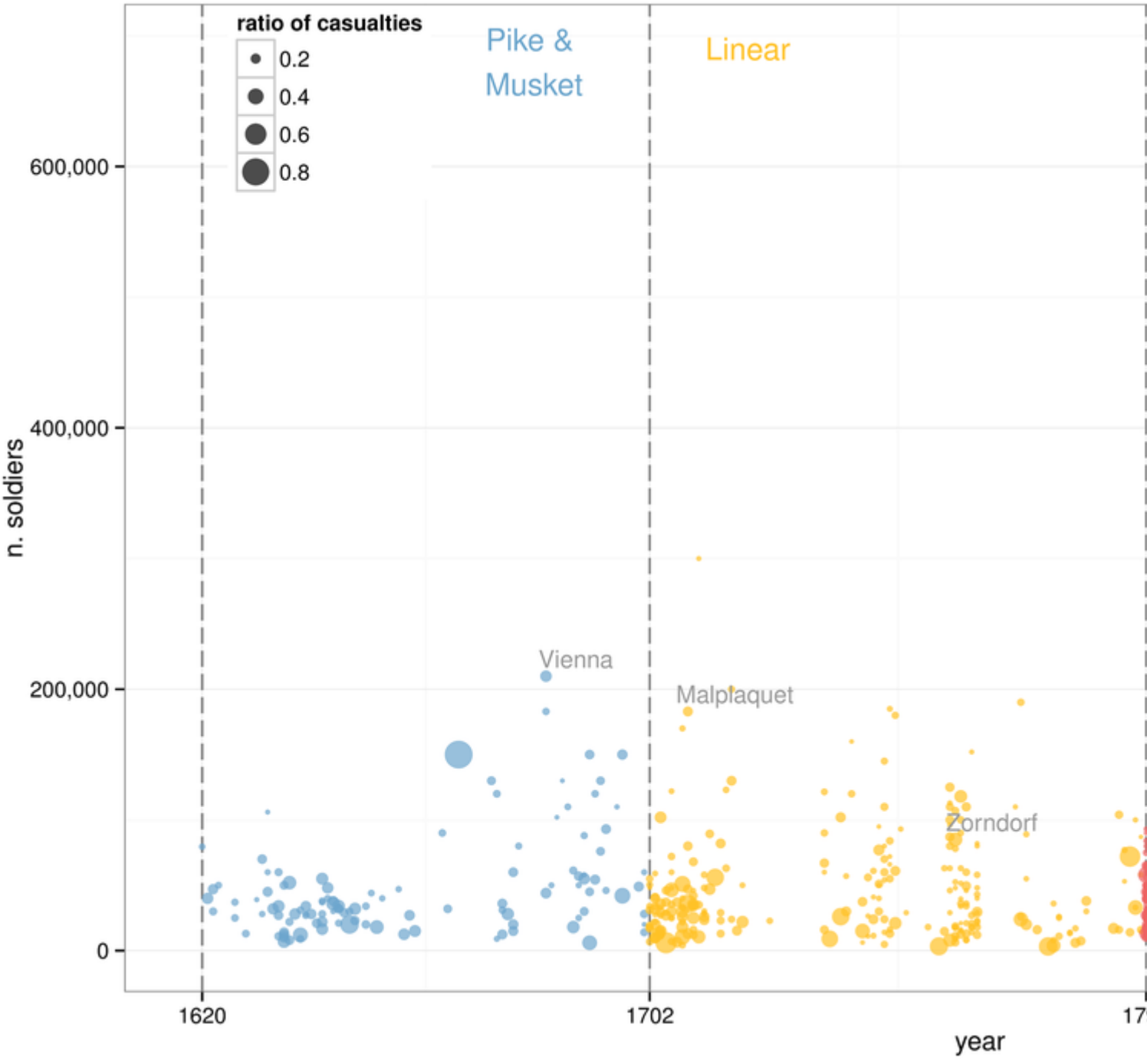
Model Selection in Historical Research Using Approximate Bayesian Computation



The well-known publication Plos One has recently published the paper titled *Model Selection in Historical Research Using Approximate Bayesian Computation*. This paper, whose author is the BSC researcher Xavier Rubio-Campillo, shows how computer simulations can improve our understanding of historical dynamics. In

this case the method is used to improve our knowledge on the evolution of warfare over 300 years. This research has been undertaken in the context of the ERC Advanced Grant EPNET, of which BSC is a partner.

Paper abstract: Computational models are increasingly being used to study historical dynamics. This new trend, which could be named Model-Based History, makes use of recently published datasets and innovative quantitative methods to improve our understanding of past societies based on their written sources. The extensive use of formal models allows historians to re-evaluate hypotheses formulated decades ago and still subject to debate due to the lack of an adequate quantitative framework. The initiative has the potential to transform the discipline if it solves the challenges posed by the study of historical dynamics. These difficulties are based on the complexities of modelling social interaction, and the methodological issues raised by the evaluation of formal models against data with low sample size, high variance and strong fragmentation.
This work examines an alternate approach to this evaluation based on a Bayesian-inspired model selection method. The validity of the classical Lanchester's laws of combat is examined against a dataset comprising over a thousand battles spanning 300 years. Four variations of the basic equations are discussed, including the three most common formulations (linear, squared, and logarithmic) and a new variant introducing fatigue. Approximate Bayesian Computation is then used to infer both parameter values and model selection via Bayes Factors.
Results indicate decisive evidence favouring the new fatigue model. The interpretation of both parameter estimations and model selection provides new insights into the factors guiding the evolution of warfare. At a methodological level, the case study shows how model selection methods can be used to guide historical research through the comparison between existing hypotheses and empirical evidence.

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