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Comparison of Modern Statistical Errors and Indigenous Errors

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Abstract: ***For ages, the reliability and interpretation of data have been influenced by statistical errors, both ancient and contemporary. Indigenous systems, especially those from ancient India, provide distinctive methods of knowledge and measurement, whereas modern statistical procedures are based on formal methodologies. This study contrasts the epistemic and observational errors present in ancient Indian systems with the type of errors in contemporary statistics, with a particular emphasis on sampling and non-sampling errors. This paper aims comparative study between modern and ancient Indian error systems.***

Keywords: Statistical Errors, Vedic Literature, Indigenous Errors

1. Introduction: Meaning of Statistical Errors

Statistical errors refer to inaccuracies or deviations from the true value or representation of data. These errors can occur from faulty methods of data collection, inherent variability in populations, or misinterpretation of outcomes. In modern statistics, errors are broadly classified into sampling errors, which arise from the process of selecting a subset of the population, and non-sampling errors, which encompass a wide range of inaccuracies not related to sample selection, such as data entry mistakes, non-responses, or biased questionnaires.

However, even though the ancient Indian knowledge system is not classified as statistical, it does have certain "error measurements" in terms of estimating, sampling, and observational accuracy. A deeper understanding of how error cognition has changed over time can be gained by placing them in their philosophical and historical settings.

2. Modern Statistical Errors

Modern statistics, rooted in probability theory and rigorous methodology, recognizes two broad categories of error:

2.1 Sampling Errors

Sampling errors occur when a sample does not perfectly represent the population from which it is drawn. Even when sampling is random and unbiased, natural variability leads to discrepancies between the sample statistic and the population parameter. These errors can be quantified using measures such as the standard error and confidence intervals.

2.2 Non-Sampling Errors

These are all errors that are not related to the act of sampling but can have an equal or greater effect on the validity of results. Key types include:

2.2.1 Measurement Error: Inaccuracies due to flawed measurement tools or subjective judgment.

2.2.2 Non-response Error: Arising when certain members of the sampled population do not respond.

2.2.3 Processing Error: Mistakes in data entry, coding, or tabulation.

2.2.4 Coverage Error: When the sample frame does not adequately cover the entire population.
Non-sampling errors are often more difficult to detect and correct and can lead to systematic bias in statistical conclusions.

3. Errors in the Ancient Indian Knowledge System

Ancient Indian scholarly traditions, including those in mathematics, astronomy, medicine (Āyurveda), and logic (Nyāya), developed sophisticated methods of measurement, inference, and classification. Although these systems did not explicitly define "statistical errors" in contemporary terms, several types of inaccuracies and cognitive missteps are identifiable and were dealt with.

In the Upanishads the Human existence at five levels as Physical body (Annamaya Kosh), life force (Pranamyaya kosh), Mental Sheath (Manomaya Kosh), Intellectual Sheath (Vijnanamaya kosh) and Bliss Sheath (Anandamaya kosh) the keen study of human behaviour at these five levels paves the way for better psychological models and also to model the ongoing errors.

3.1 Observational and Instrumental Errors

Texts such as the Sūrya Siddhānta acknowledge the limitations of astronomical observations, noting discrepancies due to time, place, and instrument. Ancient astronomers attempted to correct these through interpolation and empirical adjustments.

3.2 Epistemic and Logical Errors (Pramāṇa and Viparyaya)

In the Indian epistemological tradition, particularly the Nyāya school, valid knowledge (pramāṇa) arises from correct use of perception, inference, comparison, and testimony. Errors—viparyaya—arise from misuse or misinterpretation of these sources.

Examples include:

3.2.1 Pratyakṣa-bhrānti (illusion in perception): Such as mistaking a rope for a snake.

3.2.2 Asiddhi (Fallacy of Non-Establishment in Inference)
Nature: Logical fallacy where the reason or middle term is not established.
Example: "The mountain has fire because it has smoke," but the smoke is not established as existing on the mountain.
Explanation: The middle term (hetu) does not apply to the subject (pakṣa).

3.2.3 Viruddha (Contradictory Inference)
Nature: The inference contradicts established knowledge or logic.
Example: "Sound is eternal because it is produced," contradicts the idea that anything produced is non-eternal.
Explanation: The reasoning leads to a contradiction.

3.2.4 Satpratipakṣa (Counterbalanced Reason)
Nature: When an opposing reason of equal strength nullifies the argument.
Example: "The soul is all-pervading because it is intangible," vs. "The soul is not all-pervading because it is conscious."
Explanation: Two opposing inferences cancel each other out.

3.2.5 Śabda-Bhrama (Error from Verbal Testimony)
Nature: Misunderstanding or misinterpretation of authoritative or scriptural statements.
Example: Interpreting a metaphorical statement literally.
Explanation: Errors due to language ambiguity, lack of context, or improper comprehension.

These "errors" were recognized as critical threats to sound reasoning and were systematically categorized and debated in ancient philosophical texts.

3.3 Approximation and Estimation Errors

Mathematicians like Āryabhaṭa and Bhāskara II often used approximations (e.g., value of π), recognizing their limitations. These were practical approximations, accepted within tolerable limits, and occasionally corrected by later scholars.

4. Comparative Analysis: Modern and Indigenous Errors

Table 1: Indigenous and Modern Statistical Errors

Aspect	Modern Statistical Error	Indigenous Errors
Classification	Sampling vs. non-sampling	Epistemic (pramāṇa/viparyaya), observational
Origin of Error	Methodological, procedural, human error	Cognitive, perceptual, philosophical
Handling Errors	Statistical correction, robustness techniques	Logical analysis, debate, empirical correction
Formalization	Quantified with formulas, confidence levels	Descriptive, categorized in logic and philosophy
Correction Methods	Weighting, imputation, error bounds	Disputation, refinement by successive scholars

Modern statistical errors are largely technical and probabilistic in nature, addressed with mathematical models and computational techniques. In contrast, errors in ancient Indian systems were more epistemic and philosophical, addressed through dialectics, rational analysis, and refinement across generations. Despite the differences in framework, both systems demonstrate an acute awareness of uncertainty and the need for error mitigation.

5. Conclusion

The study of statistical and indigenous errors reveals both convergences and divergences in how humans have sought to understand and mitigate uncertainty. Modern statistical methodology offers formal precision, while the ancient Indian system provides a rich cognitive and philosophical foundation. Recognizing these traditions as complementary rather than mutually exclusive can enhance cross-cultural scholarship and inform a more holistic approach to error management in contemporary research.

References

[1] Cochran, W. G. (1977). Sampling Techniques (3rd ed.). John Wiley & Sons.
[2] Kish, L. (1965). Survey Sampling. Wiley.
[3] Pingree, D. (1978). The Mesopotamian origin of early Indian mathematical astronomy. Journal of Near Eastern Studies, 33(4), 321–330.
[4] Sarma, K. V. (1997). A History of the Kerala School of Hindu Astronomy (In Perspective). Vishveshvaranand Institute.
[5] Matilal, B. K. (1990). The Word and the World: India's Contribution to the Study of Language. Oxford University Press.
[6] Bhattacharyya, D. (2002). Studies in Indian Logic and Epistemology. Indian Council of Philosophical Research.
[7] Āryabhaṭa. (499 CE). Āryabhaṭīya.
[8] Bhāskara II. (1150 CE). Līlāvatī.