

# A Classical Uncertainty Principle for Organizations

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## INTRODUCTION

After this article introduction, we review the prevailing theory of organizations, and what it means to organizational science and the new discipline of Quantum Interaction to have an uncertainty principle ([ir.dcs.gla.ac.uk/qi2008](http://ir.dcs.gla.ac.uk/qi2008); the corresponding author is one of the organizers). Further into the background, we review control theory for organizations and its importance to machine and human agents; we review the hypothesis for the uncertainty principle; and we review the status of the field and laboratory evidence so far collected to establish the uncertainty principle for organizations. Then we review future trends and provide the conclusion.

## BACKGROUND

At the first Quantum Interaction conference, held at Stanford University in the spring of 2007, a panel addressed whether QI was relegated to being a metaphor or whether it could function as a working model that could be applied in an agent-based model to solve social problems like organizational decision making. Of the 24 papers presented at this inaugural conference, few put forth a working model with sufficient details to be falsified. We accept the challenge by proposing in this review a path forward to a working model.

Rieffel (2007) suggested that few advantages accrue from claiming that the quantum model is applicable to the social interaction when it is not, and few disadvantages from applying an uncertainty principle to demonstrate classical tradeoffs, as in the case of signal detection theory, or to demonstrate nonseparability when the tensor calculus fails

to hold. In response, the model should lay the groundwork to demonstrate classical effects of the uncertainty principle for organizations.

As an example from common experience, movie entrepreneurs manipulate individuals en masse with entertainment exchanged for payment, as in the joint viewing of a Clint Eastwood movie where individual brains have been found to “tick collectively” (Hasson, Nir, Levy, Fuhrmann, & Malach, 2004). For organizational tradeoffs, the uncertainty principle means that under interdependence, the probability of applying sufficient attention to a plan or to execute it shifts uncertainty in an opposing direction, and vice versa, *iff* the state of interdependence continues (Note: the symbol *iff* means “if and only if”).

The interdependent tradeoffs to control a system requires channels that enhance the ability of management to diminish the destructive interference from inside or outside of an organization. It means that tradeoffs form cross-sections that reflect defensive and offensive maneuvers to expand or limit the size of an organization. Tradeoffs mean that as perspectives shift, what is observed to change in an organization also shifts (Weick & Quinn, 1999); that illusions are fundamental to organizational hierarchies (Pfeffer & Fong, 2005) by driving or dampening feedback oscillations (Lawless, Whitton, & Poppeliers, 2008); and that tradeoffs explain why criteria for organizational performance has been intractable (Kohli & Hoadley, 2006).

We define illusions not as false realities, but as bistable interpretations of the same reality that can only be held simultaneously by neutrals while “true believers” drive neutrals to weigh one and then its opposing reality, for example, an ideology of nuclear waste cleanup or the concrete steps needed for cleanup. Single ideological views are usually

driven by strong-minded agents who we represent as forcing functions,  $f(t)$ , where the valence of each marginal element of fact they present to neutrals is represented by one bit of additional information. Illusions entangle only neutral agents not wedded to either competing view, where the valence of both views is represented by two bits of entangled information. Courting neutrals to decide outcomes moderates the heated debates between opposing drivers; when neutrals abandon the decision process, it becomes volatile and unstable (Kirk, 2003). Tradeoffs can reduce the effect of illusions by decreasing the volatility in organizational performance that produces “gridlock” (Lawless et al., 2008).

We define social influence as a form of social entanglement, which means that entangled elements can be manipulated together (von Bayer, 2004). Per Rieffel, a state  $|\psi\rangle$  is entangled when it cannot be written as the tensor product of single qubit states (p. 139). Here, we define interdependence from social influence as operating across neutral individuals as a superposition of waveforms composed of two or more simultaneous values that linearly combine under constructive interference such as rationalizing similar views into a single world view, or under destructive interference to disambiguate dissimilar views into the best concrete plan. Both interdependence and entanglement are fragile, do not always produce uniform effects, and experience rapid decay; the greater the clarity of an interdependent social situation (observation), the greater the uncertainty in the effect of social influence (action).

Establishing the uncertainty principle for organizational tradeoffs is not only important to move beyond the “quantum” as metaphor, but also because organizational theory has not progressed much beyond Lewin. Lewin himself has been blamed for putting too much attention on individual differences rather than an understanding of groups (Moreland, 2006), which remains elusive (Levine & Moreland, 1998). Instead of blaming Lewin, we attribute the problem to the recondite nature of tradeoffs; the greater the clarity of an interdependent social situation (observation), the greater the uncertainty in the effects from social influence (action).

### MAIN FOCUS OF THE CHAPTER

Tradeoffs are inherent in the interdependence that exists in knowledge *iff* interdependence is nonseparable either at the level of information sources (e.g., the interdependence between static and dynamic visual perception; in Gibson, 1986), interdependent uncertainties, or interdependent contexts for decision-making (e.g., hierarchical framing effects). Organizations exist in states of interdependence (Romanelli & Tushman, 1994), characterized as a whole being different from the sum of its parts (Lewin, 1951).

Two of the goals for organizational science are to increase knowledge and to reflect associated uncertainties. A current

goal of social science is to simulate human cognition. A unique contribution to these goals is to extend human cognitive simulation with a mathematical model of an organization(s) set within a system operating on knowledge interdependent with uncertainty. The ultimate goal is to design the control of a system of future human and artificial agents (in the military, warfighters and mobile machines advanced beyond present sensors, platforms like Predator-Global Hawk, and robots), or mixtures of both, but *iff* they are interdependent deciders operating under uncertainty. The system model can be used to study human organizations making decisions in marginal situations like mergers to address complex tasks under uncertainty. The primary characteristic of this interdependence is reflected in tradeoffs between coordinating social objects communicating to solve problems in states of uncertainty (Lawless & Grayson, 2004).

Mergers seem unlikely as a model because the explanations for mergers are controversial (Andrade & Stafford, 1999). Most researchers believe that mergers are a bad choice for a firm to consider because they often fail (e.g., Daimler merged with Chrysler in 1998 for \$36 billion, only to sell it in 2007 for \$7 billion). But mergers have been found to increase efficiency and market power in response to unexpected market shocks (Andrade, Mitchell, & Stafford, 2001). To protect against shocks, we have found that successful mergers, like SBC’s with AT&T and Bellsouth increase stability (see below).

Mergers exemplify tradeoffs in nonseparable interdependent knowledge. However, mergers form forced cooperative systems that reduce internal and external information, a censorship that stabilizes systems, compared to the disambiguation and volatility under competition so easily observed by outsiders (Lawless & Grayson, 2004).

As an extreme tradeoff, organizations under central, command-driven or authoritarian leadership easily exploit consensus-seeking rules for decision making (Kruglanski, Pierro, Mannetti, & De Grada, 2006). Censorship under dictatorships reduces socio-political volatility in exchange for rigid control (May, 1973). Recent examples of censorship are found in news accounts of Myanmar’s denials of village purges (Bhattacharjee, 2007); China’s imprisonment of journalists; and Russian censorship of TV commentators. Censorship occurs in organizations within democracies, too; but when censored information is released, its volatility often forces attention to address the consequences (e.g., Sen, 2000, concluded that no modern democracy has ever suffered from famine).

Whether cooperation or competition increases social or individual welfare during decision making is the canonical tradeoff. Enforced consensus-seeking actions are predicated on a consensus world view, making knowledge more easily acquired *iff* the courses of action conform to a chosen world view, making them impractical for all actions except simple ones. In contrast, focusing on practical applications

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