STATE OF THE ART

Comments on how the task of reading research articles should be reported

Whenever the intern reads articles, the intern should report the following aspects:

1) What are the problems (research questions) that are addressed? (Objective(s))
2) How are these problems attacked? (Methodology)
3) What the obtained results? (Results)
4) How important are these results? (Discussion/Impact)
5) What are the novelties through this work? (Contribution)
6) What are your critiques? (Your opinion)
7) Can you propose something else? (Possible future works)

2nd research paper: Disaster Dynamics: Understanding the role of Quantity in Organizational Collapse

1) Understanding the role of quantity in organizational collapse and how stress is related with performance?

2) The central construct of their model is interruption for 2 reasons:

   -In the literature on disaster, interruption to ongoing activities appears to repeatedly as a “generic accompaniment” of crisis.

   -As their model emerged (Mandler’s 1982) interruption theory of stress strongly shaped their view on how crisis evolve.

   Their made several assumptions for their model:

   They assume that the organization faces a continual steam of non-nouvel interruptions.

   In their model to study the dynamics generated by quantity they used in a non-nouvel interruption theory (interruptions for which the organization has an appropriate response within its existing repertoire).

   Resolving non-nouvel interruption requires 3 processes :

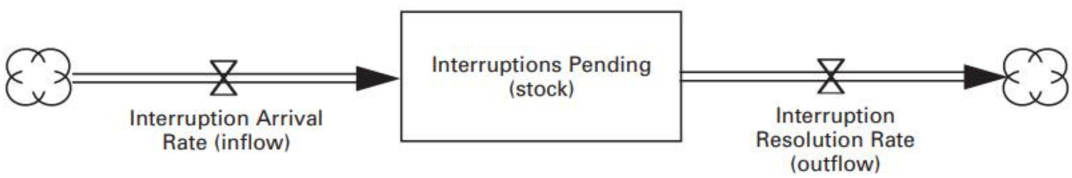
   -Attention processes to determine which interruptions are considered

   -Activation processes to trigger the knowledge necessary in the given setting

   -Strategic processes to determine which goals are given priority and the resources that are allowed to them.

   They also assumed that resolving pending interruptions is required for the individual on organizational’s survival. And that the organizational performance is strictly a function of the ability to resolve interruptions.

Figure 1. The basic stock and flow structure of interruptions in organizations.



Where :

$$\text{Interruptions pending}(t) = \int_{t}[\text{Interruption arrival rate}(s) - \text{Net interruption resolution rate }(s)]ds + \text{Interruptions pending}(t_0)$$

Accumulations of interruptions that have occurred but have yet to be resolved.

We know also that when :

Stock interruptions pending ↘ => net interruption resolution rate ↗

To define the net interruption resolution rate we must distinguish between interruption and errors

Interruptions are exogeneous inputs arising from outside the system

Errors are Endogenous, when the number of interruptions ↗ the more likely the errors ↗

And the probability(disaster) ↗.

It often requires additional attention that would have been unnecessary had the been executed correctly. Errors often create additional interruptions.

No relationship between the level of stress facing subjects and their past performance.

Current performance is affected by the number of unresolved interruptions and the number of unresolved interruptions is determined in part by past performance.

Linking Interruptions and Performances via the Yerkes-Dodson Law.

Linking between the stress (created by a large stock of unresolved interceptions) and performance.

Figure 5. The Yerkes-Dodson curve in dynamic environments.

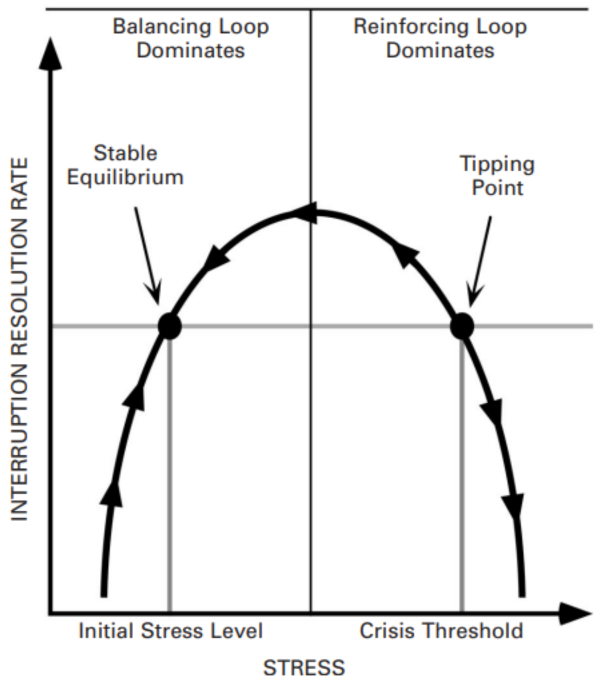
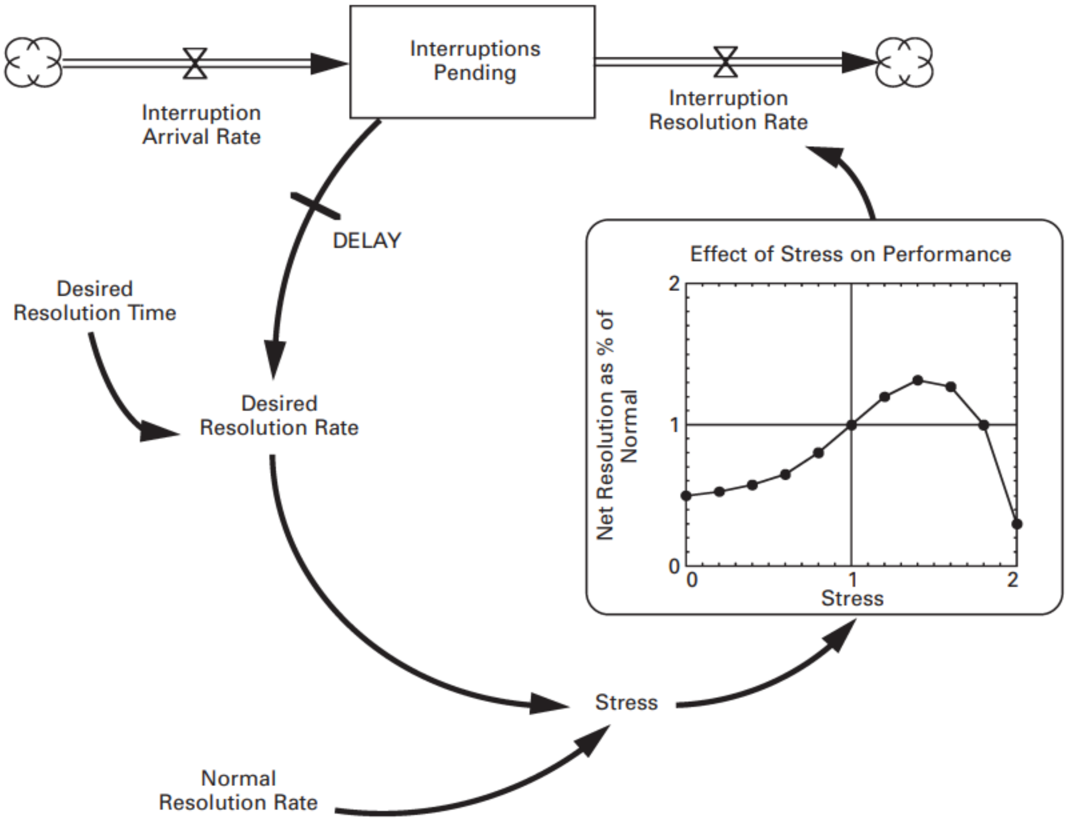


Figure 2. Model structure.



The stock of pending interruptions coupled with the time horizon over which they must be resolved determines the desired interruption resolution rate.

Desired resolution rate(t) = Interruptions pending(t)/ Desired resolution time.

Desired resolution rate = The comparison of the outstanding stock of unreleased communication and the resolution time

Outstanding interruption ↗ => Desired resolution rate ↗

Modeled stress as arising from a mismatch between the desired resolution rate and the rate at which interruptions are normally resolved.

Stress(t) = Desired resolution rate(t)/Normal resolution rate

Where we consider the normal resolution rate = 10 interruptions/ minute

Stress ↗ = Desired resolution rate ↗ > normal resolution rate

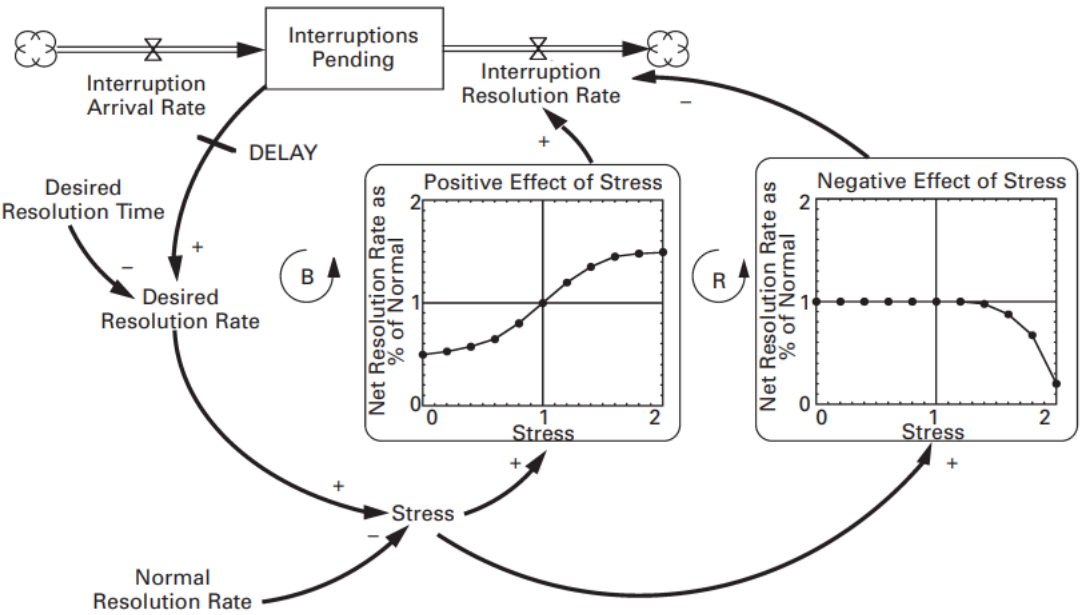
As stress increase, performance increase until the peak of the curve is reached and further increase in stress cause a decline in performance.

Positive and Negative of stress: A feedback representation.

The accumulating stock of unresolved interruptions leads to an increase in the desired resolution rate and therefore stress. The increase pushes the system further up the Yerkes-Dodson curve causing a positive change in the resolution rate.

As the stocks rises, stress grows and performance increases, thereby draining the stock of outstanding interruptions and offsetting the initial increase.

Figure 3. A feedback representation of the model's structure.



We can compare it to the Yerkes-Dodson curve, the dynamics of stress and performance do not perform a regulatory function but instead amplify changes in stress in a reinforcement feedback process (“R”).

We have 2 side of stress => Yerkes-Dodson Curves (Positive & Negative effects of stress)

Normal resolution Rate stress < threshold< Normal resolution rate stress

Positive effect of stress < threshold< Negative effect of stress

3) Case study

Disaster Dynamics

Figure 4a. System response to a one-time increase in the interruption arrival rate of 100 percent.

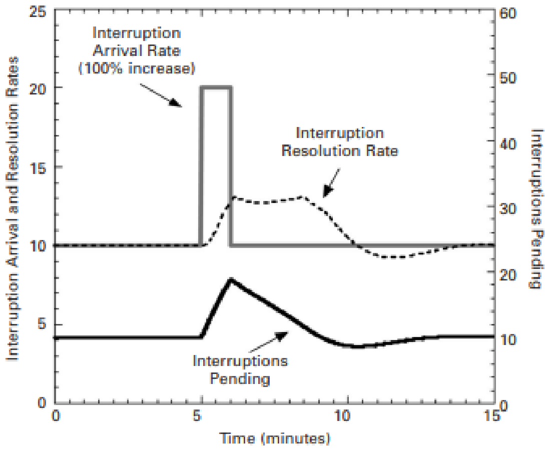
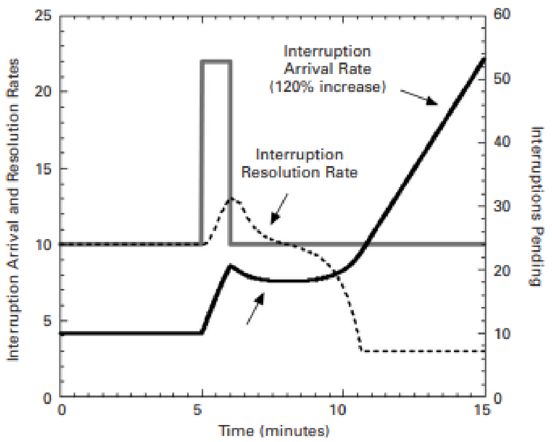


Figure 4b. System response to a one-time increase in the interruption arrival rate of 120 percent.



100% increase => easily return to its pre-pulse equilibrium

120% increase => rapidly collapse

As we can see between these 2 figures/graphs it's that infinite small change in the size of the pulse can mean the difference between survival and collapse.

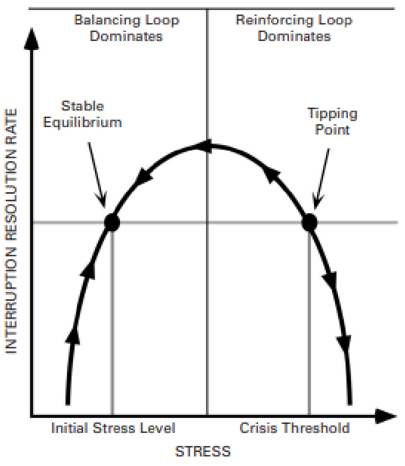
Incoming interruptions ↗ => p(disaster) ↗

A temporary increase in workload causes a permanent decline in the system performance.

Tipping points and the dynamics of quantity-induced crisis

Once the threshold is crossed, performance rapidly collapses.

Figure 5. The Yerkes-Dodson curve in dynamic environments.



Curvilinear relationship between stress and performance (where performance = net interruption resolution rate).

Capturing the dynamics created by this relationship requires 3 additions:

1) They highlight the shift in loop dominance that occurs when the system reaches the oeak of the Yerkes-Dodson curve.
2) They show the possible equilibrium by solid black dots. An equilibrium exits where the steady state interruption arrival rate produces enough stress to yield an equivalent resolution rate.

   The system has 2 such points:

   -upward-sloping segment
   -downward sloping portion

3) To capture the different dynamic characteristics of 2 equilibria we add arrows showing the direction of the system in desiquilibrium situations.

Formally this equilibrium is stable meaning that small deviations from it and counteracted by the system's dynamics.

The dynamic's the system generates when operating near this equilibrium are highlighted in the first pulse experiment:

-Stock of interruptions pending => the resulting growth in stress , the net resolution rate thereby offsetting the larger number of unresolved interruptions and bringing the system back to the equilibrium

-The second equilibrium exits in a region where the reinforcement loop dominates the behavior of the system. Because it is unstable it is extremely unlikely that the system will ever settle at this equilibrium.

In the system their model the reinforcing loop created by the downward-sloping portion of the Yerkes-Dodson curve can act depending of the level of stress as either a virtuous circle (fewer unresolved interruptions, less stress, and an increasing net resolution rate) that drives the system back to it's initial equilibrium on as vicious circle (more unresolved interruptions, increasing stress, declining net resolution rate) that derives the system towards collapse.

The unstable equilibrium represents the points at which the positives loops change directions. Before the system reaches this threshold, the reinforcement loop enhances stability.

Once the unstable equilibrium is crossed however the reinforcement loop rather than pushing the system to stability becomes an engine of disaster driving the system into a crisis of escalating interruptions pending, intensifying stress, and declining performance.

Tipping threshold => pre-programmed crisis

Figure 6a. System response to variation in the interruption arrival rate.

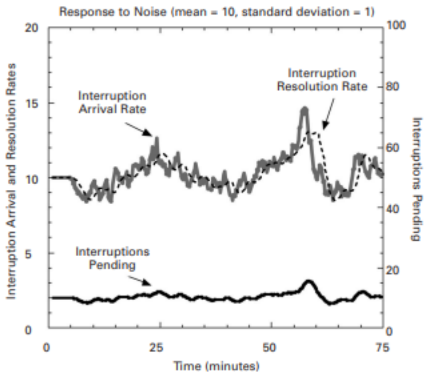


Figure 6b. System response to greater variation in the interruption arrival rate.

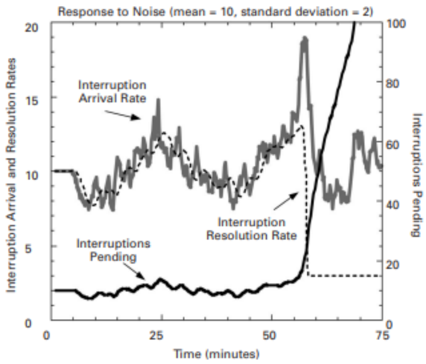


Figure 6a shows the first experiment, the system easily accommodates the variation in the number of interruptions. The arrival rate does rise significantly at approximatively minute sixty, but the tipping point is not crossed, the system does not descend into crisis.

Figure 6b shows that in the second experiment despite having the same average number of arrivals, doubling the deviation in the arrival rate poses a significant problem.

Once the threshold is crossed net resolution rates << arrival rate = stocks of interruptions pending

These experiments highlights 2 things:

-The existence of a tipping point means that the variability of the arrival rate is a significant determinant of a system susceptibility to crisis.

The wider the variations in the arrival rate, the more likely the tipping threshold will be crossed.

They also used Monte Carlo analysis to confirm the relationship between variability and susceptibility to crisis.
They performed 1000 simulations for each of twelves standards deviations of the arrival rate process (range from 10 to 50% of the mean arrival rate).
They calculated and plotted the mean time to crisis and upper and lower confidences bounds for each of the selected standard deviations.

Figure 7. Monte-Carlo analysis of variability in the interruption arrival rate versus system survival time.

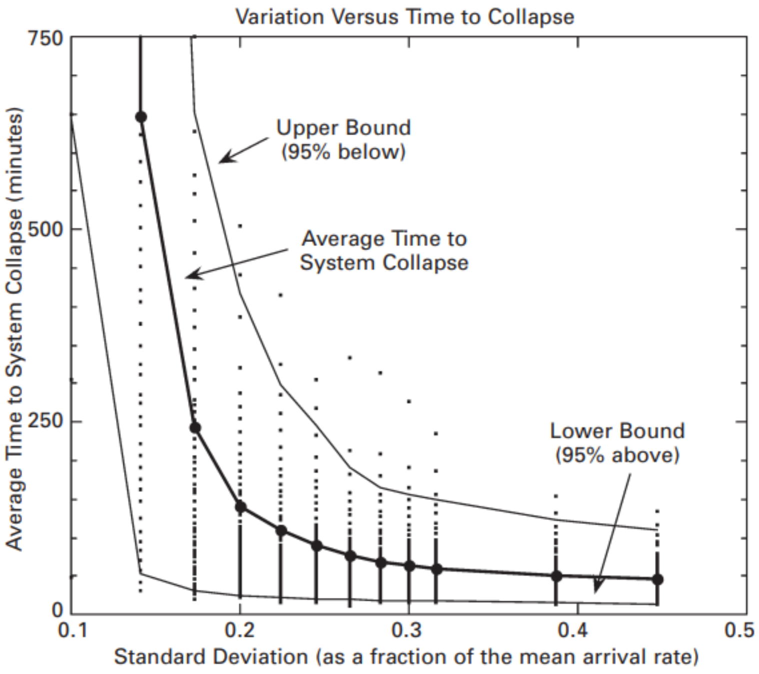
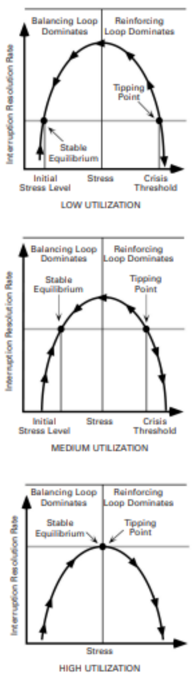


Figure 7 depicts the relationship between the variability in the arrival rate and the average time required for the system to descend into crisis.

As the variance in the arrival rate increases, the average survival time of the simulated systems falls exponentially. When the variance in arrival rate is low, the variation in survival time is extremely large.

Figure 8. System structure under three different levels of resource utilization.



Balance between handling capacity (normal net interruption resolution rate) and the steady state arrival rate determines the number of interruptions required to tip the system into crisis.

-Arrival rate low (handling capacity) => low point (Yerkes-Dodson-Curves)

-Arrival rate high => initial equilibrium+ tipping point converge to single point

As the steady state arrival rate increases on the resolution capacity declines => stable equilibrium and the tipping point climbs the Yerkes-Dodson Curves, causing the distance between them to shrink.

The tipping point arises from 2 features in the system we model:

-Unresolved interruptions do not disappear but instead accumulates

-The accumulations cause a drop in performance as long as a mounting stress eventually degrades performance, the system has a tipping point.

Individual level:

By improving the net resolution rate, all of these responses increase the distances between the stable equilibrium and the tipping point.
If filtering, chunking and abstracting can be executed effectively, they make the system more robust.

Group level:

We concluded that handling capacity is not likely to scale directly with the addition of people, but through improved dynamics may also increases handling capacity.

Organizational level:

Organizations tend to centralize control, and like individuals, filter information more heavily.

Filtering has the positive effect of reducing message overloads and stress, allowing organizations to act.
Centralizing authority speed the resolution of routines interruptions.

The results suggest that moving from the individual to the group to the organizational level does not change the features required for its existence.

4)

These results shows that an overwhelming information process capacity create a vicious cycle of increasing stress and declining performance (quantity induced crisis).

Experience suggests that in such situations (crisis situations) it is better not to leave the turnaround time up to the on-the-spot decision making.

Fixed rules and procedures can prevent the system from entering a regime (crisis).

We know also that quantity induced crisis that are preceded by a predictable pattern of events.

5)

The authors offer 2 contributions:

-Highlight quantity as a basis for disaster

-They show that the relationship between the quantity of interruptions and the organization's ability to handle them is far more complex then that (tipping points, threshold…)

6)

The paper synthesis the complex problem of disasters dynamics, and gave us hints about certain situation (quantity-induced) that are preceded by predictable pattern so that we can prevent it in the future.