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Factors that Affect the Optimal Amount of Central Control in Complex Systems

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Please note the nonstandard time and room.

Complex systems are systems whose behavior results from highly nonlinear interactions among their constituent components, referred to here as *agents*. These systems are often multi-leveled and evolving over time by adapting to their environment through feedback mechanisms. Examples include human and animal societies, business organizations, the military, and the internet. While there is a significant amount of work dealing with self-organization—and its associated emergent properties—this talk focuses on central organization. Specifically, four factors are conjectured to be key in determining the optimal amount of central control. To validate this hypothesis, these factors are represented as controllable parameters in a mathematical model. For different combinations of parameter values, the optimal amount of central control is found, either analytically or by computer simulation. The model is shown to provide results that match well with the level of control found across a broad spectrum of specific complex systems. This model also provides general guidelines as to when various combinations of these factors suggest that low, moderate, or high levels of control are desirable. The results indicate that all of these factors, though not exhaustive, should be considered carefully when attempting to determine the amount of control that is best for a system.

Daniel Solow was born in Washington, D.C. at a very young age. He soon learned that Danny was his name and mathematics was his game. He received a B.S. in Mathematics from Carnegie-Mellon University; an M.S. in Operations Research from the University of California at Berkeley; and a Ph.D. in Operations Research from Stanford University. He has been a professor at Case Western Reserve University since 1978. His original research interests are in discrete, linear, and nonlinear optimization. He now uses these tools together with mathematical modeling, analysis and computer simulations to derive insights and results that are applicable to broad classes of complex systems and to specific complex systems of human interaction. He has also developed systematic methods for teaching mathematical proofs and reasoning, computer programming, and operations research.

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