On the Connection Between the q-Exponential Probability Distributions and the S_q Entropy

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The q-exponential probability distributions, which optimize the S_q entropy under appropriate constraints, are ubiquitous; they are even discernible in early works by the founding fathers of statistical mechanics. Some authors have argued that, in order to obtain the q-distributions via an entropic variational principle, it suffices to use the standard logarithmic entropy, and, therefore, it is unnecessary to introduce a new entropic measure. Arguments of this sort have been appearing recurrently in the literature; it seems timely to re-consider them. We analyze the merits and deficiencies of the arguments and conclude that, once an entropic variational principle is invoked, the S_q entropy does provide the most elegant, fruitful, and illuminating way of interpreting the q-exponential distributions in terms of entropy optimization.