Bibby's Dilemma – a case of the Stigler fallacy How many children are in a family?

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Stigler's Law of Eponyms is well-known – that no discovery is named after its original discoverer. So Hubble's Law was not discovered by Hubble, Pythagoras's Theorem was not discovered by Pythagoras, and Stigler's Law was not discovered by Stigler.

Bibby's dilemma may be a further case in point. I've been vaguely aware of it but have only just articulated it. Where has it appeared before? What should it be called? is it important? Please let me know! I came across this while looking at the 1851 census in York, where the number of children in a household is discussed. How many children are there in a household, on average?

This seems to be a simple question but it has with different meanings which yield different answers depending upon which perspective you take. There are at least three different perspectives, which I shall call "the Household perspective", "the Household with Children perspective", and "the Children perspective".

In the York 1851 census, the number of children in a household (based on a 10% sample) varies from zero (in 34% of households) to "7 and over" (in 9.4%). But the dilemma is clearest with a simpler example.

Consider a population of 30 households: 10 have no children; 10 have one child; and 10 have 2 children i.e. 30 children in all. How many children are there in a household on average? I hold that the answer can be 1, or 1.5, or 1.67 depending on your point of view.

From the Household perspective we have 30 households and a total of 30 children. The average is 1.

From the Household with Children perspective we ignore households which have no children. This leaves 20 households with 30 children. The average is 1.5.

From the Children perspective we note that 10 children come from households with 1 child, and 20 come from households with 2 children. So the average from their point of view is (10x1)+(20x2) or 50/30 = 1.67.

My dilemma is: Is one of these averages more valid than the others? How should we distinguish between them? Does a similar dilemma come up in other places? Is choosing between these averages what we mean by "social production of statistics"? Is it a true dilemma, or is it just arithmetic?

The same dilemma exists in amplified form if we consider dispersion and higher moments.

In the York 1851 example, the three different perspectives gave means of 2.5, 3.7, and 4.7 children per household respectively. (Here there was the added complication of how to deal with "7 or more" children. I dealt with this in a cowardly manner , simply by assuming that each of these had 8 children. Undoubtedly wrong, and very wrong indeed if we are interested in dispersion and the tail.

But which to use, and how best to distinguish between them?

POST-SCRIPT: Since writing the above I have been in touch with Stephen Stigler who admonished me because "One of the lessons of Stigler's Law is that you cannot spread the name yourself" (I plead guilty). He also reminded me of "an error of Galton's: In studying famous scientists he came to the conclusion that devoting yourself to science diminished your fertility. He got there by comparing the average number of children the scientists had to the average number of children in the family they came from. Of course none came from a family with no children." So "Bibby's Dilemma" could be renamed "Galton's Error". Perhaps Galton was prompted to the fear of declining fertility by his own situation as the youngest of seven with no children of his own. So maybe he felt the need for a son. This could explain his strong relationship with Karl Pearson, whose inadequate father was born in the same year as Galton. (The reference is to pp. 36-37 of Galton's (1874) English Men of Science; this could provide a useful teaching exercise in applications of statistics that require careful thought.)