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Law of requisite variety in practice: assessing the match between risk and actors' contribution to resilient performance

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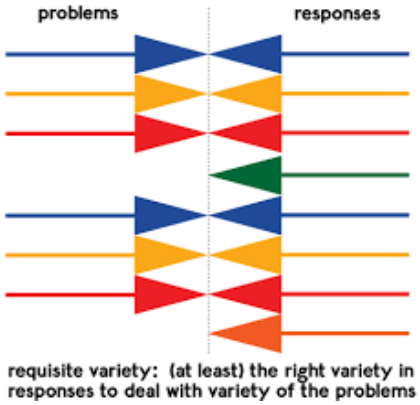
Law of Requisite Variety (LRV)

"If a system is to be stable the **number of states of its control** mechanism must be greater than or equal to the **number of states in the system being controlled**"



"Only variety can destroy variety"

Ashby, W. R. (1958). Requisite variety and its implications for the control of complex systems. Cybernetica 1 (2): 83-99.

Research problem

- ✓ LRV is commonly used only as a metaphor
  - ✓ Little empirical scrutiny in human factors
  - ✓ It is difficult to measure variety

How can LRV be operationalized to assess the match of risk (i.e., process variety) and actor's contribution to resilient performance (i.e., controller variety)?

Scenario of this study

- ✓ Cardiac ICU of a major public teaching hospital, 6 beds
- ✓ 70 healthcare professionals
- ✓ 43 tasks

Method

Social Network Analysis survey: advice-seeking

✓ A **resilience score*** for each actor, as follows:

In-degree . betwenness . closeness . availability . reliability

Five dimensions of the controller´s variety

✓ **Actor´s risk score:** each actor indicated the frequency of carrying out a task, the probability and severity of unwanted outcomes

* Bertoni, V. B., Saurin, T. A., & Fogliatto, F. S. (2022). How to identify key players that contribute to resilient performance: A social network analysis perspective. Safety Science, 148, 105648.

Method

- ✓ Cluster analysis to verify whether actors could be grouped based on their resilience scores
  - ✓ Good solution with two clusters
- ✓ Comparison between clusters
  - ✓ <u>Actors´ risk scores</u>, multifunctionality, experience

Hypothesis

Actors in the high resilience cluster would be more multifunctional, more experienced, and with higher risk scores

Main results

✓ **Cluster 1:** first-order resilience actors (***8 people***)

- ✓ 5 doctors, 2 nurses, 1 physical therapist
- ✓ 15 years of ***experience*** at the ICU
- ✓ Higher multifunctionality

✓ **Cluster 2**: second-order resilience actors (***48 people***)

- ✓ 6 doctors, 12 nurses, 3 physical therapists, 27 nurse technicians
- ✓ 8.5 years of ***experience*** at the ICU
- ✓ Lower multifunctionality

Risk scores were the same for both clusters

Discussion

- ✓ 2nd order actors obtained a minimum sufficient resilience score (controller variety) to reduce the regulated process' variety (risk) to an acceptable level

- ✓ Good enough to keep the risks as much under control as the 1st order actors

LRV is overly generic

- ✓ ***Contextual factors*** influence LRV
  - ✓ E.g., legal constraints for task assignment, individual preferences, development of shared risk perceptions over time

Conclusions

- ✓ Workable approach to ***put LRV into practice*** in the context of risk and resilience

- ✓ Insights into the LRV itself
  - ✓ Reference point to define what counts as sufficient variety
  - ✓ 2nd order actors were deemed fit for their tasks because their risk perception was similar to that of the first order actors

- ✓ Raised practical questions and insights
  - ✓ Could first-order actors be better used in riskier tasks?
  - ✓ Reassuring results for patient safety

Thank you!

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