

**(Re)Configuring Atmospheres:
Design, Technology and the Quest for Pure Air in Colonial India**

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In April 2016, the *Indian Express*, one of India's leading English newspapers, ran a series of articles provocatively titled 'Death by Breath'. The very first of these reports began with the headline 'Seven years ago, everyone saw Delhi's air take a deadly U-turn but no one did a thing.' Some years later, in the winter of 2023, it was still reporting under the same title, with stories headlined 'Nine "severe" air days in 2 weeks', 'School winter break advanced' and 'Stop crop burning forthwith' etc. In the meanwhile there had been the deadly pandemic of COVID-19, eliciting even more air talk across the world. This time newspaper headlines in India spoke of lockdowns and blue skies, about mutating viruses and global travel, about lack of oxygen and about rising indoor pollution with large populations forced inside cramped homes. And for an even longer period, concerns had been expressed about climate change, and especially in India, about extreme weather events and more frequent, more extended and more intense heat waves.

Each of these words - climate, germs, virus, pollution, heat – are familiar to us. But they have failed to merit the attention of historians to the extent that they should, leaving it to scholars of contemporary politics and newspaper commentators to shape our understanding of atmospheric modernity. In what follows, I move away from the presentism of newspaper reports, instead locating histories of air and atmospheres in India within histories of colonialism, power, class and gender relations. In doing so, I seek to simultaneously engage with climate, microbes and particles and around issues of comfort, health and energy use. It is an engagement that I propose to do at different scales – atmospheres in relation to individual bodies, air experienced inside homes and and air understood and acted upon at the level of cities and regions.

The Body in the Tropics

The understanding of India's cities in the nineteenth and twentieth century, David Arnold writes, 'was overlaid with a colonial perceptual grid that served to distance it from Western

precedents. There was repeated insistence that these were ‘tropical’ as well as ‘oriental’ cities, oppressed by climatic, social and sanitary difficulties that were not encountered (or not encountered to the same degree) in the temperate zones’. (Arnold, 2013) The word ‘tropical’, he further writes, neither simply described a geography nor was it morally neutral. Instead, it implied difference and hierarchy, the temperate as always superior to the tropical, climatically and culturally. Historians engaging with a longer history of European-Indian encounters have disputed just when such hierarchies emerged and how consensual was the view on Indian climate as inferior and being unsuitable for European settlement. ‘Climate and constitutions’, in other words, were part of a shifting discourse - in the seventeenth and eighteenth centuries the difference of climate between England and India was perceived more as a difference of *degree* rather than of kind and India was yet to emerge as a pathological ‘other’. (Harrison, 1999) Be as it may, we can reasonably suggest that by the early decades of the nineteenth century a hardening of racial boundaries may be noted. In terms of climate, this meant that while administrators, physicians, explorers, travellers and others ‘on the ground’ continued to note the climatic and environmental heterogeneity of India, the territory of the country as a whole ‘became situated within a broader tropical geography in which heat and light produced by the sun were figured as threats to fragile British bodies and an equally fragile empire.’ (Venkat, 2022). What this growing racialisation of climate discourse also implied was a gradual move away from adaptation to local climates to the making of better climatic conditions as a way of being in the tropics.

Among the most influential texts marking the transition towards a more racialised view of climates and people was by the naval surgeon James Johnson whose *The Influence of Tropical Climates, more especially the Climate of India, on European Constitutions*, first published in 1813, went through several editions over the next half century. The text began with a caution. ‘We should not implicitly confide, as too many do,’ Johnson wrote, ‘in the spontaneous efforts of the constitution, but, on the contrary, call into its aid those artificial means of prevention and melioration, which reason may dictate and experience confirm.’ (6th edn, 1841: 3) The adoption of indigenous custom was to be especially subject to reason and discrimination as these, Johnson further observed, often had ‘ignorance, superstition, or even vice, for their foundation.’ (p.538). However, having made these cautionary remarks, he went to write much about those indigenous practices that must be adopted in order to cope with the heat and humidity of India. The turban, the *cummerbund* (a broad waist shawl) and shawls were especially recommended as dresses, the ‘chattah’ (umbrella) was always to be used between the

hours of ten and four, food and drink must be moderated, and the body always kept cool by artificial means:

‘The tatties, which are affixed to the doors and other apertures, in the hot season, and kept constantly wet by *bheesties*, or water-carriers, whereby the breeze is cooled by evaporation, in its passage through the humid grass, of which the *tatty* is constructed, prove a very salutary and grateful defence against the hot land-winds; since this simple expedient makes a difference of twenty or thirty degrees, between the *bheesty*'s and the Europeans side of the *tatty*!’ (p.558)

The *punka*, suspended from the lofty ceilings of the Eastern rooms, and kept waving overhead, especially during our repasts, is a very necessary piece of what may be fastidiously styled "Asiatic luxury." Indeed, were it not for this and the *tatty*, some parts of India would be scarcely habitable by Europeans, at certain seasons. (p.559)

Over time, climatic determinism continued to hold even greater sway, marked by the emergence of medical topographies that attended to the effects of local climate. By the 1830s, Harrison notes, all kinds of attributes, physical and otherwise, began to be attributed to climate. Indeed the very *character* of people was seen as being determined by the climate that they lived in. And in this context, the concern which had been heat and humidity so far, also began to extend to light and radiation. The sun was hotter in India than in England, observed the imperial meteorologist Henry Blanford in 1889, going on to add that ‘it would be a grave mistake to suppose that exposure to the sun in Madras can be incurred with the same impunity as exposure to the summer sun in England.’ (Cited in Venkat, 2022) A whole commodity culture emerged to address these new and old concerns, including the use of sola topis, cholera belts etc. ‘Tropical’ clothing was designed to mimic “black” skin and it increased rapidly in volume as British imperial ambitions in Asia and Africa increased through the nineteenth century. (Johnson, 2009) So were foods and drinks promoted, especially designed to counter the effects of heat and to reduce lethargy. (Haynes, 2022) However, in the absence of adequate equipment and trained personnel, precise determination of heat remained a difficult exercise and embodied experiences of it continued to matter as much as the scientific measurements. (Venkat, 2022)

Quite evidently though, the body that experienced heat, and the body that Europeans were writing about, was the white body. And the focus of historians too has been on this European body, engaging with the dilemmas and prospects that so engaged European travellers, traders, missionaries or doctors in respect to ‘tropical’ climate. As a consequence, the question that has come to stand in for almost the entire body of historical research on climate in India is the question of the ability of the British to permanently settle and rule, given Indian climatic conditions. Or the development of special enclaves more suited to European bodies, from where the British could manage the affairs of India. Indians, it was believed, had little reason to fear heat, and historians have been content to leave the matter there. This despite the fact that there is much that is available in the very texts that have been studied from the perspective of the empire to suggest alternative histories of climate. Heat and humidity mattered to Indians too. In North India, frequent mentions of the summer wind - *loo* - can be found, originating in the west and blowing over the Indo-Gangetic plain. In architecture, the hotness of the wind was used to promote basement (*tahkhana*) living while its dryness led to rooms being cooled by evaporation of walls and roofs made of *khas*. The use of *jaali*, or perforated screens, to filter the sunlight and reduce solar heat gain, was common across much of South Asia. The popular drink *Rooh Afja*, developed by the *unani* medicine doctor Hakeem Hefeez Abdul Majeed in 1907, marketed itself as ‘the summer drink of the East’. And ice had been known to be brought to India at least since medieval times. The use of cotton as a dress material also finds mention, as does headgear and other items that we find described in *The Influence of Tropical Climates*. These are histories that I have yet to explore in detail, but the point may still be made that histories of heat and humidity, cooling and climate can gain much by shifting their focus away from imperial anxieties to Indian bodies.


In the course of time, the vocabulary of atmospheric conditions in India also expanded to include ‘impure’ air alongside heat, humidity and radiation. This was air rendered foul on account of miasma that originated from rotten matter so profusely found in the tropics. As Dr. Kenneth McLeod put it, the fact that Calcutta was situated in the centre of a tropical delta was a matter of considerable importance, for it implied ‘swamp, luxuriant vegetation, high temperature, great humidity, and active decay of organic matter, vegetable and animal.’ (*Indian Medical Gazette*, 1884: 201) It also implied conditions that could not have been more unfavourable for life – human and non-human! Indeed, even after the germ theory of disease began to be popularised, miasmatic and environmentalist views persisted, with bacteria

simply being added to the list of dangerous elements to be found in foul air (Svarverud, 2020). In consequence, the need for fresh air, both indoors and outdoors, became a constant invocation in theories of hygiene and sanitation; ventilation was to be the antidote to miasma! Among others, M. K. Gandhi, in a series of articles on ‘General Knowledge About Health’, written while he was in South Africa, mentioned the centrality of breathing pure air for achieving good health. There was no doubt, he wrote, that ‘bad air is the cause of more than 99 per cent of diseases...The first, the easiest and the last means of ending them is to have fresh air, purest of the pure. There is no other, *vaidya* or *hakim*, that can match it.’ (*Indian Opinion*, 2 February 1913; *vaidyas* and *hakims* were practitioners of traditional medicine) This was part of what Prasad has called Gandhi’s alternative biomoral/ bioethical vocabulary, focusing on what the community could do for itself rather than what to expect of the state (Prasad, 2015). On the one hand, the idea was for each one to ‘freely let in sunshine and air’ into their homes. On the other, it was to be wary of the ‘Air of Crowded Rooms or Dwellings’, as the *Indian Manual of Hygiene* (1894) put it. Following the popular opinion of the time, Gandhi cautioned that the air exhaled by a person, when entering the lungs of another, could be poisonous, and that tuberculosis, fever etc. were all caused by ‘the foul air we inhale’ (Gandhi, 1913a: 396). The need therefore was to maintain good ventilation and ensure constant exposure to fresh outdoor air, to live in less congested localities, fashion appropriate sleeping habits - sleeping outdoors, either in an open veranda or on the terrace -while keeping the nose exposed, and if not that, keeping doors and windows open and never breathing through the mouth (Gandhi, 1913b: 408-411). This, even as Gandhi noted that all did not enjoy the privilege of breathing the same air in the cities of the empire: ‘In Bombay ... if one can live on Malabar Hill, the air is much better. But one must have money to do this. If Durbanites want fresh air, they have to go to live in Berea. That again means expense. It would not, therefore, be quite true to say in modern times that “air is free.”’ (Gandhi, 1913a: 396)

Overcrowding emerged as another key trope, especially so in understandings of phthisis or tuberculosis. It referred not to numbers alone, but *in relation to ventilation* i.e. ‘to the freedom of the supply of oxygen to the persons in a given space,’ that allowed opportunities for contact while restricting the dispersal of germs. (Lankester, 1923: 123) Climatic reasoning did not entirely fade away. However, by the first decades of the twentieth century it was no longer seen as being fully determining, with attention also being drawn to social conditions, malnutrition and enfeebled bodies that were susceptible to diseases. An

interesting set of observations was regarding the practice of *purdah*, observed by many women in India, especially Muslim women. Purdah and ill-health, Maneesha Lal points out, had enjoyed a chequered history. In the nineteenth century, the concern had been about lack of access to the woman patients by western doctors. By the 1920s and 1930s, however, *purdah* was seen as linked to specific diseases such as osteomalacia and tuberculosis. The link was not necessarily direct. It was the *already weakened* body that was most susceptible; it was the lack of opportunity to obtain fresh air ‘with its strengthening and protective influence’ that made *pardanashin* women fall ill more often. Following Lal we may suggest that the link of *purdah* to pathology, and pathology to lack of fresh air, served to distinguish British from Indians, as also one group of Indians from another along lines of gender, class and community! ‘The reason that the health of the women of Hindustan is poor is because they do not get fresh air, because they stay closed inside purdah, the movement of all of the limbs of their body is minimal, and fresh air does not reach their lungs’, wrote Janakdulari Gurtu in the nationalist and feminist journal *Stri-Darpan* (cited in Lal, 2003: 30). ‘Lack of outdoor recreations’ and ‘too much confinement to the house’ were among the causes cited by another author to explain the “lowered standard of health and size so noticeable in the higher caste women of India.” (Lal, 2006: 103)

By the 1920s and 1930s, germs also came to occupy an important place in understanding of diseases in India. Equally, obtaining pure air was no longer to be just a matter of fresh air and sunshine, but also right consumption, with tonics, soaps and mouthwash beginning to be offered in Indian markets as antidotes to climate and germs. The chief aim was to attract the European consumer, though an emerging Indian middle class was also addressed. Among tonics, the emphasis was on gaining strength and, especially for Europeans, mitigating the adverse impacts of climate.



**Health & career-
RUINED!**

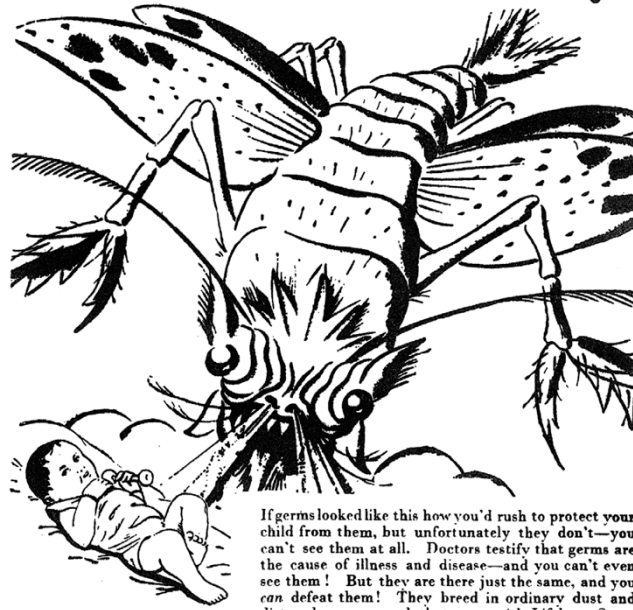
For the first few years in India he didn't even think about illness. Always well and full of energy it never occurred to him that the climate was slowly undermining his health. But to-day it's another story, and he's ordered home totally unfit for service in the tropics. Don't let this happen to you take STEARNS' Digestive and Tonic Tablets—the new tonic that replaces energy and enables you to ward off fever and other tropical illness. STEARNS' tablets are more than a tonic for they contain mildly laxative properties as well.

STEARNS
Digestive & tonic tablets.

The Dispensary, Ltd., London

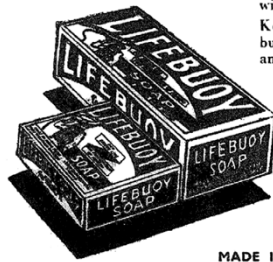
In the instance of soaps, a distinction was made between products for beauty (e.g. Lux) and those for health (e.g. Lifebuoy) and between products made in Europe and the 'purer' products of India. By 1938, Douglas Haynes writes, Lifebuoy was being advertised in 14 Indian languages, addressed to the middle class parent, with attention drawn to the dangers posed by invisible germs: 'Doctors testify that germs are the cause of disease and illness—and you can't even see them! But they are there just the same and you can defeat them! They breed in ordinary dust and dirt and you can wash that away with Lifebuoy.' (Haynes, 2022: 161) Boys and girls could not be kept away from dirt, other advertisements stated, but they could be made to inculcate the 'Lifebuoy Habit', bringing the advertisements in line with hygienic discourses that were also becoming eugenic. What was more, Lifebuoy advertised, the soap was 'made in India from pure vegetable oils only.'

Save that Child!



If germs looked like this how you'd rush to protect your child from them, but unfortunately they don't—you can't see them at all. Doctors testify that germs are the cause of illness and disease—and you can't even see them! But they are there just the same, and you can defeat them! They breed in ordinary dust and dirt and you can wash that away with Lifebuoy Soap. Its rich lather is antiseptic, it washes the germs away with the dirt.

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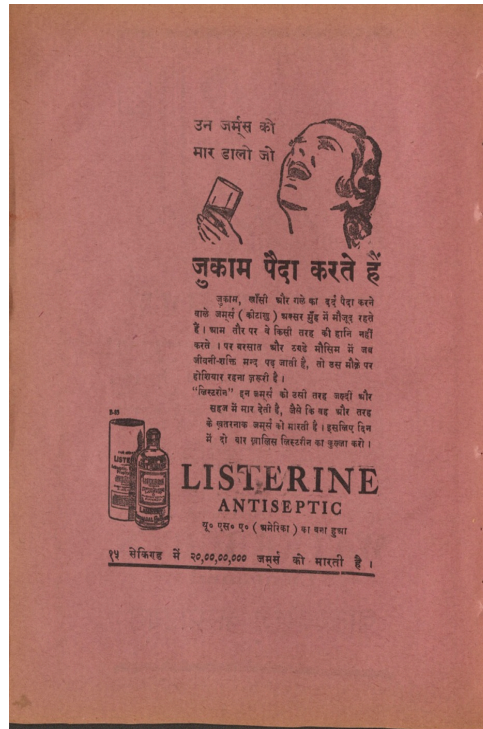
LIFEBUOY SOAP

MADE IN INDIA FROM PURE VEGETABLE OILS ONLY.

L 248

LEVER BROTHERS (INDIA) LIMITED

Listerine mouthwash was another product that aimed at capturing this new health market, drawing attention once again to the hidden germs that needed to be eradicated. Named after the English doctor Joseph Lister, the mouthwash had first been developed in 1881 and soon sold as an effective oral germ cleaner. Like soaps, it began advertising itself in India too, both in English and in Indian languages. The body copy of the advertisement suitably employed a 'shock and awe' vocabulary – claiming to kill 20,00,00,000 germs in 15 seconds! And it was especially recommended for use in the monsoon season and cold weather, when persistent coughs seemed to become a regular feature.



In sum, over a period of a century, tropical airs had been variously suggested as being pathogenic, being hot and humid and full of dust and germs. In response, various discourses of bodily care came to prominence, initially being largely about European bodies but gradually including Indians too, and advice shifted from adoption of indigenous housing style, dress and exposure to fresh outdoor air to the use of modern commercial products and mechanical means of comfort. I explore the last of these in the next section.

Homes

Closely linked to bodily discourses was the attention paid to appropriateness of domestic environments. Initially, there had been some appreciation of Indian architecture, especially the solid dwellings and lofty apartments of upper class Indians, featuring large windows, floors that were often washed to keep them cool, and having a *verandah* that warded off the glare of the sun. From around the middle of the 19thc. Calcutta as a Bengali middle class city had also begun to gain its own spatial and architectural identity. (Chattopadhyay, 2005:194-203) Common to these were courtyards and balconies, the latter permitting light and breeze to enter directly from the outside and not through the controlled micro climate of the former. ‘Modern’ orientation of rooms featured prominently in the advice offered to Bengali housewives – the bedroom ought to be the best room in the house with ample sun and open to the direction of the wind; every morning windows of the house were to be thrown open to let out the ‘toxic’ air

and let in the 'pure' air. Observers at the end of the century, however, were not entirely convinced just how much gain had been achieved. The courtyard house, the most common form of housing among the Indian middle classes, was suggested by officers of the Improvement Trust, 'to encourage a form of construction in which ventilation is practically non-existent'. (cited in Datta, 2012: 231) And the Calcutta Municipal Corporation observed in its report in 1929-30 that death on account of respiratory causes remained high. Among other things, this was on account of inadequate ventilation: bad housing, a dark, damp, ill-ventilated hut in an open suburb being just as deadly as a badly lighted and ill-ventilated room in the heart of the city. (Sharan, 2020)

Things were not much different in Bombay either, even though it was more favourably located on the sea. Fevers, 'peculiarly the disease generated by foul air of crowded, uncleanly habitations,' was seen as being even more prevalent here than in Calcutta or Madras, and the mass of the population had to breathe 'for ten or twelve hours out of the twenty-four the stifling atmosphere of their narrow and crowded chambers, loaded with animal exhalations.' Chawls and sheds made of dry leaves were the most common forms of housing for the urban poor, and were often 'crowded and sunless houses'. Standards of light and air were written into law after the plague outbreak of 1890s, but their practical realisation remained a distant dream. Workers' housing especially either did not feature windows, and when they did, these were often latticed to prevent residents from throwing waste materials out. The consequence was that the rooms remained dark and stuffy. Dr. Florence Barnes, whose report on maternity benefits for women workers was to be repeatedly cited over the following decades, counted over 15 inhabitants in rooms measuring no more than 12 feet by 15 feet, with every ventilation space packed to avoid the ingress of fresh air, and conditions being especially bad in basements where 'daylight with difficulty permeated, sunlight never'. (Barnes, 1922) Around the same time Janet Kelman, in her research on women labour in modern Indian industry, observed: 'It is very difficult to give any clear idea of what a group of very bad chawls are like...As the eye glances upwards, it may see a wall variegated by rags, boxes and matting. These indicate the stuffed up windows of chawls...the rooms behind these stuffed up windows and draped *verandahs* are dark...The heaviest burden of such conditions falls on the woman [who] ...exhausted from her long day's work, huddles down to sleep in the dark, unventilated room along with women lodgers and relations and their children and her own.' (Kelman, 1923)

Lack of ventilation was compounded by the presence of smoke. In England, *coal smoke from home fires* had emerged as the major domestic issue - family hearths warmed the indoors, but they also polluted the atmosphere outside. (Mosley 2007) In India, by contrast, domestic smoke was discussed largely in relation to fuels used for *cooking*. In the 1830s, Ranald Martin had noted the use of bamboo, reeds and cow dung mixed with husks of rice by the poor of Calcutta (Martin 1837: 57). Half a century later, the magistrate of Howrah (1882) drew attention to the persistent use of cow dung cakes within the city. The commissioner of Burdwan similarly observed that wood fuel was scarce and cow dung, 'though objectionable,' was the only fuel available for the poorer classes. And even though use of coal as a substitute for biomass had started by 1880s, this held little promise either, for Indian coal contained a large percentage of sulphur which made the products of combustion 'very disagreeable to the senses.' Not surprisingly, the use of biomass remained commonplace well into the 1930s, in Bombay, Delhi and Calcutta alike, with cow dung and wood continuing to be used as fuels. (Sharan, 2020) And with this came the 'smoky' kitchen.

At least three kinds of kitchen find mention in the historical records – those in the homes of an emerging Indian middle class, those of working class households and the kitchens of the British based in India. Homes in India, barring that of Europeans, usually did not have a separate cookhouse. The consequence was that 'the residents in them have... suffered from the smoke nuisance in the most virulent form for years; for the smoke from the *chula* cannot be confined to the kitchen; it diffuses throughout the house and lingers for hours after each meal.' (*The Statesman*, 1917) The English woman was expected more to be a manager of the kitchen (and of the servants), minimizing her personal domestic duties and consequent exposure to dust and smoke. (Procida, 2003) The Bengali housewife, by contrast, was expected to be the *grihlakshmi* (benefactor of the home) and personally attend to cooking for family members, thus being exposed to smoke to a greater degree. Conditions in which she performed her tasks therefore mattered as much for her as for the servants. Dr. H. M. Crake described a typical Bengali kitchen: 'I must confess I am astonished at the average kitchen. It is in a large number of houses, a gloomy, stuffy den, full of acrid smoke, and yet the ladies of the house have to spend hours in these very unpleasant surroundings. The entire absence of chimneys results in an atmosphere which is almost unbearable when cooking is going on in a particularly ill-ventilated kitchen.' (Cited in O'Malley, 1901: 56) Even greater contrast obtained between middle class homes, both Indian and British, and working class tenements and slums in which several household functions such as sleeping, cooking etc. were conducted in just one room

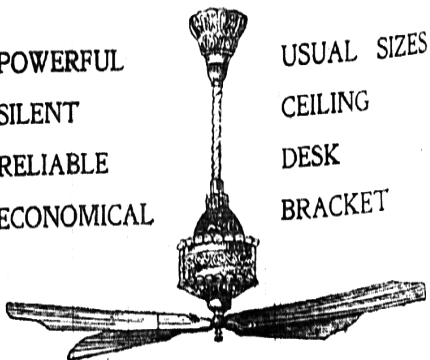
and, in the case of tenements, often by several families living together in this one room. To speak of a 'kitchen' in such households was thus to imagine not so much a separate space with its own special function but to imagine an act – of cooking – done sometime during the course of day or night whose effect lingered through the hours and the seasons, with rooms remaining full of acrid smoke day and night. And if it was a multi-caste household, as several were, different fires were lit in the same room, each adding its own quota of smoke. (Kelman, 1923: 144-146).

Nothing much was done in this regard, however, by way of building design. Faith instead came to be reposed in emerging technologies such as electricity. Commercial generation of electricity in Calcutta commenced on 17 April 1899. The Bombay Electric Supply Company was registered in 1905. And in Delhi, imperial durbars held in the first decade of the 20thc., featured installation of electric lights, before this was taken up as a municipal responsibility. It was as if a new dawn was on the horizon, set to transform urban living conditions for ever. As early as 1902 the members of the Boiler Commission in Calcutta had observed that even if the possibility of transmitting power on a large scale from generating stations located in the collieries outside Calcutta was 'only a dream of the future', in its realization lay 'the certain and only drastic remedy of the existing smoke nuisance.' In addition to power for factories, the *Indian Textiles Journal* editorialized in September 1899, electric power would 'light our cities, propel our tramcars, pump our sewage, load and unload our ships, propel hundreds of electric motor cars, pull all our *punkhas* and do a large proportion of domestic labor.' The Delhi Electric Tramway and Lighting Company Co. enticed potential investors with the promise of continual profits, for 'in a climate like that of India', the electric fans must be kept in operation continuously day and night during the hot seasons. (Coleman, 2017: 63). Companies equally emphasized how industrial designs and processes that had proven beneficial for industry and transport could be used in homes and offices. 'The energy that launches great liners,' one advertisement by the Bombay electric supply company reads, 'can be used for your Household Refrigeration', going on to add 'electricity should be the driving force in every modern household – for light, heat, cooking and refrigeration.' In yet another advertisement, electricity, 'the invaluable modern power', was advertised as 'your servant', asking consumers to think of all the advantages: 'cleanliness, efficiency, economy, simplicity'. Gas too made a pitch as an alternative source of energy for public lighting and domestic use with the Oriental Gas Company becoming a major provider. And in 1937 Volkart Brothers announced the installation of the first air conditioning unit in their office in Bombay but, contrary to temperature and

humidity control, chose to emphasise the purity of air that would ensue while cleaning the 'dusty, unhealthy' air of the city outside. Only good air conditioning could ensure both the absorption of germs and the comforts of coolness, not ventilation. For the only air to be had outside was filthy city air! (Jain, 2022)

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6 PROTONS

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However, taken in the aggregate, access to electricity within homes remained restricted. By 1944, a mere 3.3 percent of electricity in Bombay province was used to run lights and electric fans. And in Calcutta, while the area served by the Calcutta Electric Supply Company had close to 1.5 million people, merely 57,415 houses were connected with electrical wiring by 1940. (Sharan, 2020: 252). Much was being invested in creating a new desire for electric gadgets and gas appliances among the emerging middle class, though outcomes remained limited.

The City

The smoke that filled the homes also escaped into the city, where it became an urban nuisance. In Europe, smoke from homes was usually discharged at an altitude of 50 to 100 feet, depending on the height of the buildings and chimneys, and ordinarily there was a zone of comparatively pure air near the ground for breathing purposes (BenSNC, 1926). But Indian homes as a rule did not have chimneys. So smoke lingered on at the ground level, where people lived and breathed poisonous sulphurous air:

In Calcutta and the suburbs, during the cold season, when the atmospheric conditions trap the smoke near the ground level, when curtains and clothes are blackened in a few hours, and the nostrils and the respiratory tract are clogged with soot, the death rate from diseases of the breathing organ rise from 80 to 240 a week...The scientific use of fuel solved economically, at least, the problem of

industrial smoke. But domestic smoke, which is responsible for about 75 per cent of the damage, is not yet commercially solved. (Bengal SNC, 1927)

Industrial smoke could rise or wane in quantity, depending on working hours or days of strikes. But domestic smoke was a daily presence. And it was felt across all cities, not only those with major industrial presence:

If you go to a housetop in a busy quarter of a populous city, like Bombay, Calcutta, Cawnpore or Delhi, especially in the evening when the air is still, you will notice the dark trails of smoke and copper colored haze in which the city is enveloped...The phenomenon of smoke filling all the houses in winter, causing smoking sensation and smart in the eyes is due to the waste products of the lacs of *choollahs* filling the air and kept imprisoned above the ground due to absence of breeze and heaviness of the cold, dank, air. (Gurtu, 1926)

The problem posed was both direct – in the form of respiratory diseases caused by unburnt carbon – and indirect, in as much as ‘the careful housewife will close the windows to exclude the smoke and smuts, and the household will incur as a result all the objectionable consequences of unventilated rooms.’ (BenSNC, 1932) Smoke cut off the sun’s health-giving ultra-violet rays, it devitalised and poisoned, it roughened and thickened the linings of the lungs, causing chronic bronchitis, it ‘gassed’ Calcutta, especially in winters and for all these reasons, the city fog ought to be considered a ‘mass murderer’. (BenSNC, 1932; 1938)

I shall return to the issue of urban smoke in a moment. But first let us consider the making of a ‘sanitary city’ which both predated the concern with smoke and which always remained the more prominent mode of addressing atmospheric issues.

As mentioned above, by mid-nineteenth century medical topography had emerged as a distinct genre of literature, setting the tone for descriptions of regions and cities with a view to reforming bodies and spaces to make them healthy and productive. Notable among these was James Ranald Martin’s *Medical Topography of Calcutta*, ‘No climates exist that are uniformly hot and dry, hot and moist, cold and dry or cold and moist’, Martin wrote. ‘Yet certain countries have such a preponderance of one or other of these qualities as to give a very marked character to the physical and moral nature of man.’(Martin 1837: 96) Martin then went on to note the

specific features of Calcutta. Miasma was of critical import – ‘marsh and rank vegetation’ near the city ‘producing constant and unwholesome exhalations retained and accumulated in a humid atmosphere’ that infected the air. (Martin 1837: 14-15) The lanes were narrow and the smell ‘villainous’, with little exposure to the sun that could ‘rarify and elevate the vapours’ or winds that could ‘dilute and disperse’ them. (Martin 1837: 23) Half a century later, W. J. Simpson, health officer of Calcutta, reiterated this sense of difference. Urban features that obtained in Europe, he suggested, were considerably more exaggerated in tropical countries where ‘the narrow streets, the winding alleys, the crowding together of houses, form an insanitary labyrinth, which cannot be efficiently cleansed nor purified by a free circulation of air. (Simpson, 1908: 24) *The Statesman* (1890) editorialized that while much had been achieved by way of pure water, badly ventilated parts of the native town left much to be desired: ‘if the drinking of polluted water is injurious to health, so most assuredly is the breathing of impure air, although the effects of the latter are more insidious and less easy of detection’. Bombay, located on the western coast, was much favoured by sea breeze but even here fevers, ‘peculiarly the disease generated by the foul air of crowded, uncleanly habitations’, was believed to be widely prevalent. And as population increased with the expansion of docks and growth of trade towards the end of the nineteenth century, hut settlements in several parts of the town began to be converted into ‘the merest labyrinths of narrow and pestilential lanes’, with ‘crowded and sunless houses’, the population huddled along ‘poisonous tracks’, ‘breathing the miasmata that no breeze ever comes to disperse’ (Edwardes, 1902: 323-24). In concentrated form, such impure air could cause death; in dilution they acted as poison, ‘slower but no less certain’ (Bombay Municipal Corporation, 1896: 582-83).

Not surprisingly, health reports of all major cities continued to present a picture of overcrowded, dense spaces, with single rooms often occupied by several individuals and streets full of dust and particulate matter. The views found favour among leading Indian figures too who noted the dust of streets ‘impregnated with the germs of Phthisis’ that entered the respiratory tracts of residents and caused much harm. (Bose, 1911: 133) Large-scale demolition of slums and the making of wide streets were the solutions offered. The Lieutenant Governor of Bengal minced no words in saying that the chief problem was ‘to clear out the pestilential quarters’ and ‘drive broad roads through those quarters.’ (1896). Long reports were written by members of the Improvement Trust, set up in 1911, outlining among other things, nine comprehensive street schemes for the city. The plans failed to fructify, however, and to the extent that any success was to be had, the consequence was to force the labouring poor into the

already crowded suburban areas to the east and south. Initial focus of the Improvement Trust in Bombay, set up in 1898, was also two-fold, an 'improvement scheme' to open up the slums and 'street schemes' to draw in the breeze from the ocean in the west into the neighbourhoods of central and east Bombay. Immediate results were not encouraging here either, with slums being demolished without alternative accommodation provided and too many rooms continuing to get too little light or air. In time, a standard of light and air was suggested. But enforcement was never easy. At any rate, the focus soon shifted to an 'indirect' means of addressing the slum question by way of constructing a broad north-south road to attract people to more sanitary buildings that would be built in the northern suburbs. But the poor refused to move. Through all this, the Trust blamed the Municipal Corporation for the continued failure to improve things on site. The Corporation, in turn, accused the Trust of focusing on increased revenue rather than creating better living environments. The new street scheme, they argued, was far from being a 'ventilation scheme', i.e. streets schemes designed to either wholly or partly to remedy the defective ventilation of congested parts of the city. It was simply an exercise in making money through property development. And so it was that while middle class homes saw some improvement in ventilation and lighting, and consequent improvements in comfort and health, poorer neighbourhoods remained much the same through the colonial period. It was left to the Scottish sociologist/ planner to offer a trenchant critique of the policies that had been followed by these Improvement Trusts. The plans drawn up by the engineers were 'dreary and conventional', he wrote, and the sweeping clearances were 'one of the most disastrous and pernicious blunders in the chequered history of sanitation.' (Cited in Datta, 2012).

Miasma and sanitation, however, were not the only urban concerns. We have already noted the presence of smoke that wafted in from homes on to the streets. In addition, there was smoke from industries. This was a concern, however, limited to Calcutta and Bombay and, at a later date, with other industrial centres such as Ahmedabad and Karachi. In 1862, Bombay enacted 'An Act to abate the Nuisance arising from the Smoke of Furnaces in the Towns and Suburbs of Bombay', followed a year later by a similar Act for Calcutta. The extent of smoke in Indian cities as yet was hardly at par with that of English industrial towns such as Leeds or Sheffield. But it was enough for the English in India, and in time for an emerging Indian middle class, to consider it a nuisance and act to curb it. The idea was simple enough – every furnace that was employed for the working of engines by steam ought to be so designed as to consume or burn the smoke arising from it. Failing which mills would be fined. But outcomes once again

remained limited. Engineers employed by the mills, mostly trained in England, routinely disputed the expertise of the smoke inspector and of the municipal officers who had been entrusted with the task of ascertaining if the black smoke being emitted by a mill on a particular day was 'excessive'. Observations made by these officers were characterised as being amateurish and fines difficult to impose. The consequent state of the cities was described as bad as in an industrial city in England. In Calcutta, Durgacharan Ray's Bengali text *Debganer Marttiye Aagman* (1880) imagined the river Ganges complaining to the Gods about the indignities suffered by her at the hands of the English, not least on account of the noise and smoke emanating from the factories that had been set up on lands snatched from her. In Bombay, the *Times of India* (31 Jan. 1882) editorialized that the neighbourhoods of the cotton mills were becoming as grimy as they were in Bolton and Preston. A new beginning was required and this came through the initiatives of Lord George Nathaniel Curzon, appointed as Viceroy of India in 1899. Curzon was an arch imperialist, but he was also an imperial modernizer, a firm believer that the cause of the empire must be supported by expertise of different kinds. There was much to be distressed about Calcutta, he observed: 'I am reluctant to see Calcutta, which has risen like a flame, perish in soot and smoke.' (Curzon, 1903) But if this was not to be, expert advice had to be obtained. Fredrick Grover, the smoke inspector from Sheffield was the expert called for and his report on smoke in Calcutta became the basis for smoke regulation in India for over half century.

There were several sources of smoke, Grover noted, but the one that merited the greatest attention was industrial smoke. And even here a balance had to be made. Wise legislation, Grover observed, must balance between commercial prosperity and public health. And the way it could do so was to focus on efficiency. Reliance was initially placed on adequate flues and chimneys, the smoke nuisances commissions set up in Calcutta (1905) and Bombay (1912) mandating that the height of the chimney be no less than 100 feet. From a narrow local perspective the 'solution to pollution' had always been dilution. (Tal, 2002) And so it was to be in Bombay and Calcutta too. Careful firing with the use of mechanical stokers was another strategy suggested. Industry begged to differ, pointing out that there was no appliance yet invented that could help consume all the smoke generated by a boiler. Indeed, more advice was called for, mill owners pleading that while they were 'extremely anxious to meet the wishes of the Municipality,' they did not know how to do it. They remained wedded to the 'art of the possible,' not 'the urging of the idealists,' of the kind that had been done in Chicago and elsewhere in USA where a smoke inspector with engineering qualifications partnered industry

in making the right kind of technical choices. Inspectors who worked with the commissions in India were not averse to offering advice either, but they remained reluctant to recommend specific designs or recommend precise technological options, being afraid that if there was a failure to abate smoke despite their technological recommendations being accepted, it would lead to a diminishing of their authority!

Things changed somewhat in the inter-war years and subsequently. The smoke nuisance commissions now agreed to function as a store-house of technical knowledge whose expertise would be available for all those who sought it. Dimensions of flues, furnaces and chimneys for the most efficient consumption of coal were thus investigated at length, with a view to avoiding excessive discharge of gases while ensuring the correct mix of air: if there was an insufficiency of draught, the fuel would not burn completely. If too much, the excess air lowered the temperature of the furnace, resulting not only in smoke, but also carrying away the heat released from the fuel up the chimney. 'Thus do we see,' the Bengal commission observed, 'that coal is wasted by too much air; lives are lost by too little pure air.' Soon though, even this was deemed insufficient, as most owners failed to produce the quality of plans that could pass muster with the commissions. It was now time for the commissions to take charge themselves, preparing the plans in their own offices for a fee. Bombay was to follow in this direction much later than Calcutta, with the Act being amended only in 1929-30 to make it obligatory for owners to submit all plans for erection, re-erection or alteration of a furnace, flue, or chimney to the commission, so that suitable heights, area of flues etc. could be considered and an accurate and graphic record of the chimneys in the area maintained. By the 1930s, advances in combustion engineering also seemed to help, promising greater heat utilization and generation of steam and thereby reducing the amount of coal needed. And when all advice failed, the commissioners could prosecute. However, there was an important shift in this regard. The blame for excessive smoke, far from being attributed to the mill manager, as it had been in the nineteenth century, began to be increasingly attributed to Indian stokers for whom fines and other disciplinary measures became routine affairs.

Above all, reliance for abating smoke once again came to be placed on the use of electricity, transmitted from a distant generating station outside the cities. In Calcutta, this would be the coal fields of Raniganj, situated approximately 200 km away from the city. In Bombay, the supply was to be obtained from the hydro-electric power plant set up at Lonavala, 85 km away. This could hardly be adequate though. Just as the use of gas and electricity as anti-pollution

measures in England did not eliminate pollution but merely redistributed it socially and spatially, promising cleaner consumption in the city at the expense of usual dirty production elsewhere, so was the case in India. (Thorsheim, 2006) The setting up of hydroelectric power in Bombay led to India's first anti-dam struggle, while environmental conditions at Raniganj were as poor as it obtained anywhere. In the city itself, air quality had been widely understood affected all alike, as this image from a Bengal commission report would suggest:

Calcutta Smoke Ruins Cold Season.

These are Calcutta's weekly victims poisoned by polluted air, when the aerial scavengers wind and rain fail and the air we breathe becomes thickened with impurities, and the nose and respiratory tract are clogged with soot, and household linen and clothing are blackened in one day.



But even here assessments about relative impacts continued to differ. As early as 1922, the commission in Calcutta had declared success, noting that the atmosphere of the city was comparatively cleaner than what was usually associated with an industrial and shipping centre, and that its efforts to work in the interests of all residents had been much appreciated. A decade later though the *Amrita Bazar Patrika* (Calcutta's nationalist newspaper) noted that to the people of Calcutta innumerable chimneys continued to 'speak through the dense black clouds of smoke covering their houses, clothes and nostrils.' Even more damningly, the Director of Public Health noted that the death rates in mill districts continued to be higher than elsewhere, and that north Calcutta, where poor and middle class Indians lived, suffered to a greater extent than the southern parts of the city occupied by the British and by elite Indians. Smoke had neither been eliminated nor evenly distributed!

Postscript

As Gandhi had observed in South Africa in 1913, and as the Director of Health was to observe in Calcutta in 1939, smoke and foul air had specific geographies. To talk of air is thus to also talk about differences within cities and between them, differences that were shaped by race, gender and class. It is also to talk about both visible smoke and invisible particles and germs. And for the period under consideration, while air talk remained firmly focused on homes and cities, we also get occasional glimpses of its regional dimensions. There is much that can be said to have changed in regard to all these, even as significant continuities remain. There is still a greater concern with pollution that is visible, but as the *Policy Statement for Abatement of Pollution* issued by Government of India in 1992 notes: ‘earlier concerns with pollution that was visible and degradable are giving way to new types of pollution with very small quantities of synthetic chemicals that ... damage the environment... Despite uncertainties and insufficient knowledge, political and scientific discussions concerning environmental change will increasingly be necessary.’ Since then, it is precisely these invisible elements – PM₁₀ and PM_{2.5} - and the virus that cannot be seen by the naked eye, that have dominated atmospheric discourses in India. The scale has also changed. The city still remains politically salient and court rulings on urban environments continue to be about what happens within specific urban boundaries. But increasingly when it comes to particulate pollution, the emphasis is on acting at the level of airsheds and to consider global implications of local pollution. With the event of the pandemic, the regional and global scale have gained even greater salience, with greater appreciation of mobility and atmospheric risks across borders. This concern had first emerged in India in the 1940s, regarding the possibility of yellow fever coming to India in the wake of the new air routes that were being opened with Africa. It had then been forgotten for some time, only for it to return in the wake of SARS and more recently, COVID 19. Finally, there is much at stake in the uses of particular energy sources. In *A Climatological Study of Delhi* commissioned in the 1950s, a strong case had been made for passive cooling while avoiding desert coolers and air conditioning, this being ‘the normal economic limitation’ of individual family incomes and also of the country as a whole, with limited resources and limited available electric current. However, by the 1990s, urban India had fast begun to transition towards the use of coolers and air conditioners. As Radhika Khosla et. al (2021) note, India’s urbanising middle class is at the brink of an unprecedented increase in residential cooling demand and energy use for space cooling is growing faster than for any other end use in buildings, being fuelled both by rising incomes and increasing temperatures. Making more efficient choices about this demand would be one way of coping

with it. Recovering and promoting passive cooling design would be another. Either way, the debate on energy and environment that emerged at the beginning of the twentieth century continues to pose fresh challenges in the twenty-first.

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