

THE BENASQUE QUESTIONS (June 2013)

- Is causality fundamental or emergent?
- Are there principles that constrain any general theory of causal processes?
- Are there principles that constrain any general theory of inference?
- Are there constraints on correlations that can be derived solely from assumptions about causal structure and general principles of inference?
 - Example 1: inequalities on strength of correlations
 - Example 2: if A is d-separated from B given C in the DAG, then A is independent of B given C
- Can we find a generalization of the no-signalling principle in hidden Markov models?
- What does local orthogonality imply? Is there a deeper principle that implies it?
- Can we formulate quantum theory as a theory of inference?
- Is there a formalism that overcomes the limitations of Directed Acyclic Graphs? In particular, one that has more time-symmetry?
- How are the various proposed frameworks for describing causal structure in quantum theory related to one another?
- Can we obtain a finite causal de Finetti theorem?
- Can we obtain a quantum causal de Finetti theorem?
- Can we find a quantum theory of counterfactuals?
- Can causally nonseparable process matrices be understood as superpositions of causal process matrices?
- Is there a notion of event that does not occur at a definite time?
- Is there a theory of the measurement process in generalized probabilistic theories? Can we classify all generalized probabilistic theories that have a movable von Neumann cut?
- Is there a theory of the measurement process in QFT?
- Can we construct nonquantum state spaces where the manifold of pure states is that of quantum theory?
- Can we construct foil theories to decoherent histories?
- Is there a categorical distinction between dynamics and inference?
- Is quantum probability theory a generalization or a restriction of classical probability theory?
- What is the underlying ontology of the universe?