Butterfly Theory of Crisis Management

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Synonyms

Chaos theory; Dynamic systems; Non-linear systems;

Introduction

The single flap of a butterfly's wings in Brazil generates a minor atmospheric disturbance continuously expanding to produce a tornado in Texas a month later. This butterfly effect, often attributed to Lorenz (1963), and sometimes called butterfly theory, suggests small events may generate large consequences. Butterfly theory was initially applied to meteorology, but in recent years, the theory has been applied to other fields including mathematics, physics, and economics. This paper applies butterfly theory to matters of crisis management in public administration.

Butterfly Theory

"Does the flap of a butterfly's wings in Brazil set a tornado in Brazil?" was the question posed by meteorologist Edward N. Lorenz at a national meeting of scientists in 1972. In asking the question, Lorenz challenged conventional notions of science, such as deterministic and linear systems.

Butterfly theory contends a small input may result in a disproportionately large output. Synonyms include chaos theory and stochastic systems. Black swan events and the random walk theory are related to butterfly theory.

A *deterministic* system is one in which randomness does not exist. Independent variables precisely predict dependent variables. In public administration, for example, a new policy mandating a two dollar per hour increase in workers' minimum wages results in each worker receiving two more dollars. A conventional *linear* system is illustrated here, as each worker receives exactly two additional dollars for each hour worked. Linear systems, a type of scientific modeling, assume a reliable mathematical relationship between variables.

Whereas theories of linear systems facilitate elegant scientific models, and comforting forecasts, the empirical reality may differ significantly. As recent events in Los Angeles, San Francisco, and Seattle reveal (Puzder 2015) the raising of minimum wages by fiat, does not result in higher earnings for the workers but, in fact, lower earnings. Profit-maximizing companies, following Coase's (1937) theory of the firm and tendencies of capital mobility, have been found to move their operations away from cities where minimum wage laws have been enacted.

Factor substitution is also implemented, as machines assume functions previously performed by workers. And so, in a nod to the theory of unintended consequences, public administrators intending to aid the working man have instead done him harm.

Chaos theory rebuffs, or redefines, notions of deterministic and linear systems. Whereas linear systems suggest initial present conditions may predict future conditions, chaos theory emphasizes the possibility that initial conditions may not be fully understood; therefore, future conditions may widely differ from what the deterministic models predict. A gentle 5 mph breeze in Brazil surely would not predict high winds in Texas, but the additional flap of the butterfly's wing may be the tipping point to create the eventual tornado.

Malcolm Gladwell, in his best-selling book, *The Tipping Point* (2002), offers an example of crime reduction in New York City. High crime rates in the 1980s were reduced in the 1990s as a result of application of the *broken windows theory*. Police cracked down on petty crimes such as graffiti and jumping subway turnstiles. The subsequent reduction of serious crimes was attributed to the zero tolerance for small crimes. Tipping points are akin to butterfly theory, in that a small cause sets the course for a large effect.

Stochastic systems contradict deterministic systems, in that random variables are included in the models. A distribution of outcomes may be estimated employing probability, but precise outcomes cannot be predicted. Malkiel's (1973) *random walk theory* is an example of stochastic systems. The direction a drunk man walks after exiting the bar is random; he may go left, right, straight, or fall on his face and not walk anywhere. Butterfly theory exists as a subtext within chaos theory and stochastic models.

Malkiel applied his theory to financial instruments, especially stocks. Numerous public organizations, especially public pension funds and municipal governments followed deterministic logic in investing assets in a multitude of financial securities. Many were overexposed when they bought mortgage-backed securities. CalPERS and CalSTRS, pension funds for public employees in California, lost as much as $1.6 billion as a result of the housing crash of 2007–2008 (Lifsher 2015).

Taleb's (2007) *black swan theory* is related to butterfly theory. Evidence of thousands of white swans does not serve as proof that all are white. Instead, the appearance of one black swan can disprove the notion that all swans are white. And so the black swan is a metaphor of an extremely low probability event that has large impacts.

In 1973, residents of California's conservative and wealthy Orange County elected Bob Citron treasurer. Citron managed the county's finances, including a large investment portfolio. His strategy, widely avoided in most finance circles, was to "borrow short to invest long" (Ludwig 1995, p. 37). By 1994, Citron accumulated $1.6 billion in "paper losses," representing a reduction in portfolio assets of nearly one fourth. The County declared bankruptcy. Local government leaders made a crisis management mistake in not preparing for the low probability event that the actions of a single employee, with no formal training in finance, could create a magnanimous disaster impacting public services, schools, and jobs.

Whereas butterfly theory focuses on magnitude (small event, large consequences), black swan theory focuses on timing (low probability event, large consequences).

Crisis Management

Crisis management is the process of planning for and responding to events that can harm an organization. By definition, a crisis is a major event with extremely harmful effects to both internal and external stakeholders. Normal routine procedures are not capable of coping with the disruption (Booth 1993). Regarding timing, crises generally occur suddenly, require quick reaction time, and have greater impact the longer the duration of the crisis. The organization is likely to be permanently changed after the crisis (Venette 2003).

As a field of study, crisis management is relatively young, with the literature developing after a number of environmental and industrial disasters of the 1980s, such as the 1980 eruption of Mt. St.

Helens, the 1983 bombing of US and French military barracks in Beirut, the 1986 nuclear meltdown in Chernobyl, and the 1988 explosion of Pan Am Flight 103 over Lockerbie, Scotland. A number of high-profile tragedies in the private sector also contributed to the emergence of crisis management theories and practices. In 1982, a miscreant added cyanide to Tylenol capsules resulting in seven deaths and over $100 million in losses for parent company Johnson & Johnson. In 1992, a woman received third-degree burns from scalding coffee from McDonald's, resulting in an initial judgment of $2.9 million against the company.

GHP Model of Crisis Management

Current literature on crisis management is abundant and rife with numerous theories, models, and heuristics. Gonzáles-Herrera and Pratt (1995) offer a common sense model of crisis management applicable to both public and private sectors. The model consists of four phases: (1) issues management, (2) planning-prevention, (3) the crisis, and (4) the post-crisis.

Issues management is the first phase of crisis management, wherein managers "scan the environment" looking for, and collecting data on, trends or single issues that could become crises. In the context of readiness planning for municipal governments, Vastveit et al. (2014) suggest this initial phase generates a "risk image" describing the stakeholders' views of threats. The risk image contains likelihood or probability of events and the potential consequences of those events.

Many threats can be identified in advance, but some cannot. As Defense Secretary Donald Rumsfeld famously quipped, "There are known knowns…we also know there are known unknowns." Public officials in California know earthquakes will occur in the future and make readiness plans. Regarding a terrorist attack, those same officials do not know whether such an attack will occur nor do they know the time or place. Nonetheless, public sector leaders plan for both earthquakes and terrorist attacks.

The second phase of crisis management, planning-prevention, consists of setting proactive policy to respond to potential crises identified in the issues management phase, analyzing "the organization's links with multiple constituencies," and preparing "general or specific contingency plans" (Gonzáles-Herrera and Pratt 1995, p. 28). A forthcoming crisis could be known as imminent; for example, after the rogue trader forced Orange County into bankruptcy, other municipalities with similar investment portfolios should brace for a comparable imminent crisis.

Similarly, the planning-prevention phase may identify an existing problem that has the potential to evolve into a full-scale crisis. City leaders in Detroit, for example, had full knowledge of the city's fiscal shortfalls and made plans for the 2013 bankruptcy filing.

The crisis is the third phase of crisis management. Gonzáles-Herrera and Pratt suggest at this phase that the organization evaluates the organization's response to the crisis, preempts negative publicity, and "targets" the organization's message to "appropriate audiences" (1995, p. 29).

Here, the model falls short, as the organization's leaders, when faced with a new crisis, should focus their energy on resolving the crisis and minimizing harm to internal and external stakeholders. When a crisis hits, public relations although important take a backseat to actually resolving the crisis. When faced with the 2015 crisis of using a private, and potentially insecure, email server for US State Department business, Secretary Hillary Clinton appeared to commit more energy to manage public perception of the event than to actually resolve the crisis by protecting sensitive government data.

In the fourth and final post-crisis phase of the Gonzáles-Herrera and Pratt crisis management model, the organization monitors the crisis "until its intensity is reduced," informs stakeholders and the media of the organization's actions, and "evaluates how the crisis plan, if one existed, worked" (1995, p. 29). As Venette (2003) warned, the organization may never be the same. Gonzáles-Herrera and Pratt note the organization "yearns for bygone glorious days" (1995, p. 29).

Hurricane Katrina of 2005 was the costliest natural disaster in US history. Despite accurate forecasting and ample lead time, the hurricane's landfall generated more than 50 levee breaches resulting in over 1200 deaths and more than $100 billion in property damage. The US Army Corps of Engineers was found culpable for using inadequate levee building materials.

The crisis was also exacerbated by feckless responses by local, state, and federal entities including the New Orleans Police Department, the Louisiana governor's office, and the Federal Emergency Management Agency. Farazmand criticized the public sector response to Hurricane Katrina as "a global case of grand failure in, governance, leadership, and public management" (2009, p. 399). A perfect storm of bureaucratic failure accompanied the literal perfect storm of the hurricane.

Whereas public administrators responsible to respond to the crisis had certainly received ample training in crisis management, copious failures occurred both in resolving the crisis and in the post-crisis phase. Years after the hurricane, several New Orleans neighborhoods remain destroyed and serve as reminders of the destructive power of the hurricane and the compounding effects of poor leadership.

Butterfly Theory of Crisis Management

Numerous theories and models, such as the Gonzáles-Herrera and Pratt (1995) model, offer thoughtful and practical tools for crisis management. This paper adds butterfly theory to the existing literature of crisis management. Butterfly theory of crisis management suggests crisis managers should anticipate, and prepare to respond to, small and low probability events that have the potential to result in major harmful crises.

Butterfly theory avers that small events may cause large effects. Similarly, black swan theory asserts low probability events may cause large effects. These theories apply to the first "issues management" phase of the Gonzáles-Herrera and Pratt (1995) model. While "risk images" are being developed, leaders are obliged to consider small

issues, and improbable events, that threaten the organization with substantial harmful effects.

Paradoxically, black swan events are not predictable by definition. Whereas every possible threat cannot feasibly be anticipated, leaders are obligated to be well informed of various small events threatening the organization's status quo.

As part of crisis management strategy, leaders should prepare contingency plans for small and low probability events that might result in a crisis. Many of these events can be anticipated including natural disasters, severe weather, fires, chemical spills, bus crashes, bomb threats, disease outbreaks, terrorism, active shooters, and employee malfeasance.

In addition to preparing for butterfly effects as the cause of crises, leaders should also be open to butterfly effects as possible solutions to crises. Hong and Sun (2000) cite butterfly effects as critical events to the normalization of diplomatic relations between China and the USA in the 1970s. Relations between the two nations had soured during the Cold War. But during an international competition in Japan, American and Chinese national ping pong teams had friendly interactions, beginning with an American player accidentally boarding the Chinese team's bus. A number of additional butterfly effects took place, resulting in the eventual rapprochement between the USA and China.

Leaders cannot feasibly anticipate all threats, just as weather forecasters cannot monitor every flap of a butterfly's wings in a far-off continent. Nonetheless, those engaged in crisis management would do well to include the possibility of small and low probability events in their crisis management plans.

Cross-References

▶ Budgetary Assistance for Crisis Management
▶ Complex Systems and Crisis Management
▶ Contingencies and Crisis Management
▶ Crisis and Emergency Management
▶ Crisis Awareness and Organizational Response

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