Measuring Hierarchy: Mahalanobis, Majumdar and the Statistical Analysis of Physical Anthropology

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In the period of India's transition to political independence, as Nikhil Menon and Benjamin Siegel have shown, India's mid-century development and planning paradigms were firmly rooted in a faith in science, and contemporary approaches to the economy, society, data and statistics. The decade that followed decolonisation was, in many respects an era in which older research disciplines confronted the new. India's Planning Commission had embraced these, then relatively new disciplines with a significant investment of time, labour and money in the lead up to the First Five Year Plan: Developing India's economy and society was to be rooted in measurement, analysis, and the potential computerisation of empirical data embracing all forms of human activity.

As we have seen in previous blog posts, the approaches of anthropology and sociology, although in the former case sitting quite uncomfortably with many of the ideals of the post-independence state, were also integrated into this knowledge and data economy. Nehruvian planners subscribed, clearly, to a modernist agenda in which ethnically or religiously defined social inequalities were to be eliminated or reformed. In this article, I will argue that the wedding of anthropological research with new developments in the discipline of Statistics did not significantly challenge the basic premises of physical anthropology, despite the claims of 'greater accuracy' or more robust methodologies on data. If anything, the partnership reinforced many of the older presuppositions about race, ethnicity and crucially and most fully, renewed particular kinds of social hierarchy. This was not principally a problem with the science itself or an issue of mismeasurement, or the skill of the intellectuals involved. Rather, *a priori* assumptions about ethnography were reinforced and embedded by the processes and methodologies of data collection itself, and particularly in the intersection of fieldwork and the statistical laboratory.

The Statistical Survey

One of the most detailed and thorough examples of this inter-disciplinary engagement came in 1949, with the publication of the 'Anthropometric Survey of the United Provinces, 1941: A Statistical Survey' in *Sankhya: The Indian Journal of Statistics* under

the joint authorship of P.C. Mahalanobis, D.N. Majumdar, M.W.M. Yeatts and C Radhakrishna Rao. Historians are agreed that the 1941 Census was largely an exercise in failure, given the conditions of the War, but Majumdar's specific ethnographic work in UP which formed the basis of the survey was, to date, 'one of the largest sets of individual measurements taken by a single observer' (Mahalanobis et al, 1949: 90), but which was related to Majumdar's other study in Bengal. Most importantly, this was, the Survey noted, the first application of statistical methods to physical anthropological measurements.

Majumdar's entire fieldwork for the 1941 Census was handed over to the Indian Statistical Institute, which undertook sixty-five computer months of analysis at a total cost of Rs 12,000. The initial workers on the data were J M Sen Gupta and N R Mathew, with C R Rao and Mahalanobis coming on board later. In 1942, the research materials that had been sent from Lucknow to Calcutta had to be transferred again to Giridih, due to the wartime conditions. Mahalanobis noticed two sets of errors in how the data had been recorded and so the entire research had to go back and forth two further times – another indicator, the report noted, of the importance of using statisticians in anthropological research. Further delays were created by the ISI's preoccupation with collecting crop data during the 1943 famine, which meant that most of the work was not completed in 1945. As luck would have it, Rao and Mahalanobis were on a trip to Cambridge in 1946. Being in the presence of 'more advanced' computers in the Fens, they 'increased the range of statistical analyses' (Mahalanobis, 1949: 112).

The mid-century commitment to positivism was encapsulated in the foreword to the Survey, provided by the 1941 Census Commissioner, M M Yeats, who addressed the problem of how the 'individualistic' methods of anthropologists were often slow to pick up on the necessary focus of 'measurement' in the sciences. The Statistical Survey therefore engaged squarely with much older anthropologies, of Herbert Hope Risley and William Crooke in particular, using the argument that since much of Risley's data was likely to have been wrong (especially given recent archaeological discoveries), there was a need for a more careful analysis of similar forms of data. To this end, the survey made much of the unconscious bias inherent in Risley's work – the deliberate selection of 'standard types' which applied *a priori* notions of racial difference by caste, and the rejection of the measurement of 'outliers'. Risley's legacy was also applied in a critique of data collected as late as 1931, with the criticisms of 'Mrs Karve' [Irawati Karve] due to the fact that most of the data for 'Marathas' in the 1931 Census had been collected from Maratha students of the Fergusson College and Poona (97); and that Guha, in the same year, had collected 'Bengali Kayasthas and Brahmans in Ahmedabad from the textile mills there' (Mahalanobis, 1949: 98).

But the critique of Risley and anthropologists of his generation was focussed squarely around their use and analysis of the data they had collected, and not the character of the data itself as Projit Bihari Mukharji argues for Mahalanobis's work on race in the 1930s, or its means of collection. None of these anthropologists, least of all Risley, the Survey noted, had used even basic statistical methods such as 'standard deviations or probability errors'. This was a problem that did not, by any means, overturn the value of

physical anthropology, but simply weakened its development: Karl Pearson's 'Coefficient of Racial Likeness' for example, used by Biraja Sankar Guha in the 1931 Census, had not been 'standardised'. The size of samples in previous work, the Survey noted, were also dangerously small, suggesting that 'the amount of confidence with which racial theories are made is very often inversely proportional to the evidence obtained from the physical data', and again Guha was criticised for relying on data that was consistently based in low group sizes, averaging 64.4 and in some cases less than 50.

In the Field

This question of sample size and the critique of its geographical location brought the Survey to a discussion of fieldwork methods, which in its light-hearted anecdotes revealed the nature of research practice in this period. Here again, older assumptions about the researcher-subject interaction had survived, albeit in altered form. A laboratory for obtaining blood tests had been set up in Lucknow, but in many cases subjects attempted to evade measurement and analysis: In Mirzapur, Majumdar reported, not only did members of the Kharwar tribe disappear when asked to assemble, they did not return to their homes for fear of the anthropologists' tools. When Majumdar entered the Criminal Tribe settlement in Moradabad to take measurements from 'Bhatus' he was confronted by a 'rowdy group' of women who 'demanded that he release their menfolk from military service'. Majumdar evaded the threat by arguing that he could not be measuring for the military, since he had not done their chest measurements. Nevertheless, he had by his own report, 'faced danger to my person and it was the vigilance of the chowkidar that saved me from being a martyr to the cause of science' (Mahalanobis, 1949: 102-3).

For this Survey, background assumptions were similar to those of earlier studies and arguably this context was reinforced by the statistical tools themselves. Majumdar had measured twenty-two different groups across UP – a task that had been made more difficult due to the suspicions aroused by the war. But he still made reference to a racial 'parabola' across UP with the 'upper arm related to Indo-Aryan and Mongoloid castes and the lower to Dravidian and proto-australoid'. Between these two groups were another selected for measurement – 'Criminal' and Nomadic Tribes, 'who wander about as nomads, acrobats, snake-charmers and dealers in charms and narcotics'. Randomised selection, Majumdar suggested, was made more difficult the further one went up the social hierarchy, and different tribes resented being measured or photographed together (Mahalanobis, 1949: 105). The team used the following instruments: An Anthropometer (manufactured by Hermann Rickenback and Sons), with a footplate; sliding and spreading calipers, by the same manufacturers; steel tape; head spanners; standard beam scales and a Stangenzirkel (beam compass). Most subjects were measured in 12 ways – Stature, sitting height, head length, head breadth, minimum frontal breadth, nasal length, nasal breadth, nasal depth, total facial length, upper facial

length, bizygomatic breadth and bigonial breadth (width between cheek bones and jaw bones respectively).

Despite the seemingly robust critique of older ethnographers' methodological errors, there were ways in which some of their practices (particularly those of reduction) were further reinforced by the alliance of Anthropology with Statistics. For example, the argument for perpetuating relatively small group quantities of data - in Majumdar's case necessitated by the expense of the research and its need to take place in 'vacation periods'- was also supported by statistical approaches. New methods of 'multivariate analysis', at which Mahalanobis was at the international forefront, revealed the number of measurements did not need to be large in a particular subject. Indeed, the statistical approach made it necessary to 'use the more stable ones' suggesting *a priori* reasoning not unlike Risley's dismissal of 'outliers'.

As well as strengthening some of the foundational arguments for forms of physical anthropological measurement and data collection, the Survey's focus on statistical methods re-framed and in many cases, hardened new forms of social hierarchy observed across the data sets. This was partly rooted in the field, and partly in the laboratory, and the certainly in the interaction between the two. The process of field research itself, as was the case in the Criminal Tribe settlement (itself state-sponsored although managed by the Salvation Army), was facilitated by the intervention of local administrative officers. The names of assembled subjects were recorded and selected by local administrators, patwaris and assistants in tehsils. Further, in selecting the particular districts for samples, the guidance of administrative and forest officers was pivotal, who 'were a great help in securing for us the subjects we measured in several districts' (105).

It is likely that the local officers who helped choose the individuals surveyed particular castes on the basis of their local knowledge and that therefore, as Irawati Karve had complained for the 1931 census, caste groups were selected from individual villages or neighbourhoods. Their physical similarities to those in their 'group' may, therefore have been just as much about location and environmental proximity as it was to do with caste. There was no mention in the Survey that the same caste from diverse or relatively remote locations were sampled. There were of course other figures assisting Majumdar. The measurements were not collected by the research leader alone: some were also gathered by a group of mathematicians and physicists who were recent PhD graduates – P.R. Roy, U.K. Bose and Indrajit Singh, as well as the laboratory peons, Bhosiali and Hiralal. Mentioned in familiar terms, these assistants were still considered 'invaluable' and Majumdar noted that each measurer cross-checked their results throughout.

In the Laboratory

It was in Part II of the Survey – the 'Statistical Analysis', that the detailed treatment of the anthropological data took place, and it was in this section too, that new forms of hierarchy were introduced. Chapter 4 introduced the 'basic statistical concepts' that would be used across the measurements of the 22 groups. This principally involved the grouping of particular population 'types' and then the calculation of distance between those groups, in relation to the measurements recorded. A consolidated 'D2' statistic (originally developed by R C Bose and Mahalanobis) for each group took into account variances in measurements and their stability for each caste group. Mahalanobis pointed out that it was only when samples were selected at random that this statistical approach could be used, and that typically anthropologists 'selected' samples introduced 'unconscious psychological bias'. In order to see how random Majumdar's samples really were, a calculation of 'standard error' was used.
For Majumdar's data, the authors suggested that these statistical analyses proved his samples were large enough to determine differences between the caste groups. However, it was noted that not all of the 12 standard measurements showed a wide enough distance between the D2 statistic for each caste group. In other words, the Survey based most of its calculation on the 8 measurements in general that did remain 'stable' in differentiating the caste groups. Overall, the statistical conclusions went further to suggest that most of the variations could be put down to 3 or 4 measured variables (Mahalanobis, 1949: 177-180). Such was the confidence, however, of the authors in the usefulness of D2, that they suggested that calls for a 'standardisation' of physical measurements (which had arisen at the 1941 Indian Science Congress in Banaras), should not be based on typical anthropomorphic measurement but on D2 itself.

D2 usefully allowed the authors to not only reproduce an older hierarchy, but also to juxtapose multiple sub-sections of that hierarchy to give it more definition. From the 22 groups (Brahman (Basti), Brahman (other), Agharia, Chattri, Muslim, Bhatu, Habru, Bhil, Dom, Ahir, Kurmi, Other artisan, Kahar, Tharu, Chamar, Chero, Majhi, Panika, Kharwar, Oraon, Rajwar, Korwa), the Survey created 3 clusters: A 'Tribal' (T) cluster, an Artisan (A) cluster (in which 'untouchable' communities were placed towards the T group), and Brahman group (B). The T group was found to be 'sharply contrasted' from the B group. In the A group, Ahirs were somewhat closer to the B group than Chamars, who were closer to T.

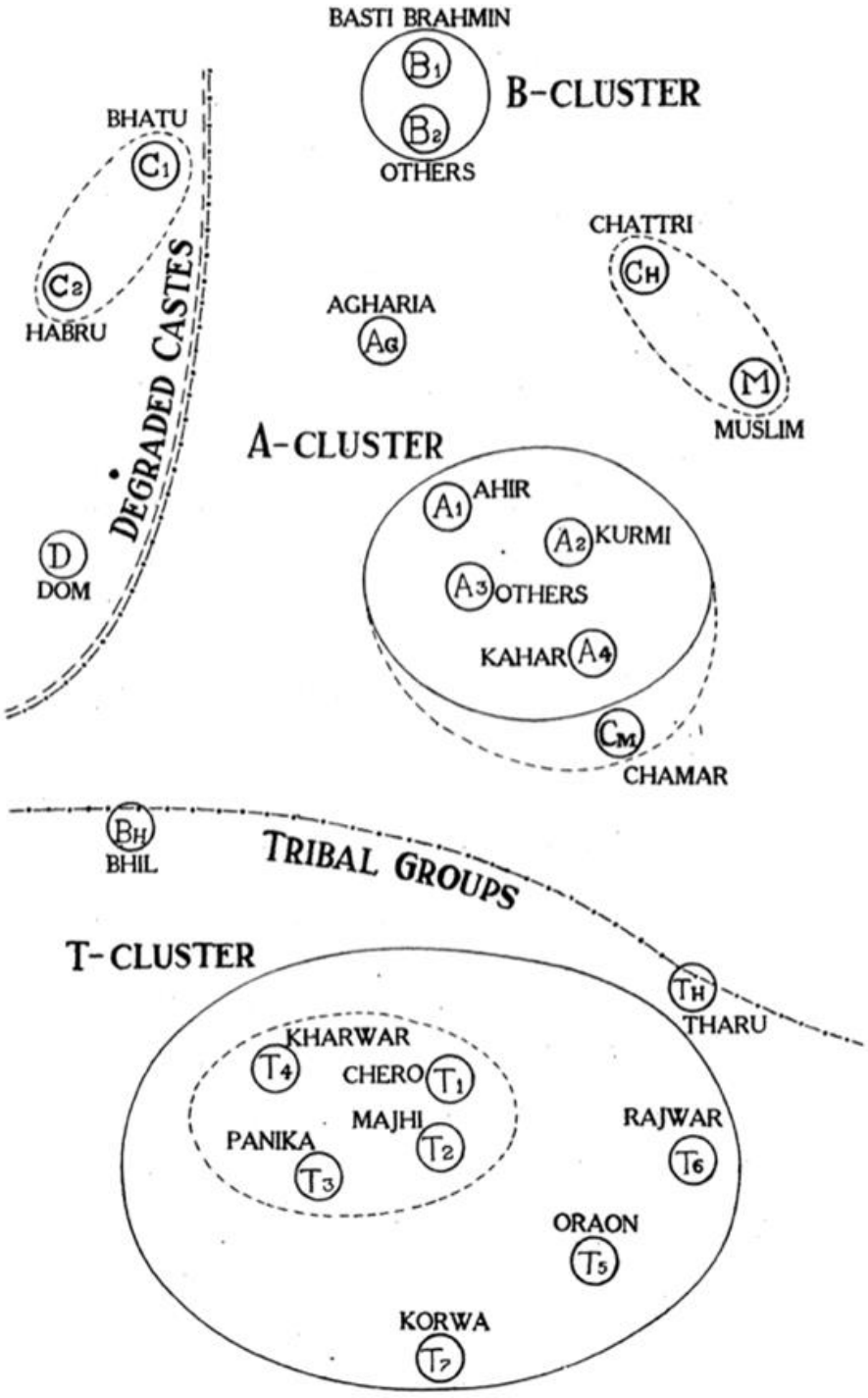

Chart 8(b). Distribution of castes and tribes indicating physical differences in relation to the ethnological classification

In presenting the data, tables and diagrams for specific castes were mostly presented in pairs, again suggesting a pre-existing juxtaposition by hierarchy which was now further reinscribed with hard statistical data. For example, Doms and Bhils were aligned, and the two 'Criminal Tribes' – Bhatu and Habru likewise, enabling them to be grouped together as 'degraded castes'. Because the tribal groups were shown 'to resemble one another apart from in nasal characteristics' it was suggested that they could therefore be classified on the basis of nasal characteristics.

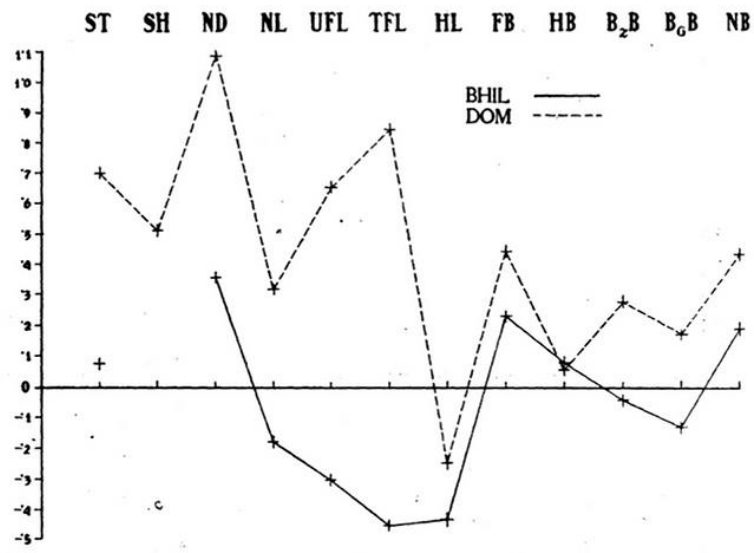

Chart 9.7 A comparative study of Bhil and Dom.

All's Well that Ends Well

Overall, the statistical conclusions not only re-affirmed but fine-tuned to a great extent, what the authors suspected or knew all along. Further, the relative 'distancing' of groups by physical characteristics set up new forms of evidence for hierarchising communities by caste. There was one exception in the research. Both of the 'Criminal Tribe' communities measured, showed a closeness to the B group in their D2 value that surprised the authors. But Majumdar and Mahalanobis pointed out that these 'fineness of features' was also what allowed them to 'move freely among high castes', an aspect of their nomadic existence and suspicious occupational *modus operandi.* (Mahalanobis, 1949: 191).

The final section of the survey explored ethnological and historical accounts of the communities. The authors compared their results to existing ethnological accounts which explored the deeper 'racial' histories of each community, Dravidian, and Austric families of languages, and degrees of autochthony or geographical 'nativeness'. Much of this section was drawn from an array of older British-led ethnographic studies, the focus of which had been the question of 'racial origins'. A repeated refrain of this section was the question of how far the new data analysis had any bearing upon older familiar questions: Had there been 'intermixture in historical times'? Had one community or another constituted an 'original tribe'? Could x community be considered a 'mixture of Vedic people with Tribal groups'? Surprisingly, the Survey's authors did not attempt to relate the data to more recent sociological research, detailed work on contemporary social practices, marriage customs, or the environmental circumstances of the subjects. Many of these considerations, arguably, might have diverted the authors from their dogged and persistent focus on the dynamic of caste alone.