Abstract: Through completing an underspecified probability model, Maximum Entropy (MaxEnt) supports non-monotonic inferences. Some major aspects of how this is done by MaxEnt can be understood from the background of two principles of rational decision: the concept of Indifference and the concept of Independence. In a formal specification MaxEnt can be viewed as (conservative) extension of these principles; so these principles shed light on the 'magical' decisions of MaxEnt. But the other direction is true as well: Since MaxEnt is a 'correct' representation of the set of models (Concentration Theorem), it elucidates these two principles (e.g. it can be shown, that the knowledge of independences can be of very different information-theoretic value). These principles and their calculi are not just arbitrary ideas: When extended to work with qualitative constraints which are modelled by probability intervals, each calculus can be successfully applied to V. Lifschitz's Benchmarks of Non-Monotonic Reasoning and is able to infer some instances of them. Since MaxEnt is strictly stronger than the combination of the two principles, it yields a powerful tool for decisions in situations of incomplete knowledge. To give an example, a well-known problem of statistical inference (Simpson's Paradox) will serve as an illustration throughout the paper.

Stichworte: Indifference; Independence; Maximum Entropy; Non-Monotonic Reasoning; Probabilistic Reasoning; Default Reasoning; Undirected Graphs;
Decisions under Incomplete Knowledge; Simpson's Paradox

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