Cardinal likelihoods: A joint derivation of
the logarithmic and linear likelihood functions

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Abstract: A likelihood function is a real-valued function on the set of events of the sample space representing the likelihood of the occurrence of the events, and the logarithmic and linear (positive affine) likelihood functions are given by the logarithmic and linear transformations of a probability measure on the events, respectively. By specifying a statistician's subjective likelihood of the events using a difference comparison relation, this paper provides some axioms for the relations that are represented cardinally by the two likelihood functions, the probability measures of which coincide with the unique subjective (conditional) probability measure determined by the relation. This result shows that the difference in axiomatizations for the likelihood functions is the only difference in the Lucian independence axioms, (i.e., difference in the definition of irrelevant events for the relations).