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Jeff Grover

**Strategic Economic
Decision-Making
Using Bayesian
Belief Networks
to Solve Complex
Problems**



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Strategic Economic Decision-Making

Using Bayesian Belief Networks
to Solve Complex Problems

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Sergeant First Class Charles V. Lang, IV
(U.S. Army, Retired)
“Friend”

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Chapter 1

An Introduction to Bayes' Theorem and Bayesian Belief Networks (BBN)

1.1 Introduction to Bayes' Theorem and BBN

Determining future states of nature based on complex streams of asymmetric information is increasing comes at a premium cost for today's organizations across a global economy. Strategic leaders at all levels face uncanny events where information feeds at near real-time require decision-making based on the interactive effects of this information and across all spectrums of operations, to include the militaries, governments, corporations, and the scientific communities. The dominate information that has historically been absent here is subjective in nature and flows directly from the innate knowledge of leaders and subject matter experts (SME) of these organizations. With the use of inductive reasoning, we can integrate this truth and have a more plausible future expectation based on the decisions these leaders make today when we filter it through the lens of Bayes' theorem. This is done by formulating a hypothesis (a cause) of the proportional relationships one believes that exists and then filtering this knowledge through observable information (the effect(s)) to revise the initial beliefs.

There is a gradual acceptance by the scientific community of traditionalists (frequentists) for the Bayesian methodology. This is not through any new theoretical revelation, but through the sheer momentum of its current utility in scientific discovery. It possesses the uncanny ability to allow researchers to seamlessly transition from the traditional cause and effect to the effect and cause scenario using inductive logic or plausible reasoning.¹ This precipice is possible, in part, through the use of subjective (prior) beliefs where researchers obtain knowledge, either through historical information or subject matter expertise, when attempting

¹ E. T. Jaynes, in his book, "*Probability Theory: The Logic of Science*" (Jaynes 1995) suggests the concept of plausible reasoning is a limited form of deductive logic and "The theory of plausible reasoning" . . . "is not a weakened form of logic; it is an extension of logic with new content not present at all in conventional deductive logic" (p. 8).