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## **Is shock treatment good for you? The impact of a crisis as a function of its length**

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### **Abstract**

The dualistic nature of crises as both problems and opportunities has engaged researchers for a long time. In particular, we lack insights into what features of an organizational design might maximize the chances of benefiting from crises, for example as leverages for strategic change. As collecting reliable data is difficult, this working paper uses computer simulations to model the impact of a crisis, or 'shock event,' as a function of the length of the shock event. Although the results presented here are preliminary, they suggest that the common wisdom - that crisis produces change - may potentially be a result of a selection bias.

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## Abstract

The dualistic nature of crises as both problems and opportunities has engaged researchers for a long time. In particular, we lack insights into what features of an organizational design might maximize the chances of benefiting from crises, for example as leverages for strategic change. As collecting reliable data is difficult, this working paper uses computer simulations to model the impact of a crisis, or “shock event,” as a function of the length of the shock event. Although the results presented here are preliminary, they suggest that the common wisdom - that crisis produces change - may potentially be a result of a selection bias.

## Introduction

*"...[O]nly a crisis - actual or perceived - produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around."* (Friedman 1962:ix)

*"It is not strange ... to mistake change for progress."* (Millard Fillmore, U.S. president, 1852)

The dualistic nature of crises as both difficulties and opportunities has not escaped thinkers modern or ancient, as the anecdotes ranging from double meaning of Chinese character for "crisis" to voluminous "change is good" literature suggest. It is clear that some crises are opportunities to get rid of the old and adopt the new; it is equally clear that other crises may be mortal challenges that must be overcome, or else. However, assessing whether a given crisis is a benefit or a problem for a given organization, for example, has proven to be a remarkably difficult exercise. In particular, given the impossibility of replicating the experiments, we have a rather limited understanding of the contextual and organizational design elements that might make organizations more or less likely to benefit from sudden shocks and discontinuities.

This working paper seeks to partially address the deficiency. The focus of the study is on the quality and permanence of adaptive response of the organization as a function of the length of the crisis, compared to the speed of the decision-making process within the organization. Assuming a particular time scale for the speed of organizational change, I use agent-based modeling to examine the effect the length of the crisis has on the likelihood of the crisis proving to be beneficial to an imaginary organization. The use of agent-based modeling allows me to fully control all the variables and isolate the effects for further study.

The paper is structured as follows: first, a brief discussion to the nature of crises and definitions used is provided, and a brief overview of prior research is given. Second, the methodology, the model, and the assumptions made are explained. Third, the results are analyzed. Fourth and finally, the results and their implications are discussed.

## **Crises and shock events: definition, prior research and aims of the study**

What, exactly, constitutes a crisis? An academic definition may be formulated as "a low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect, and means of resolution, as well as a belief that decisions must be made swiftly" (Pearson and Clair, 1998:60). As noted above, a crisis does not necessarily lead to negative outcomes; as Faulkner (2001:137) notes, such an event may have "transformational connotations" and lead to positive outcomes as well (Faulkner and Vikulov, 2001; Meyer, 1982; Prideaux et al., 2003). Much of the above work on crises and their effects has been conducted under the topic of tourism management (Faulkner 2001, Faulkner and Vikulov, 2001; Meyer, 1982; Prideaux et al., 2003, Bonn and Rundle-Thiele, 2007). However, the applications seem to be universal. In general, four aspects of crises can be distinguished:

1. A crisis is a significant, unpredictable event that is likely to interfere with normal business operations and may even threaten organizational survival (see Pearson et al. 1997; Hermann 1963)
2. A crisis is surprising, i.e. it has a low probability of occurring. E.g. Shivastava et al. (1988), also Hermann (1963).
3. A crisis requires a decision or judgment intended to improve the organization. E.g. Aquilera (1990).
4. A crisis is characterized by time pressures, and the decision or judgment must be made quickly to minimize the impact (or maximize the benefits) of the crisis. (Quarantelli 1988)

The literature differentiates between internal and external causes of a crisis. For example, Faulkner (2001) argues that the word "crisis" should in fact be reserved to describe a situation "where the root cause of an event is, to some extent, self-inflicted through such problems as inept management structures and practices or a failure to adapt to change" (p. 136). For external events, he suggests to use the term "disaster" to refer to situations "where an enterprise ... is confronted with sudden unpredictable catastrophic changes over which it has little control" (p. 136). However, for the purposes of this paper, the term "shock event" - coined for the same purpose by Bonn and Rundle-Thiele (2007) - is more suitable. As in original definition, a shock event may be considered to refer to "a sudden and unexpected event that may cause significant stress in individual organizations, seriously threatening their profitability and existence" (Bonn and Rundle-Thiele, 2007:616).

General organizational research has for long addressed the problems of crisis management, as in the management of the practical "emergency" situations (Hermann 1963; Mitroff et al. 1988; Pearson and Clair 1998). Behavioral research has also studied e.g. when executives see crisis as an opportunity (Brockner and James 2008) and not inconsiderable effort has been put into how to use a crisis as a leverage in change strategy (for just one example, see Rochet et al. 2008). In general, this research seems to have a lot in common with research on how organizations can use constraints as a lever to break their path dependencies (e.g. Srinivas and Sutz, 2005; Popp, 2006).

In the field of organizational design, several researchers have noted the rise of new organizational forms as an adaptive response to continuing rapid changes in the environment - in other words, as a response to more and more common crises (e.g. Hamel and Prahalad 1994; Brown and Eisenhard

1998). In a paper particularly pertinent for this research, Siggelkow and Rivkin (2005) even used an agent-based model to study what organizational designs might be the best for coping with rapid change. Their conclusion was that successful adaptation in turbulent environments requires a balance of "speedy improvement" and "diverse search" for new opportunities.

However, there seems to be little extant research into how the length of the shock event affects the adaptive response of organizations. Much of the research quoted above focuses on single, spectacular events, such as accidents and natural disasters. These events unfold relatively rapidly (from an organizational point of view) and crisis management is then a question of responding to the problems and opportunities created by this "instantaneous" event. This formulation suggests that any adaptation caused by the shock event must ultimately result from a shock-caused disruption in the operating environment of the organization.

This disruption can be permanent or temporary. If an organization adapts to the changed environment, but the disruption is temporary, a rational organization should in theory adapt back to its original configuration after the disruption is over. Of course, this does not happen very often, and any changes in the organizational configuration tend to be more or less permanent. Usually, this is assumed to happen because of path dependencies and structural inertia (Hannan and Freeman 1977, 1984; DiMaggio and Powell 1983): once an organization is committed to a certain path, unless *new* shock events happen, reversing the process is difficult.

But what is the length of the shock event required to initiate irreversible change? Theoretically, shock events whose effects last less than the organizational decision-making cycle takes time to gather unstoppable momentum should result to no permanent changes in the organizational configuration. A disruption should last at least for the duration of one decision-making cycle for the effects to be felt. Then again, is one cycle-time enough? How many are required, on average, to effect irreversible change?

Perhaps even more interesting question is posed by the title of this paper. Is such a shock treatment beneficial for the organization? It would seem arguable that in some cases, breaking the path dependency might allow the organization to shed its old baggage and adopt new ways of working, potentially improving the performance of the organization. While a fully rational organization would adopt the new configuration even without the shock event, it is usually accepted that most organizations are not rational in this sense, and may require some prodding to change. However, it would seem equally arguable that shock events may also cause the organization to adopt "temporary measures" that worsen its performance in the long run - and that the path dependency and structural inertia prevents going back even after the disruption has passed.

Furthermore, it seems likely that the adaptation process is moderated by the competitive intensity. If organizations are capable of imitating the configuration of successful organizations (although this is by no means certain - see Rivkin 2000), and the competitive pressures within the organizational ecosystem (e.g. industry) are high, it should follow that most if not all the organizations have relatively similar configurations. To do otherwise would probably result to lower performance, leading to difficulties in a highly competitive environment. In such an environment, experimentation is risky and therefore it should be relatively rare. As a result, even if a shock event opens up a new development path, it should produce results very quickly or risk being abandoned.

Conversely, if the competitive environment is less intense, variation and experimentation have more breathing room. Such an environment should be more likely to allow potentially useful offshoots to survive until they can prove themselves.

## Simulating shock events

It is obvious that testing these ideas through empirical study would be very difficult, if not impossible. In addition to the difficulties of gathering data in the first place, I believe that selection bias would form a major obstacle for any empirical effort: it is likely that data would be available mostly on the "success stories" where the shock event *did* result to an improvement.

However, these longitudinal, potentially nonlinear dynamics and the problems of data collection make simulations an attractive methodology (Davis et al. 2007). Following the lead of e.g. Levinthal (1997), Rivkin (2000), Lenox et al. (2006), Siggelkow and Rivkin (2005) and many others, I have used the standard binary NK model (Kauffman 1993) to model organizations as systems of interdependent choices and their operating environment as a landscape of varying complexity. (For a thorough introduction of NK models in organizational research, see e.g. Levinthal 1997 or Rivkin 2000.)

As is usual in the literature, the organizations in this study start from random 16-bit configurations ( $N = 16$ ) and are allowed to seek higher performance by altering up to one choice configuration at a time. The preliminary results reported here have used exclusively local search, i.e. search within 1-change neighbors. The selected choice alternative has always been the first alteration that improves performance. Although simulations using "greedy search" dynamics, where the organization would evaluate all the 1-change neighbors and select the alternative that offers the greatest improvement in performance (see e.g. Frenken 2006) are planned, I believe that the assumption made here is in line with observations from real-world crisis decision-making (e.g. Bonn and Rundle-Thiele 2007). These observations suggest that following shock events, decision-making is more likely to be more intuitive, less analytical and less consultative. Hence, it would seem somewhat unlikely that an organization in crisis would evaluate all the alternatives.

For this study, the basic NK model is modified by adding an exogenous shock event and modeling the effects of inter-organizational competition. The shock events are modeled by forcing all the organizations to set the configuration of one of their design choices to "1" for the variable duration of the shock event. The shock event is introduced after the organizations have reached stable, "mature" configurations. As such, it is entirely possible that the "industry" contains organizational configurations that are unaffected by the shock. The assumption is that in most fields, there are always organizational forms in use that are less affected by any given single shock event.

The competitive intensity is modeled by allowing (in most simulations) the imitation of better-performing organizational configurations. Although Rivkin (2000) notes that imitating complex organizational configurations may be impossible, as a single mistake in imitation may result to drastically lower performance, I assume that at the level of abstraction (organizations being composed of only 16 yes/no decisions) minor errors in copying do not matter. The imitation is triggered by an organization falling below a preset percentage of average performance of all organizations within the simulation; for the results reported below, settings of 0 (no imitation), 25%, 50%, 75% and 100% (always imitate, if performance anything less than the average) were used. The likelihood of being imitated is proportional to its performance; in other words, better organizational configurations have a better chance of being copied, and thus spread in the "industry." It should be noted that this setup is equivalent to a model where organizations whose performance is sufficiently poor exit the industry and their market share is taken by one of the leaders.

The simulation does not have a fixed time scale; instead, it is assumed that each change in organizational configuration takes one “turn.” This allows the scaling of the results to the “pace” or “velocity” of a particular industry or organizational field. The shortest length of a shock event is one turn, or one “decision cycle” of an organization. Each simulation ran for 30 turns. Shock events were introduced on turn 15 and lasted for 1 to 10 turns. After the event, the organizations were free to alter the "shocked" choice if that improved their performance.

## Results

The preliminary results are displayed on Figure 1 below. The panels show the average change in organizational performance, compared to performance before the shock event. Positive results (above dashed horizontal line) indicate positive change, while results below the horizontal line indicate negative change. Error bars indicate standard errors of the mean.

As can be seen, on average temporary shocks have only a very slight although positive effect on organizational performance, with the "no change" horizontal line fitting comfortably within the error bars. However, the results also indicate that there is a chance for a shock to have even significant impact on performance - although these cases are rare.

It is worth noting that the largest changes - and typically negative ones at that - are seen when the competitive intensity is the highest (imitation trigger 100%). The explanation for this is that high levels of competition will typically result to a low variety even *before* the shock. Thus, there will be fewer alternative configurations for the managers to imitate. If these few alternatives were heavily affected by the shock event, the overall performance within an industry will necessarily suffer.



More careful analysis of the data suggests that shock events may have interesting effects in eliminating variety from within the industry and promoting the adoption of "tried and true" organizational configurations. However, as these results are still preliminary, they are not included in this version of the paper.

Future updates to this paper will analyze the results in more detail and include analysis of "greedy search" dynamics as well.

## Discussion

At this point in research, the results are very preliminary. However, the feasibility of using the NK model in simulating variable-length shock events has been demonstrated. Moreover, the early results demonstrate that temporary shock events may not - on average - be very great drivers of change and innovation in organizational design, at least within the given parameters of the simulation. This suggests that either the model should be improved - or that the common wisdom regarding the necessity of "shock treatments" may be based on selective reporting. It is entirely plausible that the common wisdom, encapsulated in the opening quote by Milton Friedman, is a result from a selection bias and fails to consider all the cases where a crisis occurred but nothing (much) changed. If so, even these preliminary results suggest that further research into the topic of shock events might be an interesting and fruitful area of research.

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