

Information Theory and Partial Belief Reasoning

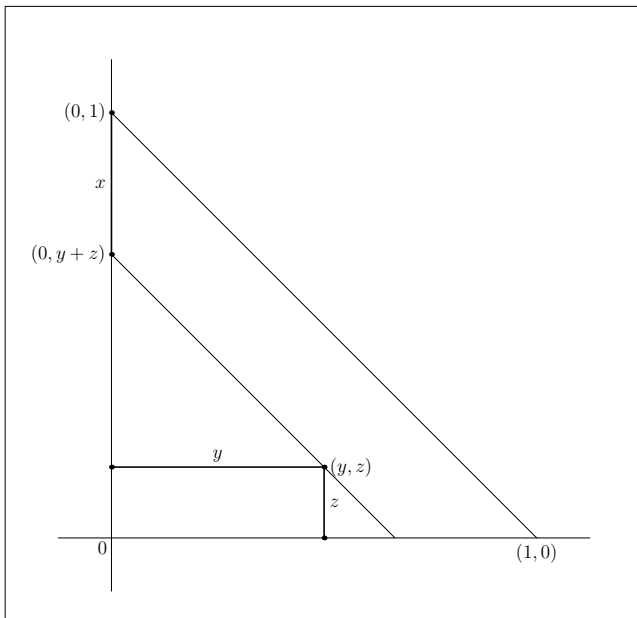
Final Oral Defence, University of British Columbia

Stefan Lukits

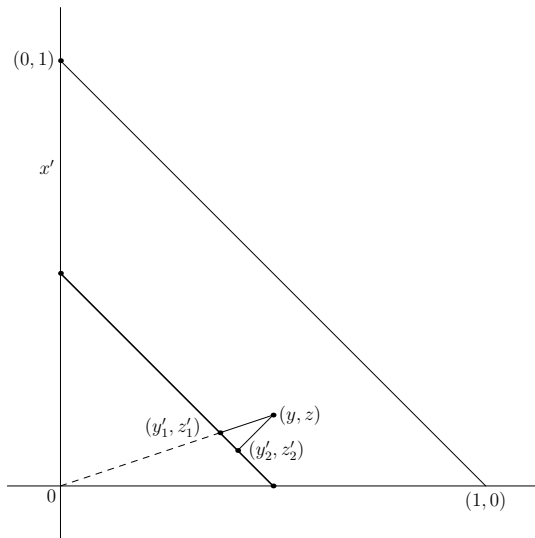
May 16, 2016

- *Sharp Credences*: The partial beliefs that a rational agent entertains are formally expressed by sharp credences.
- *Information Theory*: When a rational agent updates these partial beliefs in the light of new evidence, the norms used are based on and in agreement with information theory.

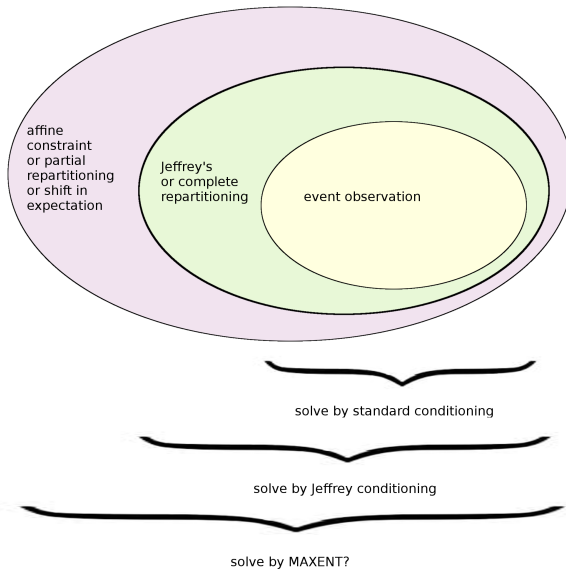
Norms of Rationality and Logical Consistency I



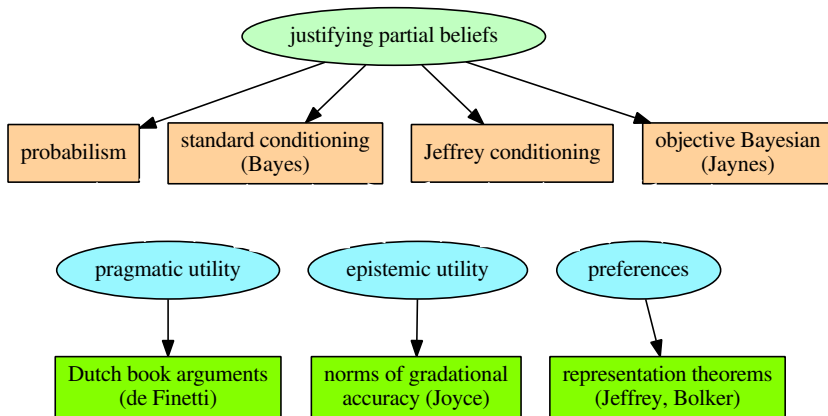
Norms of Rationality and Logical Consistency II



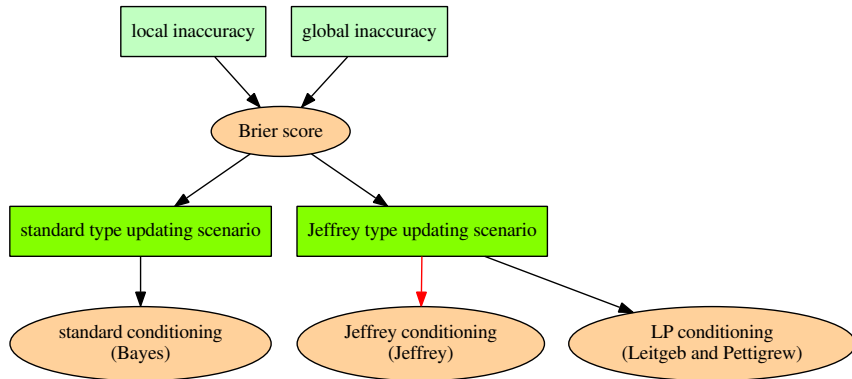
Affine Constraints



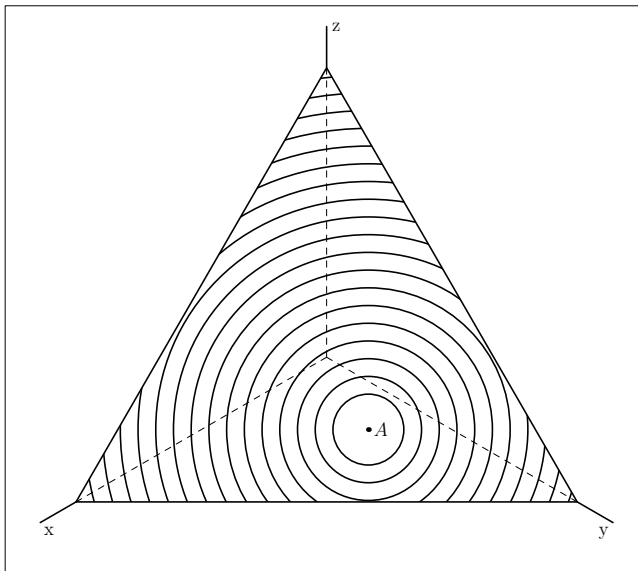
Asymmetry and the Geometry of Reason I



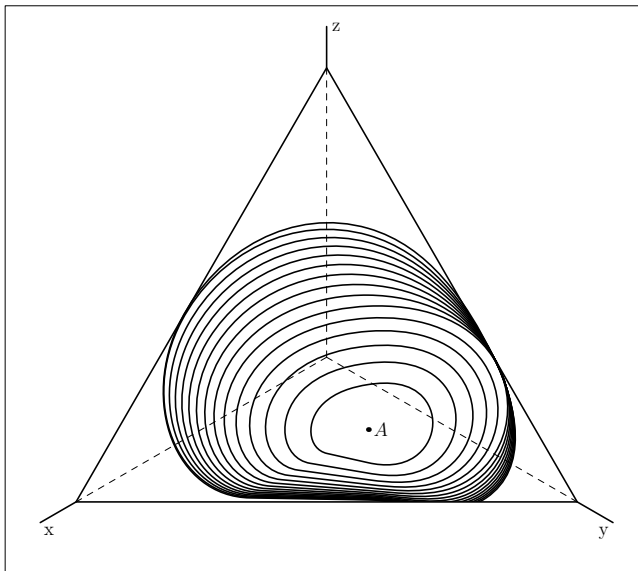
Asymmetry and the Geometry of Reason II



Geometry of Reason Contour Lines



Information Theory Contour Lines



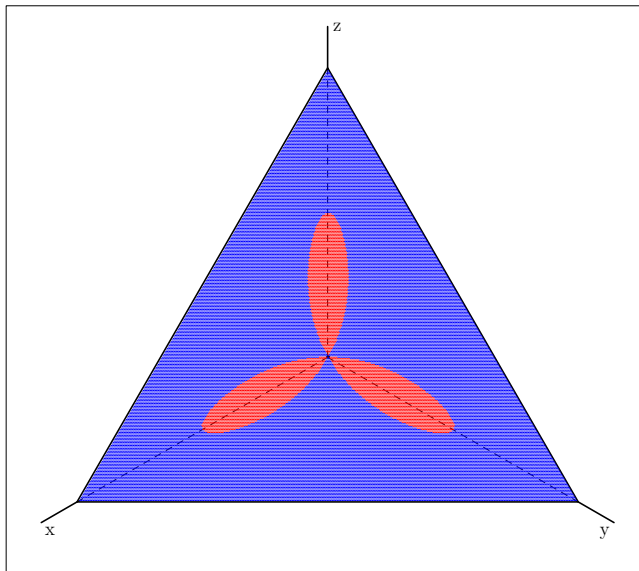
Expectations for the Geometry of Reason

- CONTINUITY An amujus ought to be continuous with standard conditioning as a limiting case.
- REGULARITY An amujus ought not to assign a posterior probability of 0 to an event which has a positive prior probability and about which the intervening evidence says nothing except that a strictly weaker event has a positive posterior probability.
- LEVINSTEIN An amujus ought not to give “extremely unattractive” results in a Levinstein scenario
- INVARIANCE An amujus ought to be partition invariant.
- EXPANSIBILITY An amujus ought to be insensitive to an expansion of the event space by zero-probability events.
- HORIZON An amujus ought to exhibit the horizon effect.
- CONFIRMATION An amujus ought to align with intuitions we have about degrees of confirmation.

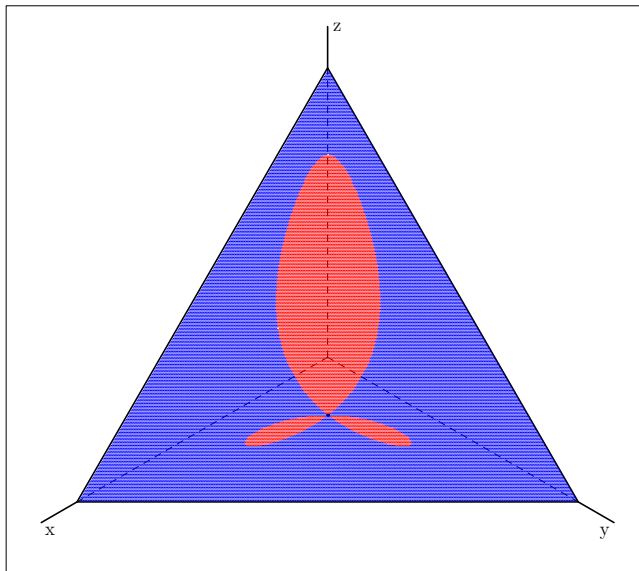
Expectations for Information Theory

- **TRIANGULARITY** The difference measure obeys the triangle inequality. If there is an intermediate probability distribution, it will not make the difference smaller.
- **COLLINEAR HORIZON** This expectation is just a more technical restatement of the **HORIZON** expectation in the previous list.
- **TRANSITIVITY OF ASYMMETRY** An ordered pair of probability distributions is asymmetrically negative, positive, or balanced with respect to the difference measure used. If (p, q) and (q, r) are asymmetrically positive, (p, r) ought not to be asymmetrically negative.

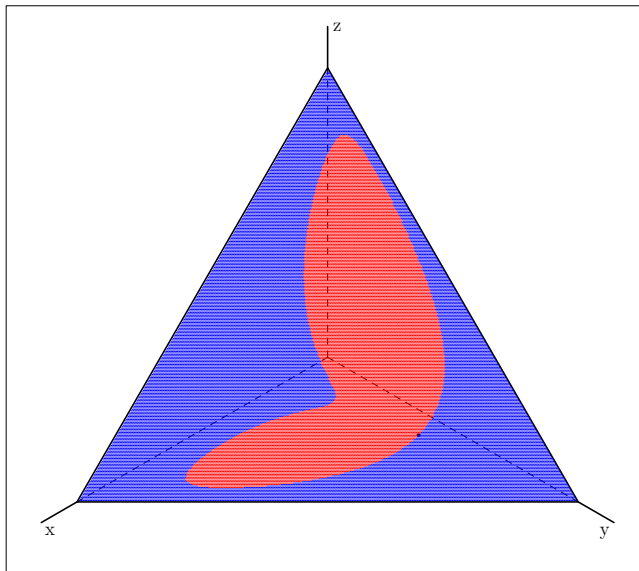
Asymmetry of Information Theory



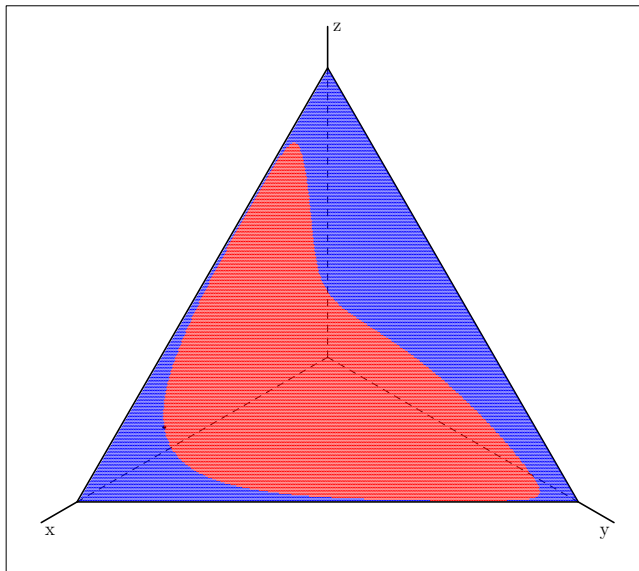
Asymmetry of Information Theory



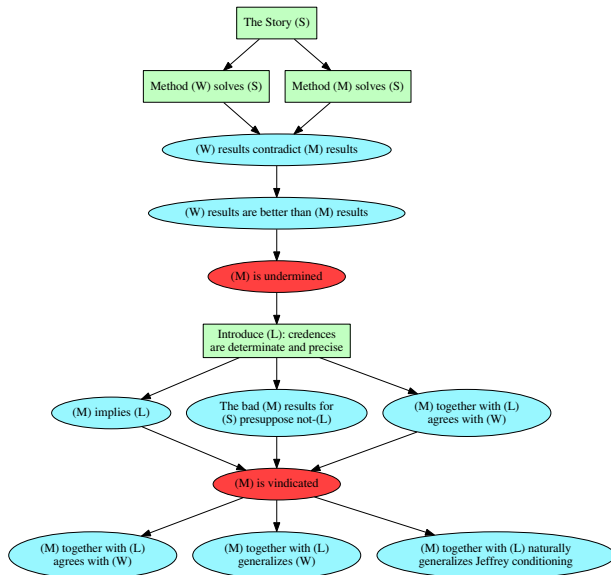
Asymmetry of Information Theory



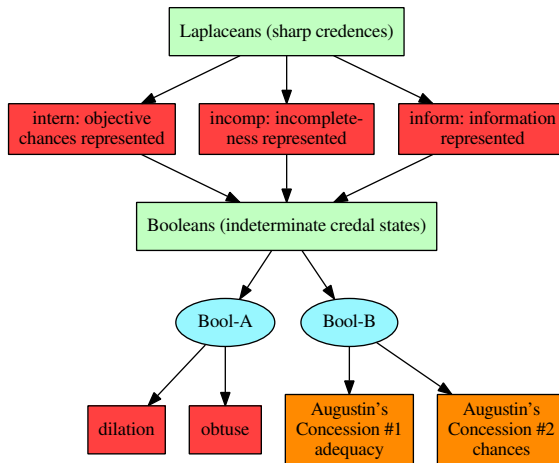
Asymmetry of Information Theory

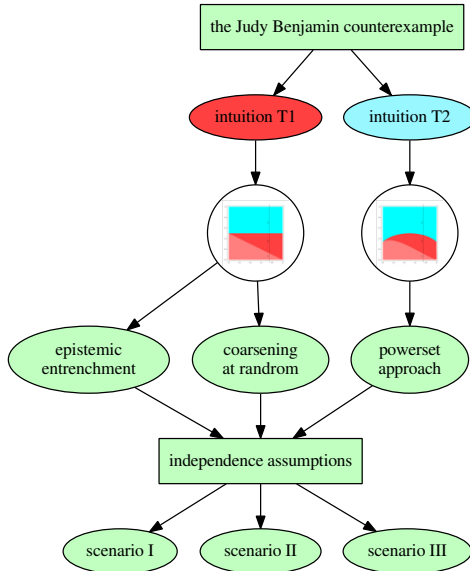


A Natural Generalization of Jeffrey Conditioning

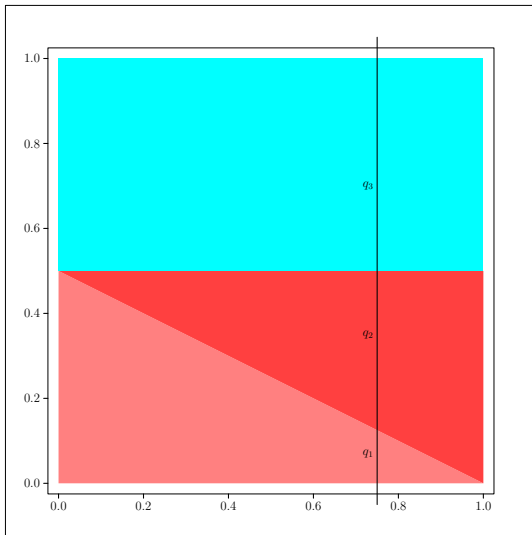


A Problem for Indeterminate Credal States

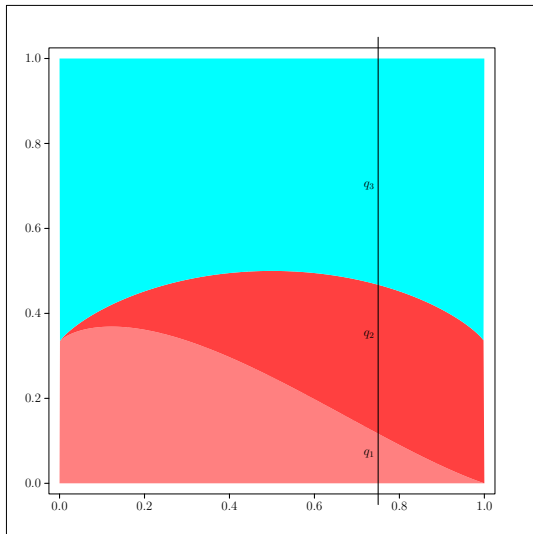




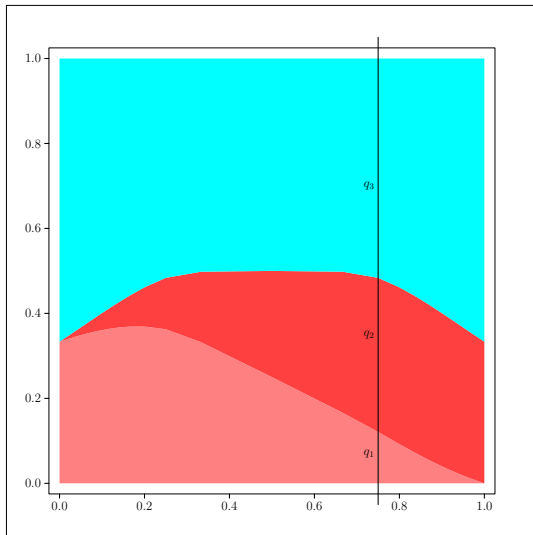
Judy Benjamin: Independence



Judy Benjamin: Information Theory



Judy Benjamin: Powerset Approach



End of Presentation

Thank you for your attention.