
Paleodemography and statistics : History uncertainties and a story of uncertainties

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Résumé

If we follow Nietzsche, who stated that certainty is a more dangerous enemy of truth than lies, the search for the historical truth, if any, requires to criticize the methods and carefully analyze their uncertainties: what is the nature of these uncertainties? can they be quantified? can they be reduced? We shall find the tracks of this process in the work of Jean-Pierre Bocquet-Appel, focusing here on the statistical uncertainties (not to exceed my skills) arising when estimating the age at death of an adult from a biological aging indicator. Is it possible to obtain a reliable age at death for such an individual? Is it at least possible to get a reliable estimation of the age structure of a human group? Of the mean age at death? Originally, flagrant errors were raised, for instance in Masset (1971), and emphasized by Bocquet-Appel and Masset (1982) who specified the statistical rather than biological nature of these errors. Once these errors were avoided, many problems still remained due to the parsimony of the site data (and their consequent sampling variability), and the rather poor correlation between biological and chronological ages (regardless of the age indicator). Thus, the first solutions to estimate the age structure led to disappointing results. They consisted most often in maximum likelihood estimation within a frequentist approach. A decisive step to improve the method was made by Jean-Pierre Bocquet-Appel et Jean-Noël Bacro (2007) who introduced demographic information: the age structure of a human group corresponds to some mortality law, which means that the distribution of ages cannot be "anything." This contribution resulted in the algorithm "Iterage." This statistical approach, resting on the use of a prior information, was basically a Bayesian method,

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later formalized slightly differently by Caussinus and Courgeau (2010) by clearly integrating the different kinds of uncertainty (reference and site data), and by improving prior information on the estimated age structure (Caussinus, Buchet, Courgeau, Séguy, 2017). Several examples of the various proposed statistical solutions will be presented to demonstrate how the statistical uncertainty can be controlled and, to some extent, reduced. However, we must keep in mind that these methods have to be considered very cautiously as they remain subject to a large number of various uncertainties but, hopefully, with a better understanding of how and why.