and known to be hazardous in its ionising form but not to which extent nor with which consequences in their surroundings. Statistics became a means by which to make visible uncertainties that 'relate both to the chances of a negative outcome *and* the nature of the outcome itself' (Boholm 2003:166, emphasis in the original). Hence, numbers were not simply useful in concretising nebulous effects to do with radiation, but they also had a transformative effect. They were not just representational or justificatory, but also performative – produced out of, and creating new social realities.

I became involved in the two month long survey and recorded much of the process with my notebook and cameras, some of the photographs being used in their final report. I attended meetings, and accompanied the project co-ordinator and doctors to the medical camps in order to verify some of the identified health problems. These 'camps' were set up by local sympathisers – usually a room with a desk where individual families were seen by the doctor who later accompanied the survey protagonists. My views on the survey work were also solicited on several occasions, although this was more for opinion than determining the direction of the survey. My involvement in the survey, however, was not simply to 'objectively' account for survey practices. I cannot pretend that I was not sympathetic to the protagonists' cause. Rather, my intent here is to present an engaged ethnography on tactical and reflexive survey work that was believed to generate actionable knowledge. Recently, Seta M. Low and Sally Engle Merry (2011) proposed a number of action-orientated ethnographies that range from sharing and support, teaching and public education, social critique, collaboration, advocacy, and activism. The account I present here is in alignment with many of Low and Merry's proposals rather than in the convention of representing 'ringside' ethnography.

The People and the Region

Peninsular southern India in Tamil Nadu is largely populated by Hindus and Christians of varying denominations, the main ones being Church of South India (Protestant), Roman Catholic and Syrian Christian. Left with little recourse but to rely on census data myself for background information: most of the fishing communities are Catholics from a Mukuvvar caste background, who despite the devastation of the tsunami from the Indian Pacific in December 2004 continue to live near their boats on the coastal sands. Inland communities are mainly Hindu ranging from high caste Brahmins and Vellalars to lower caste Nadars

and Ezhavas as well as Scheduled Castes and Tribes. The largest minority are of Muslim background.⁸

The survey was mainly conducted in the district of Kanyakumari. The district capital is Nagercoil, a town of approximately 200,000 people, approximately 30 kilometres from the Koodankulam Nuclear Power Plant in the neighbouring district of Tirunelveli and located about 10 kilometres from the nearest coastline where the sandmining company, Indian Rare Earths Limited, is based in the village of Manavalakuruchi (Figure 1, see below). This area of coastal south western India contains heavy atomic minerals such as monazite, ilmenite, rutile, garnet and sillimanite for a stretch of about six kilometres. The sandmining is done by manual methods and dredging with machinery whilst processing of the sun-dried sand was done by electromagnetic and electrostatic operations (Figure 2). The monazite in particular contains the radioactive thorium which is ear-marked as nuclear fuel when converted to uranium for the fast breeder nuclear reactor in Kalpakkam near the state's capital, Chennai, located about 800 kilometres away from the Indian Rare Earths Limited sandmining company (henceforth IREL).



Fig 1

⁸ Census of India, 2001. See <http://www.kanyakumari.tn.nic.in/stat2008.pdf>. Accessed: 26 September 2012.



Fig 2

To convince the authorities of the hazards of living with high levels of background radiation, Daniel, a conservationist and retired marine biologist, initiated the idea to conduct an independent survey. Born and resident in Nagercoil, he was concerned about the hazardous consequences of sandmining and was keenly against the construction of the Koodankulam Nuclear Power Plant in a densely populated area, estimated at a figure of one and a half million in a 30 kilometre radial distance.⁹ He believed that surveys and statistics could be one way of 'rationally' presenting their case against nuclear expansion. He later became a consultant to those conducting the survey.¹⁰

Through literature available in his compact library, Daniel was attuned to the fact that studies conducted by government-funded scholars and agencies in India invariably conclude that no significant correlation exists between background radiation and cancer or Mental Retardation (locally referred to as MR used both as a noun and an adjective – that is, for instance 'MR children' or 'he is MR') (Sundaram *et al* 1998). This then precludes them from accepting any responsibility for health problems due to sandmining for

⁹ This survey preceded other kinds of more sustained and collaborative scientific investigations with regards to the Koodankulam Nuclear Power Plant as part of an independent expert committee set up by the People's Movement Against Nuclear Energy in 2011 whose report is available here <http://www.scribd.com/doc/75770018/PMANE-Expert-Committee-Report-Dec-2011>. Accessed June 1, 2012. For updates on this related struggle, see www.DiaNuke.org and Kaur (2012).

¹⁰ On other studies on the effects of radiation on health based on the Chernobyl nuclear disaster, see Burton Bennett *et al* (2006), a conservative analysis which is essentially compatible with the Indian government view; and C. C. Busby and A.V. Yablokov (2006), and Fairlie and Sumner (2006) which both contend that there is irrevocable damage even with exposure to low dose radiation. On a review of studies on coastal areas with high background radiation in the neighbouring state of Kerala, see Abraham (2011, 2012).

radioactive minerals by the state-run IREL. A prime site for these studies in the region is the Regional Cancer Centre, which was established in Trivandrum in the neighbouring state of Kerala, and the Bhabha Atomic Research Centre in Mumbai, Maharashtra.

Conversely, concerned experts argue that there is a strong correlation between background radiation in the environment and human health. A national conference was organised prior to my visit in 2002 in the Nagercoil, the central town of Kanyakumari District on the health hazards of radiation by the Nuclear Power Awareness Committee. According to the seminar proceedings, it was noted that a gynaecologist, Dr Sumitra Raghuvaran, was convinced that radiation from nuclear reactors was dangerous especially to pregnant women as it could result in miscarriages, deformed children and cancer. Furthermore, Dr Indira Surendren noted that many new unknown diseases, especially of the skin, were reported in the area of coastal sandmining, the causes of which were not known. Similarly, Dr Jeyakumari Jacob from the Institute of Indian Technology in Chennai explained the radiation hazards of thorium along the coast. She stressed the health hazards on mining labourers and residents and informed that cases of cancer and congenital diseases were more frequent in these areas.

Environmental scientists have also demonstrated interest in the Malabar coast due to its high natural radiation: their results seem to favour that the environment does play a significant part in public health (see Forster *et al* 2002:1, 5). Invariably government officers dismiss such studies for being biased, methodologically flawed and so forth, whereas activists use them to their advantage. The 'tennis match' goes on, each expert with vested interests in maintaining their position.

It is true that state-endorsed health reports have not been published in publicly available outlets in their entirety where independent experts could analyse their methodology, findings and conclusions. Information may well be available somewhere in the public sphere, but it could be spread across various sites or annual or monthly reports (see Ramana 2009). Such detailed information pertaining to the nuclear industries was denied, the authorities arguing that anything to do with the matter of radiation is a 'defence issue', a 'defensive' rhetoric which has become ubiquitous in the corridors of an increasingly intransigent bureaucracy since India's declaration of its nuclear weapons in 1998 and the increased vigilance against terrorist threats and attacks in towns and cities throughout India.

In places like Manavalakuruchi where the sandmining company, IREL, was located, discussion of cancer was suppressed from various perspectives. Those who had developed cancer did not wish to draw public attention to it. Social stigma attached to cancer which, not only affected them individually, but also marred the marriage prospects

of their children in what would be another case of 'contaminated communities' exposed to the effects of toxic industries (Edelstein 2003:10). As a disease whose causes are rarely accurately known, it was subject to deep-rooted fears of contagion. To contract cancer was tantamount to being served a 'death sentence', the imminent death of not just the physical but also the social being of the afflicted and his/her next-of-kin (see Sontag 1979).

In terms of representatives of the IREL, there was of course little to gain from conceding that their activities could increase the rate of cancer amongst employees and neighbouring residents. The IREL had such an imposing presence in the village that to openly talk about radiation-related illnesses was to invite castigation, particularly if they worked for the company. Instead, the idea that local workers were mining sands to strengthen the Indian economy was encouraged. Nationalist rhetoric was used to seduce people into thinking that this work was for a higher cause – the greater good of the nation was worthier than the smaller needs of the individual. It placed their region on the national map, some even led to believe that sandmining for atomic minerals in Manavalakuruchi played a part in the manufacture of the 'nuclear bombs' that were tested in the deserts of Rajasthan in 1998. As entry into the IREL factory was not possible, I met a few workers in their homes. Some of them suggested that if they did not mine the rich mineral sands, then it would go to waste and could even be carried away by ocean currents down to Sri Lanka. Indeed many residents had come to believe that the company was 'doing a good job' by, as they understood it, 'taking away the monazite' which contains the radioactive thorium and thus decreasing radioactivity in the area.¹¹ Moreover, the IREL had done what they euphemistically call 'welfare work' to promote their views in the village, including many public relations exercises and the funding of a school for girls in the village. The IREL authorities seemed to use health data for a cost-benefit analysis when data about people's health was scaled against profits; and the higher mission of serving the nation by mining for radioactive minerals to keep it 'strong and secure' was deemed a worthier concern than the fate of individuals and their families.¹²

With the perpetuation of such views, it was hardly surprising that local workers at the company were uncertain as to whether or not and how exactly they were jeopardising their health when they also believed that they were contributing to the nation and economy, not forgetting their own pockets. One former member of staff who worked for the company had three daughters to marry off. The handsome salary of 12,000 rupees a month (approximately \$300), almost three times the district average, was more than enough to convince him that he should carry on with the job. It was a gamble he was willing to take

¹¹ Conversely, Daniel maintained that radiation is increased when the sand is disturbed and the ilmenite blanket is removed.

¹² See also Abraham's study in the contiguous state of Kerala (2012: 115-7).

for the benefit of his family. He eventually retired after 25 years of service when he developed cancer which he had come to associate with his sandmining work. It was a sacrifice that he felt he had to make for the welfare of the family.

Context and Process

An ethnography of a survey implies two main interwoven considerations: the first is the context(s) of the motivations for, activities, location and effects of the survey; the second is due regard to the survey process and implications thereof. Whilst central to anthropology, context is predominantly taken as an indistinct given at the general level that ethnographers have configured in specific ways according to their research aims. Thus, context provides a variable field which R. M. Dilley describes as indicating 'different levels of analysis as well as the substantive focus of analyses' (2002:438). Here, I invoke context as a series of frames in which to embed the discursive effects of power, knowledge, and the social matrices between survey protagonists and householders that influenced the outcomes of the survey process. Context was also contingent on place as the grounds for a complex play of state, corporate and locally based dynamics. Together, these forces at work presented distinct assemblages in the three villages that were selected for the survey as will be elaborated below.

However, echoing the performative contradiction in methodological implications of quantitative and qualitative approaches as detailed in the introduction, there was also an incompatibility between context as understood by myself and my interlocutors. For them, context presented a series of sometimes contradictory frames. It was both a situated drive to raise public awareness about health hazards in their neighbourhood, 'to do something about it'. Yet, it was also an inconvenience where it was conceived of as 'social factors' that could hinder or obscure the collation of statistics (see Sismondo 2008), and thus considered a necessary burden which they managed by attributing a quantitative value in terms of a 'margin of deviation' in the survey results. Otherwise context was usefully understood in environmental terms, namely in terms of the levels of ionising radiation in any vicinity, another index which could be given a numerical value.

Process provides a temporal dynamic to context(s), enabling the appreciation of a series of revelatory and sequential moments, although not necessarily in a linear and predictable fashion. The processual study of a survey brings to mind Alfred North Whitehead's (1978) speculative philosophy on process and reality where 'actual occasions' or 'drops of experience' as part of process constitute the coming into being of the 'concrete'. In this case, occasions entailed the gathering of household data and case studies from local villages about health problems and radiation levels to produce 'concrete' statistical results

in the two month period. In theorising process, a connectedness is palpable in the occasions considered for the survey work, which the end (survey) results may pertain to be apart from, providing a Euclidean gaze with which to view and understand the vagaries of the lived world.

It bears mentioning that the occasions considered as part of the survey process are necessarily inflected by my partial and incomplete lens where during the two month period, only the more conspicuous and relevant survey occasions are selected and interpreted for this abridged ethnographic account. Their selection was also compelled by physical constraints as I could not be with all ten survey protagonists who were placed in at least two places at any one time, but aimed to be at as many of the sites as were feasible as well as attend meetings, prior to, during and after the life of the survey (see Marcus 1998:94).

Apart from the consultant, Daniel, others who worked on the survey included Martin, a well-respected manager of a home for people with intellectual disabilities who became the project co-ordinator, and eight women from neighbouring villages who were described as fieldworkers as they were to go out into the 'field' to conduct surveys. Women from the locality were favoured as it was felt people would be more willing to discuss health issues with them than had they been men. Their ages ranged from the mid-20s to the early 40s. All were educated to the twelfth standard at the age of eighteen, with one of them having completed a degree in the arts. All were known to Martin due to their prior work with children with intellectual disabilities and from other field studies that he had conducted with people with intellectual disabilities in the region.

It was agreed by the survey organisers that the three most significant indices for health problems due to radiation were (i) cancer, (ii) infertility and spontaneous abortions after the first trimester, and (iii) Mental Retardation and variations of intellectual and physical disabilities thereof. In Kanyakumari District, it was cancer that was of most public concern. People were beginning to realise for themselves that it was not just high background radiation that was of issue, but also that sandmining could exacerbate the problems. The other two indicators of radiation-related health problems were relatively unclear in people's understanding, but that was to change with the impact of this survey.

Initially, Daniel and Martin decided that a survey would be conducted to assess the health situation in the coastal mining villages of Manavalakuruchi. Levels of natural radiation were expected to be high here due to the presence of monazite and IREL sandmining which would entail more contact with the alpha radiation emitter, thorium. This data was to be compared with that from an inland village about 27 kilometres miles away set in

agricultural lands, Thovalai, 'the control site', where negligible levels of ionising radiation were assumed to be present.

Simultaneously, sand was to be collected by the project co-ordinator, Martin, from several designated places in the villages and sent to a nearby laboratory scientist who had offered to analyse it for levels of radiation in his free time. Only alpha and beta radiation could be tested due to a technique where Argon gas was passed over the sand samples, which were then weighed for changes. Gamma radiation could not be analysed with this method, and as nobody in the town had a Geiger counter and they could not easily get access to one, this enquiry had to wait for another occasion. Radiation results were to be tabulated and then compared with the health data from the areas in the respective villages by Martin.

Each of the fieldworkers received a week's training as to survey objectives, radiation-related health problems, methodology, and details about the villages. According to *panchayat* (village council) figures in 2006, Manavalakuruchi is a village of 4.2 square miles with a total population of 10,412 (including the adjoining coastal hamlets of Periavilai and Chinavilai). This approximates to 2,866 houses. Thovalai is a smaller village with a population of 4,605, and the population of Kuttankuzhi is 4,537, both villages consisting of roughly 1,000 households each. Officially the survey was focused on MR with intentions to find out about primary disabilities – hearing and/or visually impaired, orthopedically disabled, Down's Syndrome, and Cerebral Palsy (locally referred to as CP). Unofficially, especially in Manavalakuruchi, it was also about incidents of cancer. Wherever possible, data was also to be sought about spontaneous abortions, infertility and pregnancy-related health problems, but it was appreciated that this was a sensitive area, and many people would not readily divulge such information to strangers even if they were female.

Four fieldworkers were assigned to conduct a survey in each of the two main villages over a one-month period. The aim was to conduct a door-to-door enquiry, identify households with people with MR, cancer or any problems to do with infertility or pregnancies, followed with the completion of a four-page questionnaire (a pro forma) where a health problem was reported. The pro forma to be used by the fieldworkers was adapted from a previous survey questionnaire in Kerala conducted by an unnamed government authority which was found in Daniel's library, further underlining the modified reverse-mirrored mimicry of their tactical survey.

Daily reports were to be given by each of the fieldworkers to their team leader who then briefed Martin. The results were to be tabulated by Martin on a weekly basis. At the end of each week, a doctor, Martin and I were to visit some of the main cases of people with health problems to verify the data collated in a medical camp. Several weekly meetings were also to be held including Daniel where fieldworkers provided a report on their

progress and any problems that they encountered. With this data, Daniel imagined that officials would sit up and take notice. A 'seminar' (the local appellation for an afternoon symposium) to publicise the results of the survey was planned with this in mind along with ambitions to invite the District Collector, the District Health Officer, IREL personnel and the local media.

The Life of the Survey

October 2, Gandhi Day, was chosen as the day to start the survey: 'a good day to start' explained Daniel in view of his thoughts on Mohandas Karamchand Gandhi as an advocate 'for the people', and the fact that he felt the survey could benefit people rather than the nuclear authorities. Four sari-clad fieldworkers caught their respective buses to Manavalakuruchi and Thovalai early in the morning from the central bus station in the town. With the help of local maps, the two team leaders gave instructions for the day and organised the paths of fieldworkers who worked in pairs throughout the village.

On average, a total of about 70-150 houses a day were visited, depending upon their proximity to each other, by the four fieldworkers in the two villages. At the end of the day, the team leader collated the pro forma and discussed any issues and problems. At a project meeting at the end of the first week, team leaders aired any problems that they had encountered in Manavalakuruchi. Householders were willing to give information about children with MR but when it came to other questions such as cancer and problems to do with infertility and pregnancy in particular, they were less obliging. Two strategies were adopted: one was to change the team leader and replace her with the more experienced one that had been working in Thovalai. She had been working in a home for children with special needs for 21 years and was highly attuned to ascertaining sensitive information due to previous fieldwork experience with intellectually challenged children. Strategies were discussed as to how information could be subtly brought out – for instance, by focusing on related concerns to do with children, or comparing the total number of pregnancies and the total number of children for any one mother. The second strategy was for Martin to go out to the village himself and familiarise himself with village residents, IREL politics, and so forth, in the process, developing a relationship of trust with the residents and attaining other kinds of information which could supplement the figures collated by the fieldworkers

In Thovalai, fieldworkers experienced comparatively few problems in gathering data. The main point of consternation amongst fieldworkers here was that 'rich families' did not want to disclose information about family members with MR. However, by asking neighbours, fieldworkers ascertained whether or not there was a case of MR in the family. Whilst they

noted this down, they could not get any further data on family backgrounds with which to fill out the pro forma. It seemed as if wealthy families had to live up to a certain reputation, and they were reluctant to discuss cases of MR in the household – they feared people may think that ‘it runs in the family’ and, thereby, affect their reputation in marriage circuits.

Medical camps were held with a doctor to confirm the survey findings in the two main villages on alternate weeks. Describing herself as ‘a jovial terror’, the doctor proved to be a very loud, larger-than-life character whose opinions we heard as we travelled to the village in a hired white Ambassador car. She had a deep distrust of what she described as uneducated people, ignorance in her view being the main cause of so many health problems in the area. She complained of their resistance to hear the ‘facts’, facts in her view that were endorsed by biomedical discourse (see Good 1994).

At the first medical camp held in a village school office in Thoivalai, we saw some of the people with MR identified by the fieldworkers one by one, after which Martin distributed a packet of biscuits to the children. There were in total seven children who came to this first camp, three girls and four boys. Some had mild MR. One was extremely severe – a combination of CP, MR and microcephalus (indicated by an undersize head). The mother of the girls who were all sisters also had mild MR so the doctor established the cause as ‘hereditary’. In another case, a woman from the Vellalar caste admitted that she had married her cousin, which the doctor attributed as conclusive proof for MR in the child. With other cases, causes were less certain. The doctor would ask questions, be none the wiser and put it down to other reasons such as late delivery: ‘if a baby is born an hour or so late, it can develop MR’ was her explanation. Sometimes the doctor had to write ‘no information’ on the pro forma which she was likely to dismiss as ‘not relevant’. But, of course, these ‘mystery causes’ were of extreme relevance to the project organisers. If a bio-medical cause could not be determined, could the reason be something to do with the environment?

Whilst the doctor’s medical knowledge was impressive, it mainly consisted of ‘text book’ diagnoses, relying a lot on ‘Davidson’s book on medicine’, a primary text for students of medicine in India.¹³ She understood intellectual disability as the result of a competition between recessive and dominant genes, consanguinity or due to the mother’s late-in-life pregnancy. In her eyes, even the age of 31 was seen as late to have a child. Be that as it may, the crippling pressures of dowry payments led many poorer families to delay their daughter’s marriage so as a dowry could be collected. Consanguinity occurred frequently in Kanyakumari District so as to avoid dividing property when marrying off a sister’s

¹³ Nicholas A. Boon, Nicki R. Colledge, Brian R Walker, John A.A. Hunter (2006) Davidson’s Principles and Practice of Medicine, 20th edition, London: Churchill Livingstone.

daughter amongst Muslim, Hindu and Christian families alike.¹⁴ Yet these aspirations were antithetical to medically informed thinking that cross-cousin marriage was to risk genetic malformations amongst offspring. In addition to biomedical causes, doctors cited reasons to do with 'lifestyle' that could seriously undermine reproductive health, and disapproved of any signs of drinking and smoking for their detrimental effects on health. It was as Daniel had commented at a project meeting: 'Whatever their credentials, the majority of doctors are not well-qualified to think outside the box and study new subjects such as radiation-related disease.'

Another Development

During the first week of the survey, a public hearing was held by the Nuclear Power Corporation of India Limited on October 6 in order to pass the construction of four more nuclear reactors at Koodankulam in addition to the two already under construction (Kaur 2013). From the attendants, Daniel learnt that the incident of MR appeared to be extremely high in the coastal village of Kuttankuzhi in the adjoining district of Tirunelveli. Village residents shouted vehemently at the nuclear officials at the public hearing as they blamed sandmining for health problems in their families. Here the sandmining was not at the behest of the IREL, a government undertaking, but a private venture, V V Minerals, locally known as the 'sand mafia' due to their *goondha* (gangster) activities. The company was notorious for its well-funded muscle power in the region, so much so that my interlocutors mentioned how through their networks they had managed to twist the arm of central government so they could engage in activities which legally are only permissible by the government. The Atomic Energy Act (1962) strictly prohibits individuals or private enterprises from undertaking mining activity related to atomic material, but since 1998, the government has relaxed its policy to include selected private enterprise.

This occasion was to have a major influence on the survey process. Consequently, Daniel advised that fieldworkers should collect data from the village of Kuttankuzhi near the nuclear power construction site in the ensuing week in order to gauge as to what extent their health was affected by sandmining in the vicinity. The survey fieldworkers were warned about the company and their henchmen, their safety ensured through the help of the village priest. It was decided that for two days, all eight fieldworkers would go out and gather data: it was to be a 'quick in, quick out' approach. No medical camp was organised here for that would be to invite too many queries and possibly even trouble.

¹⁴ Parallels may be noted in Cecilia Busby's observations on the Mukkuvar fishing community in Kerala - that the mother's brother's constitution differs conceptually from the mother on the basis of gender (2000:83). Therefore, even though they are related, gender differences posit that they are different enough for their children to intermarry.

Kuttankuzhi consisted of poorer households than those in the villages in Kanyakumari District. There was no hospital or doctor in the village, only a clinic and often the health worker would not be present. At the project meeting after the second week of fieldwork, team leaders reported that in Kuttankuzhi, many families wanted to *exaggerate* afflictions to do with physical disability. The residents assumed that the fieldworkers were officials who could exact funding for such ailments. They were aware that the government provided social welfare funds for the physically disabled. Thus a lot of information was attained on Cerebral Palsy and less on Mental Retardation – but that too could be due to radiation, reasoned Daniel. Again, residents were reluctant to discuss cancer and infertility or pregnancy-related problems. They may discuss MR, but, in contrast to what Daniel had encountered at the public hearing, residents would not only identify the sandmining as a possible cause for children with MR, but also sometimes in the same breath, dismiss them as due to fate or ‘the woman’s fault’. Blaming the woman for defects of fertility or childbirth was indeed common across the region.

The data looked impressive on paper for its comprehensive coverage, but in reality the force of social hierarchies, conventions and the politics of place came into play in the condescension of the survey process. Daniel and Martin reflected on these concerns as a problem in practice, ‘social factors’, but it did not dent their faith in the principle of comprehensive survey work. What may be called scientific methods and the ‘facts’ they informed continued to hold a sublime grip on them with which to make validity claims.¹⁵ The methodological problems in dealing with different contexts were quantified; and the project organisers estimated that there would be about ‘a 5-10% margin of deviation’ in the final results.

More Medical Camps

Due to reasons of length, I will briefly summarise the main ‘drops of experience’ as Whiteheads describes it - those moments deemed as significant by the survey practitioners in the two medical camps held in Manavalakuruchi. In this village, the onus was to visit houses spread across its widely dispersed geography rather than congregate in a central location (Figure 3). When we moved down ‘IREL Road’ – the road that leads to the sandmining company on the beach (Figure 4) - we could hear the hum and drone of machinery dredging the sands. Outside, the road was covered with blackish sands from the trucks that regularly came down here with their loads of mined sand. We entered a house from which we could directly see the frequent passing of sand-laden trucks to and from the IREL company. The child here was aged one and had problems with his bowels.

¹⁵ ‘Scientific’ is a term I have adopted to indicate the compatibility of discourses about science and statistics. It is not intended as a means to describe the survey work as somehow inferior or a simulacrum of ‘real’ science.

His father was a 'coolie' – that is, he worked as a casual labourer including for the IREL. The mother was aged 40 when she had the child, after eight years of marriage, which the doctor reasoned was the likely cause of this health problem.



Fig 3



Fig 4

Further into the copse on the beach, the second child seen was a nine year old girl. Her two other sisters were of good health. She was the first child, and her mother claimed it was because her husband would get drunk and beat her that she gave birth to child with MR. Another slightly more upmarket house was located on the other side of the dusty IREL Road. Here, a thirteen year old girl had CP from birth. The mother reckoned that during birth, the baby suffered from 'some suffocation'.

In a fenced-off house with goats, chickens and ducks, we entered a dark house where there lived a family with a nine year old girl with Down's Syndrome. She hardly went out. 'If she goes out people gossip in a bad way', explained the mother, 'They think she should stay indoors and not scare the children'. The mother explained that Down's Syndrome was due to *chevannya* ('enchantment' or a spell), a reasoning that the survey protagonists were keen to dispel.

After another week of survey work ascertaining health problems, another medical camp was held accompanied with a second doctor in Manavalakuruchi due to the non-availability

of the first. At this 'camp', there were five known cases of consanguinity. But the afflictions of the rest of the children with intellectual and physical disabilities could not be gauged. The major revelation here was encountering an IREL worker who estimated that there were about 40 people with cancer in a total of about 300 people who lived in Periavilai, the hamlet next to IREL, and who provided daily labour for the company. Martin asked one local fisherman to get names and details of those with cancer, 17 of which he provided a week later.

The IREL did not systematically inform casual/daily labourers (hired by a sub-contractor) of the hazards and protective measures. Conceivably, they were at the bottom of the pile of 'nuclear necropolitics' (see Sabu 2011) - those whose lives were not valued and thus deemed disposable by the nuclear authorities in that they were not sufficiently resourced with training and protection against the hazards of ionising radiation. The casual labourers used porous bags for the transport of sand instead of plastic ones which ought to be used to contain the alpha radiation in the monazite mineral. In addition, several of the workers had developed spondylitis, spinal and neck problems, due to the heavy weight of the sand bags carried on their heads. They had also signed away their houses to the IREL in order to move to replacement accommodation inland should the company want to expand their industry in the future. Discontent was brewing amongst the village residents against the IREL but at the same time, people were in a double bind in that they had become dependent on the company in various ways. This brewing discontent led some casual labourers in Periavilai to support the survey, believing that it could improve their work and residential conditions. Clearly, even though on occasion cultural interpretations seemed at loggerheads with biomedical explanations, the epidemiological approach adopted by the survey protagonists was to identify clusters of radiation-related health problems, a strategy to which local village residents also added their known and collated data.

Overview

After a month of fieldwork, survey protagonists presented the collated figures to each other with Martin doing the final count: 109 cases of physical and intellectual disability were identified in Manavalakuruchi, 66 in Thoivalai and 154 in Kuttankuzhi. Manavalakuruchi was the larger village, and the two others were roughly comparable in size, Kuttankuzhi registering more than double the number of disabilities when compared to Thoivalai. Even though information on spontaneous abortions was least forthcoming, from the available figures, Daniel reasoned that in Manavalakuruchi, the total number of pregnancies in 109 households was 483, yet the total number of children was 403. Therefore there were 80 losses, 17%. However, despite this striking figure, it was inconsistent with the findings in Thoivalai, a village away from the coast and therefore away from high radiation zones: out

of 66 households, the total number of pregnancies was 231, the total number of children was 186. Here there were 45 losses, an even more dramatic percentage of 19%. Daniel concluded that this could be due to conditions of poverty and the fact that there were no nearby hospital facilities in Thovalai. Another more likely reason suggested by Martin was that the residents in the village were more helpful as they were familiar with the fieldworkers and therefore were more willing to disclose information about health problems. With this reasoning, Martin implied that there would be more 'hidden cases' in Manavalakuruchi. By comparison, in Kuttankuzhi, the total number of pregnancies was 501, the total number of children 492 out of a total of 105 household. 9 losses led to a percentage of 2%. The comparatively low figure next to results from Thovalai surprised the project organisers in view of their recollection of the residents' complaints at the public hearing on the construction of a further four nuclear reactors. Similarly, Martin and Daniel concluded that perhaps not 'all relevant information was disclosed' – that is, they did not question the mode of surveying, only that some figures could not be collated due to various 'social factors'.

Results on cancer were sporadic, as several people chose not to talk about it mistrusting the destination of the information and fearing even further stigmatisation. The only significant findings on incidents of cancer were concentrated in the hamlet of Periavilai next to the sandmining company in Manavalakuruchi. Here one of the acquaintances from the fishing community provided an indication of the numbers - 40 (of which details of 17 people were provided) in a total of about 300 people who provided daily labour for the company, a percentage of 13%. Based on this finding, Daniel thought that in future it may be useful to choose sympathetic residents to gather information in their neighbourhood which could then be compared with that of the fieldworkers.

When considering radiation readings in the area, levels in Kuttankuzhi and Manavalakuruchi were extremely high. It even indicated the presence of beta radiation, the source of which the project organisers could not then get any further information. Measured in Bq/kg, Becquerel is the rate of radioactive decay equivalent to 1 event of radiation emission per second. Periavilai hamlet in Manavalakuruchi was reported to contain as high as 9,780 Bq/kg dry weight of gross alpha radiation and 69,260 Bq/kg dry weight of beta radiation. In Kuttankuzhi, the highest readings for alpha radiation were 15,000 Bq/kg and for beta radiation 99,040 Bq/kg. These figures compared dramatically with the highest readings for the inland village of Thovalai which were a mere fraction - 260 Bq/kg for alpha radiation and 3,920 Bq/kg for beta radiation. Radiation was almost given tangible form through the numerical readings, the higher readings transmitting ripples of anxiety amongst the survey organisers for having exceeded their expectations. The readings indicated extremely high levels of radiation in both the coastal villages of

Manavalakuruchi and Kuttankuzhi, some of which were deemed dangerous for human habitation if the alpha and beta radionuclides were to enter the body.

Whereas the project practitioners relied upon dealing with people living in particular social contexts, these very contexts were also the cause of much consternation in that the adequacy of statistics on the health problems of interest could not always be evaluated. It was almost as if the survey practitioners idealised human beings in laboratory-like set-ups where information could be cybernetically transmitted for the purposes of a survey. Whilst statistical collation seemed relatively easy through tests in laboratory conditions, a context where obstructive social factors were deemed to be minimal (see Latour and Woolgar 1988), when it came to the survey, numerous factors and limitations became apparent, not least of which were the *a priori* assumptions of the doctors that attended the medical camps. Their biomedical text book understanding of physical afflictions made it difficult to openly evaluate other possible causes such as the environment. They attributed reasons such as 'superstition', 'enchantment', and practices based on 'ignorance' to the parents of the children they saw, not realising the limits of their own thinking to appreciate what they encountered. It is a problem that Daniel had experienced before as he tried to attain information from medical experts from the state-funded Trivandrum Regional Cancer Research Centre where they attributed cancer to factors to do with genetics and lifestyle, but not the environment.¹⁶

Despite differences in perspectives, the survey organisers strategically utilised the role of the doctors for their own agendas. Anything that the doctors dismissed with a statement such as 'no information' was taken seriously by the fieldworkers. In addition, throughout the course of conversations with Daniel and Martin, and on realisation of the scale of the health problems, the two doctors began to moderate their opinions and appreciate more and more the part the contributory factor of the environment. For instance, on one occasion on the way back from the first medical camp in Thovalai, Martin had to make an impromptu stop at the home for people with special needs that he managed. Whilst we waited for him in the garden, the doctor was approached by about twenty people with MR who all gathered around her out of curiosity. I had already familiarised myself with the occupants, but the doctor was visibly unnerved by the number of people with intellectual disabilities she encountered in one place, an experience she had not had before, to the point that later in the car, she began to reassess her earlier views on causation. This turn of opinion was an important development in view of the fact that scientific and medical experts held a high status in the district and many people looked to them for clarification and guidance. Medical experts also provided a stamp of verification that the survey was

¹⁶ See for instance their website <http://www.rcctvm.org/risk%20factors.htm>. Accessed: June 19, 2012.

conducted on credible grounds and the health afflictions were as identified. For these reasons, their role was seen as crucial to the project's aims and its publicity.

Public Presentations and Reception

Publicising the results was a crucial part in generating further awareness and action on the issue. In a matter of days, Daniel wrote up the report in Tamil and English. With an introduction, and sections on methodology, findings, a discussion, and recommendations, the report also incorporated appendices with maps, photographs and tabulated results from all three villages alongside radiation readings from specific sites in those villages. The limited findings on cancer in the hamlet adjoining the IREL were included in tabulated form.

The report highlighted the rigour (quantitative methodology and statistics) and minimised the 'fluff' (process and context): it presented survey findings as 'facts' in that any 'background noise' which obscured any of the results was omitted by concentrating more on incidents of MR and cancer from the small hamlet next to IREL. In so doing, it exemplified the 'iceberg axiom' which characterises report writing in general (Rew 1985, see also Good 2006). The survey process and report exemplified an attempt to enlist the discourses of modernity, rationality and objectivity to their cause of highlighting local health concerns which were being dismissed by the authorities. Daniel concluded the report as follows:

The survey has shown that incidents of MR persons and cancer are significantly higher in coastal villages in Kanyakumari and Tirunelveli districts due to the high background radiation. This is increased in places where there is sandmining.

Alongside the report, a seminar was organised and publicised to coincide with Children's Day on November 14, 2006, a date held dear by former Prime Minister Jawaharlal Nehru as it was also the date of his birthday. The symbolic resonance was not lost – whilst Gandhi epitomised a pro-people agenda for the start of the survey, Nehru's modernist and science-orientated outlook provided a respected ring to the statistical findings about the health of residents in their locality.

Information had to be performed to have agency. To these ends, district dignitaries were invited to speak on the subject of radiation and health, after which the results of the survey were disseminated. They included the chairman of the municipal council, a member of the legislative assembly, and another local doctor who spoke about congenital anomalies and birth problems in the region, comparing the cumulative effect of low radiation dosage over many years as equivalent to cases after the Hiroshima and Nagasaki atom bomb attacks. The survey findings were then read out by Martin. They were presented with little

contextualisation, only to mention that each house was visited in the three villages, followed by a reeling off of numbers to do with radiation readings and health problems in these locations.

In all, about 80 people attended the seminar. These included some of the householders who were included in the survey. Whereas many of the attendants understood radiation, most that I talked to after the seminar did not fully understand the effects of radiation or units of measurements, but conjoined with high numerical figures, they saw it as testament to the convincing case for the hazards of living with high background radiation in the region. On the basis of the 'comprehensive' survey and the statistical information collated, and their conjunction with experts or figures of authority standing on the stage delivering presentations, the information sounded impressive and many of the audience members became convinced of the links between not just radiation and cancer, which was well-known albeit through hearsay and speculation, but also radiation and MR and genetic deformations. Several of them began to consider people with MR in a different light, allocating possible causes to the environment rather than to the family, 'enchantment' or divine will. The information from the survey left a deep impression and became a filter with which to view phenomena around them, transposing socio-cultural explanations oscillating around karma and 'enchantment' to that of scientific discourse about health risks in the locality which had a combined substantive and auratic character. One woman was particularly impressed by the doctor's presentation on pregnancy and congenital abnormalities and wove this information with a bricolage of thoughts influenced by the survey results. She recalled how her friend had a couple of spontaneous abortions in the space of a few years. Even though her friend did not live on the coast and background radiation readings were not known for her village, the attendant began to suspect that environmental radiation could well be the cause of the miscarriages, not what she had earlier thought - stress and anxiety due to personal problems with her husband. The feedback loop was led by articulate observations and charismatic commentaries coupled with the spectral presence of collated numbers that resulted in a certain reflexivity on the parts of the attendants. In the process, the representative and containing function of the statistical information mattered little when they shape-shifted and settled into other forms to do with this woman's personal experiences and thoughts.¹⁷ Numerical data may demonstrate an attempt at mastering the life-world, but in the end the life-world got the better of numbers.

¹⁷ Peter Miller and Nicholas Rose (2008) talk about a similar process describing it as 'thixotropic associations' where for instance scientific/statistical configurations shape-shift and settle into other forms. I also noted a comparable process where statistical correlations once collated, shape-shifted into a cultural ecology of embodied experiences and personal histories.

Reflections

In a de-briefing meeting with myself where we exchanged the different kinds of knowledge that we had acquired, Daniel acknowledged that stochastic factors could not be taken into account due to the deterministic nature of the survey's methodology based on seeking linear correlations between the degree of radiation levels and the density of health problem clusters in that area.¹⁸ The data on infertility and spontaneous abortions was cursory due to the intimate nature of the enquiry. Information about infant mortality and those children with MR who may have died had not been sought. Many of the intellectually disabled were not expected to live past the age of 30. Daniel and Martin relied upon a filtering process by the first set of fieldworkers, who however admirable for their coverage and courage in venturing into difficult areas, could not be fully relied upon for picking up the nature and extent of health problems in all the households of the three villages. However, rather than admitting that a qualitative approach would be beneficial, Daniel argued for the case of more quantitative work. He reasoned that they had dug up a veritable minefield of useful information, a database which could be further developed in an additive, rather than revised, frame of logic.¹⁹ Despite areas of ambivalence, numerical data retained its seductive aura and it was felt that more information of this kind was needed in the quest to present further proof of the links between radiation and cancer, infertility, spontaneous abortions, MR and other congenital abnormalities. Where the substantive was lacking, the auratic gained force, lent succour by the fact that the survey entailed locally known and respected individuals at the helm.

Whereas there is little in terms of an ethnography of a survey in the literature, a parallel may be noted in Bruno Latour and Steve Woolgar's work on laboratory practice (1988). They demonstrated that the actualities of laboratory practise are far from the truth regimes enshrined in the discipline of science.²⁰ Whilst scientific method was premised on experiments as proving grounds for theories, laboratory practice was not as systematic and objective as scientists would like to claim. Inconclusive data was attributed to the

¹⁸ On an investigation of such variability, see Petryna (2002:100, 149-90) and Abraham (2012: 112-113).

¹⁹ Indeed, even though sympathetic NGOs professed to do more work on the area, to date, the only subsequent survey has been at the behest of a local Nagercoil-based hospital in 2012 that was funded by the Department of Atomic Energy and not yet published. Daniel is yet to gain access to the report in which the surveyors, not surprisingly, concluded that there were no substantial health risks from high background radiation in the coastal areas of Kanyakumari District.

²⁰ See also Gusterson (2004), Hecht, (1998), Traweek (1992), and Cetina (2007).

failure of the experimental method or apparatus, and subjective decisions as to which data to retain were more than frequent. I too observed the truth regimes statistics informed, a sublime goal for there were several difficulties, hindrances and inconsistencies in collating statistical data for survey protagonists. However, diverging from Latour's and Woolgar's deconstruction of dominant truth regimes, science as a close kin to statistical discourse could also be powerfully agentive and even counter-hegemonic. On a related point, Ulrich Beck observes that whilst scientists are obsessive about making causal connection, such correlations can also be useful for environmentalists to fight their cause (1992:63-4). Beck gives the example of a Japanese court case where statistics were held as demonstrating proof for environmental pollution. It was a similar impulse which drove my interlocutors to organise and conduct their own survey.

Speaking Out

Knowledge in south India was not premised on a dichotomy between modern versus indigenous, or professional and lay communities, but where the local is deeply imbricated in the modern (see Nygren 1999). In this case, local residents deployed modern methodologies for themselves where 'citizen statistics' were mobilised with a view to investigate health effects for people living in regions with high background radiation. This did not involve an established and funded NGO, but individuals from varying background who came together with minimal funds and dedicated their time and energy to the survey.²¹

The qualitative analysis of the survey context and process in and around coastal areas in south India highlights the power of numbers both in their sublime aspects imbued with substantive and auratic forces; and the profane difficulties and hindrances in the limitations of numbers as demonstrated by the fault lines in deciding which debilities and mortalities could be attributed to ionising radiation levels and which to other factors such as consanguinity, lifestyle and so forth. Nevertheless, the sublime retained its allure, and a collated constellation of numerical patterns imbued an agentive potential to numbers such that quantitative surveys were held as a higher form of knowledge. Numbers could almost take on a magnetic and libidinal force, draw other kinds of information around them, and shine light onto obscure uncertainties. Numbers provided concretising information and injected with a vitality such that they became 'facts that spoke' (Berglund 2001) or, in Talal Asad's (1986) terms, 'a strong language', around which to weave impressions of dangerous radiation. They also provided hope, in that everyone knew that in political corridors, it is statistics that matter, and evidence about the high incidence of health problems and radiation levels may well be taken seriously. Even if there were certain disappointments and inconsistencies in the results, these paled next to the consistent findings, which were deemed enough to make the survey worthwhile and 'evidential', lending their views authority and agency in terms of negotiating with state agencies. Facts could also become alchemical agents as in individual interpretations and extrapolations of statistics woven in with their social experiences and understandings.

I focused only on select 'actual occasions' and 'drops of experience' that led to the condescence and presentation of survey results within the limited space of this article. The moments pertained to the revelatory understanding of the survey organisers, fieldworkers, doctors and seminar audience. Just as certain drops of experience characterised the above ethnography of a survey, so too certain processes were connected in the minds of the survey practitioners and seminar audience which temporally

²¹ For a NGO to embark on a survey on radiation-related health problems that could potentially undermine the state's official version was also to invite state-backed investigations into the organisation's financial account, funding sources and other intimidatory practices.

revised views and led to results enabling a series of equations with which to observe and understand their experiences of health-related matters. As it transpired, the survey proved to be a voyage of discovery rather than of verification alone (see Bryman 1984), where new information was used to orientate the fieldworkers to another survey site, and surprising or inadequate information on cancer, foetal development, infertility and beta radiation became the basis of hypotheses for future investigations.

Context enabled several interlocking and occasionally contradictory frames of interpretation. For myself, context enabled a means with which to understand the rationale, motivations, process, results and effects of survey work in a region of high background radiation, sandmining and a nuclear power plant under construction. For my interlocutors, context was primarily a means with which to acknowledge social factors that delimited the efficacy of their survey. Whereas familiar contexts provided the impetus for pursuing a survey, this could only be given significance if it too could be quantified. Context was effectively condensed into factual figures about the villages, its population and radiation readings of the environment, and anything else that intervened was decried as a 'margin of deviation'. The survey protagonists seemed to dwell on an *aporia* – for even though social factors were seen as an 'inconvenience', they also relied upon social context to lend validity to their claims that data was excavated faithfully, away from the vested interests of government or corporate bodies in order for it to be conferred with the status of 'true knowledge'. These contexts implied a locally generated survey entailing house-to-house data collation, fieldworkers trained to acquire information, the involvement of local communities and upstanding figures of society such as doctors, and their interlinking with local dignitaries for the dissemination of survey results as locally understood guarantors of value to the information collated and disseminated. As Marilyn Strathern notes: 'the point or source of knowledge production is then seen to lie neither in narrative nor interpretation as essentially social practices but in the efforts of identifiable knowledge-producers' (2000:208).

The politics of place was contended with in different ways: for instance, the additional use of qualitative information and data collated by sympathisers based in Manavalakuruchi; the soliciting of information from neighbours in Thovalai; and the adoption of a 'quick-in, quick out' approach with the help of the village priest for Kuttankuzhi. This was due to a variety of factors. Residents of Manavalakuruchi had to contend with the problems of sandmining in their vicinity, government impositions, possible displacement from sandmining expansion, and rising health problems that came with an abiding suspicion of how collated information might be used. By comparison, Thovalai was a friendly place to conduct an investigation, and many of the residents were already familiar with the fieldworkers due to their work in the nearby home for children with intellectual disabilities. Kuttankuzhi, for other reasons, was another fraught village to conduct a survey. This was largely due to the

fact that any 'outsider' or untoward activity would invite not just inhospitality, but hospitalisation by the V V Minerals henchmen. Not only did the village have the heavy-handed presence of V V Minerals to contend with, but also the health hazards unleashed by sandmining in their village. Their anxieties were compounded by the fact that the construction of the Koodankulam Nuclear Power Plant project was just 'down the road' so to speak. It was within ten kilometres and was visible from certain points on the beach in front of their homes – a towering portender of more environmental doom in the opinion of many of its neighbouring residents.

So what does an ethnography of a tactical survey imply for anthropological methodology? It is true that there was a certain mimicry in the survey of official practice but this was with a view to transform an investigative and representative technique into one of informed intervention using a methodology that was also sanctioned by the authorities. The objective to 'speak truth' to power and domination (Scheper-Hughes 1992:229) need not be counterposed to statist discourse with its correlates of objective or natural science. Rather the latter can be interrogated and channelled into a powerful trope for counter-hegemonic practices as exemplified by survey protagonists with ambitions to destabilise official discourse that obfuscated the relations between radiation-related afflictions, the environment and the nuclear industries.

A collaborative, reflexive and situated approach to quantitative work can demonstrate a particular kind of engaged anthropology where, on the one hand, the ethnographer attunes methodology to highlight the agentive and alchemical force of surveys and statistics; and on the other, subjects can reflect upon the discursive approach to an ethnography of a survey in order to fine-tune and further develop their tactical surveys and other collaborative methodologies. Following Latour (2005), numerical findings can constitute conceptual actors or actants which could have results and outcomes on other actors. They can also travel and be compared with other case studies where the state too has obscured or denied vital statistics to do with radiation and public health (see Petryna 2002, Johnston 2007). Such an investigation enables people to understand, articulate and operationalise discourses associated with hegemonic authorities in order to turn the gaze back at edifices of power. In the process, it encourages a certain disciplining of the state even though its outcomes can be curtailed by strategies of denial and repudiation by state authorities. Nonetheless, tactical surveys remain a powerful tool in knowledge acquisition such that findings could be of meaningful value to the subjects that typically form the flesh and bone of ethnographic research.

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