

## **Resilience, Adaptation and Improvisation – increasing resilience by organising for successful improvisation**

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**Abstract.** The paper discusses how the concept of resilience has improvisation as a key premise. The paper aims to map out where aspects of improvisation are inherently part of resilience. The results are discussed in terms of possible organizational consequences in high risk environments. Three different approaches are applied; First; how resilience and improvisation are related in general. Second; improvisation in resilient adaptation, in which sensemaking plays a key part. Third; recasting resilience and improvisation onto the Cynefin framework for making sense of complex systems and organizations.

The paper integrates the three approaches to resilience and improvisation, and outlines what types of initiatives it may be relevant for organizations to take with respect to design, work organization and training to facilitate successful improvisation. By suggesting improvisation as an engine of resilience, it follows by implication that resilience as such does not preclude the possibility of inadequate improvisation. Hence, the potential for serious safety breaches remains, regardless how resilient we may be.

### **1 INTRODUCTION**

Hollnagel (2004) argues that when a work situation is planned, four conditions are usually assumed: 1) inputs to the work process are regular and predictable; 2) the demands and resources are within limits; 3) working conditions in general fall within normal limits; and 4) output complies with the expectations or norms. In practice, the four conditions are often not fulfilled, bringing employees to adjust their work practices to get the job done. The adjustments will involve trade-offs between requirements for efficient and safe performance, and may imply that established rules and procedures are deviated. Reliable outcomes require the capability to sense the unexpected in a stable manner and yet deal with the unexpected in a variable manner (Weick and Sutcliffe,

2007). Decision support related to such trade-offs is needed to build a resilient organization (Woods and Wreathall, 2003).

Resilience Engineering (Hollnagel, Woods and Leveson, 2006) as a theory covers a lot, also in a literal sense. The far reaching scope of the theory may conceal or overshadow key premises. This paper is based on the assumption that *improvisation* is one of those.

Improvisation as a concept have traditionally been associated with handling of exceptions. As Resilience Engineering emphasises the constantly changing environment, it could be argued that all operational activities should be considered from a non-routine perspective. A similar point is made by Weick and Sutcliffe (2007) in terms of their principle of *Sensitivity to Operations*, which emphasise that any function must be implemented in a specific context, and that even minor contextual differences may imply some degree of adaptation. The distinction between Regular, Irregular and Unexampled events (Westrum, 2006) may therefore be somewhat misleading, creating an impression that the lion's share of dangerous events can be handled as non-singular instantiations of categories of events, in a repeatable manner. A distinct focus on improvisation however, renders plain and intelligible the need for constant awareness and adaptation.

Theories of Resilience implies the use of "provoking" concepts and terms, advocating a certain degree of "letting go" that jeopardise traditional assumptions of staying in control. Highlighting improvisation will not bring more comfort in that sense, but contribute to a more realistic view on the challenges of managing complex systems.

## 2 IMPROVISATION IN RESILIENCE

As anticipation, attention and response are seen as key qualities of a resilient system (Hollnagel and Woods, 2006), improvisation embraces these by "*thinking in action*" (Cunha et al., 2002). Improvisation is characterised by nearness in time between planning and execution of an action (Chelariu et al., 2002; Moorman & Miner, 1998), and as a behavioural and cognitive time-constraining activity to meet certain objectives, implying deviations from existing practice or knowledge (Chelariu et al., 2002). Resilience in terms of the ability to expect the unexpected and look beyond the obvious goes beyond experience (Hollnagel and Woods, 2006). "Requisite imagination" (Adamski and Westrum, 2003) is a mandatory principle for resilience.

Improvisation supports this by creating more flexible behaviour to achieve objectives in a new ways (Chelariu et al., 2002). Improvisation may create, solve or worsen a problem. To facilitate the ability to improvise successfully, a number of factors, e.g. expertise, teamwork quality and a high level of real-time information, have to be in place (Crossan & Sorrenti, 2002). However, there are no alternatives: Though humans might not be well suited or may lack the adequate resources and tools, they will occasionally be required to engage in improvisation. Their ability to improvise successfully should thus be supported by the organization.

Improvisation is thus too important for resilience to be marginalized as a piece of *bricolage*, that is, as accidental tinkering through the combination of resources at hand. On the other hand, *recognizing* bricolage is important because it is a "natural" form of disclosing new uses and applications of technology and things at hand (Ciborra, 2002).

### 3 ADAPTATION AND IMPROVISATION

Adaptation is a central part of resilience. Adaptation comprises knowledge in terms of Anticipation (what to expect), Attention (what to look for), and Response (what to do) (Hollnagel and Woods, 2006, 350). These three elements (A-A-R) are not positioned such that anticipation precedes competence, which in turn precedes response. Rather, all three should be continuously applied. How may improvisation contribute to countering of failures in single elements, or in combinations thereof? E.g., may improvisation compensate for anticipation failure so that the attention - or response - ensures success instead of failure. Improvisation may also be a source of failure in the adaptation process. We see three ways of addressing this issue: 1) *reductionistic*: looking for improvisational elements in A-A-R respectively; 2) *holistic*: looking for improvisational dynamics in adaptation as a whole; and 3) *critical*: questioning the unity of adaptation.

#### 3.1 *Reductionistic*: Improvisation in Anticipation, Attention and Response

*Improvisation in Anticipation* implies the presence of a repository of cases, facilitation of imagination and creativity, and reluctance to simplify. People should be socialized to make fewer assumptions, notice more, and ignore less (Weick and Sutcliffe, 2007, 95).

*Improvisation in Attention* implies the ability to interpret signals in many ways, and be sensitive to a greater variety of inputs. It also implies that people that are expected to improvise are not “technologically locked in” to what Hollnagel and Woods (2005) denotes a hermeneutic relation, in which technology enforces a specific interpretation.

*Improvisation in Response* implies the ability to create new patterns of anticipation and attention within a short time frame, that is, “thinking in action”.

#### 3.2 *Holistic* : Adaptation by Sensemaking

A resilient system must be in a constant preparedness to respond to unforeseen events and surprises. This kind of preparedness appears related to characteristics like flexibility, creativity, and spontaneity. The forward looking readiness (and capacity to respond) resembles a highly proficient coping ability. This kind of readiness must be filtered through our capacity to perceive, understand and *make sense of* what is experienced. The concept *sensemaking* refers to the processes involved in this human propensity to ascribe meaning. Sensemaking is a process of structuring the unknown, and can be described as a complex interaction of seeking information, ascribing meaning, and action. According to Weick, Sutcliffe, and Obstfeld (2005), sensemaking is not a conscious human process, but a process that will come into play as an intuitive reaction (e.g. to unfamiliar or chaotic situations). Weick et al. (2005, 409) define sensemaking as being about “the interplay of action and interpretation rather than the influence of evaluation and choice.”

Resilient watchfulness and readiness to respond stands out as features in which elements of improvisation seems involved, and the concept of sensemaking raises some interesting issues: First, being watchful and able to manage the unforeseen must depend upon both skills and knowledge. This is close to what Tierney (2003) terms resourcefulness (capacity to identify problems and establish priorities) and rapidity

(capacity to meet priorities and achieve goals). Sensemaking takes these aspects further based on the proposition that we make sense of our experiences by using our past; and vice versa. Past and present are hence tied together. If our perception and understanding is filtered via, and linked to our history, will not this also imply a limitation in terms of what we are capable of being ready for; what we are able to make sense of, improvise and respond to? On the other hand, sensemaking represents a way to reinterpret the past, thus expanding and developing our knowledge base and coping ability.

A second theme that ties in with the above is the point made by Weick et al. (2005), that sensemaking is more of an intuitive reaction than it is a conscious process. By implication, will not this suggest that the ways we make sense of the world (e.g. improvise and act upon it) are inescapably based on a knowledge repertoire that we never fully take into conscious evaluation? Third, the capacities to anticipate and react to unforeseen events, positions the ability to improvise as a sort of engine; improvisation becomes a force that enables this flexible and creative solution oriented disposition. The ideal is to bounce back, recover, or evade by anticipation. Given that some response is needed however, there is always the possibility that improvisation goes awry. If sensemaking as a retrospective process is part of this improvisation, there is a risk that the repertoire of past experiences may suggest wrong solutions for the problems at hand.

### **3.3 Critical: Adaptation by Containment**

Weick and Sutcliffe (2007) argues that resilience (as part of containment) may be seen as coping with problems posed by anticipation and planning, as well as reacting to emerging problems that cannot be foreseen. They argue that this requires a different mindset than anticipation and planning. Hence, the unity of Adaptation as such is questioned, indicating a need for mutually excluding staffing and training regimes.

Emerging patterns can in some cases be spotted early by “re-inventing” the past to match it with a similar pattern, that is, by sensemaking. Improvisation can thus be seen as a junction from anticipation into coping, or seen as divided into two separate forms.

## **4 RECASTING OF RESILIENCE AND IMPROVISATION**

The need for resilience is often justified by *intractability*, which may be perceived as (Perrowian) complexity or incomprehensibility, or fundamental un-order. However, resilience is also justified by the lack of time to analyse a complicated system or operation in depth (e.g. the ETTO<sup>1</sup> principle), thus it is necessary (or more practical) to rely on resilience. That is, a more “economical” ability to cope with “surprises” – being unavoidable or not - as they show up. The objective of the Cynefin framework (Kurtz and Snowden, 2003) is to make sense of *systems* that are perceived to be both ordered (Known or Knowable) and un-ordered (Complex or Chaotic) at the same time (Fig. 1).

We argue that while Resilience is apparently targeting Complex systems, the ETTO principle actually also implies Knowable systems. In the latter case, lack of time and resources renders the Knowable system intractable in an epistemological sense, while in

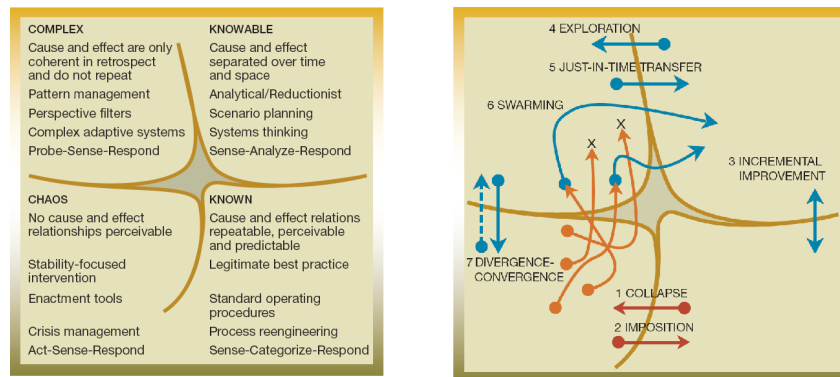
<sup>1</sup> Efficiency-Thoroughness Trade-Off (Hollnagel 2004)

the former case the intractability has an ontological reason. Moreover, we argue that the central ambitions of Resilience Engineering can be interpreted in terms of Cynefin dynamics, e.g. (referring to the right side of Figure 1):

- Detecting a possible unexpected variation, and stabilising it to avoid harm (“Exploration” and “Just-in-time-transfer”)
- “Bouncing back” and mitigating surprising variations that can develop into dangerous sequences (“Divergence-Convergence”)
- “Bouncing back” on severe circumstances that threatens the system as a whole, into a degraded mode of operation (“Swarming” or “Imposition”)

Pavard et al. (2008) argue that there is a significant difference between resilient engineering and robustness engineering (encompassing the possibility of self-organization). We argue that the Cynefin framework can encompass both.

From our definitions of *improvisation* in section 2, only one is easily mapped to the right (ordered) side of Cynefin in terms of a high speed analytical process. The others may be interpreted as a kind of sensitivity to changing circumstances and emergent problems, emphasising the significance of both *probing* and *acting on* the system.



**Fig 1.** The Cynefin framework. Excerpts from Kurtz and Snowden (2003)

From Section 3, we recall that improvisation is about interplay of action and interpretation, and about interchangeably looking forward and backward in order to make sense of what is happening. This maps neatly to the very idea of Cynefin dynamics; to use different frames of interpretation, according to circumstances.

Improvisation could thus be perceived as the “engine” that actually drives movements between (Cynefin) domains, and thus makes resilience something substantially different from economically motivated substitution of rational analysis in advance.

## 5 IMPLICATIONS FOR ORGANISING RESILIENCE

What implications does the above line of reasoning have for our ability to increase resilience by organizing for successful improvisation? What initiatives might it be

relevant to implement with respect to work training, design, and work organization? Adaptation – anticipation, attention, and response - might serve as a starting point for indicating the contours of what an answer to this question might look like.

To facilitate successful improvisation, training should be directed at improving the trainees' ability to anticipate and attend to patterns in the system's behaviour. A basic element in this type of training could be to present trainees with a group of scenarios, which contain a varied set of examples of ("unexpected") situations. The scenarios should imply that the boundaries for acceptable performance (Rasmussen, 1997) would become manifest during training. The ability to recognize patterns might further be facilitated by the introduction of human-system interfaces developed based on the ecological design approach (e.g., Vicente and Rasmussen, 1992). To respond adequately in a situation which involves improvisation, the employees should have available - and efficiently master – a set of response options, which allow flexible intervention, depending on the particular needs in the situation at hand. To facilitate successful improvisation it would further be of key importance that the users obtain feedback (as immediately as possible) on the effects of their responses, to allow them to adjust their course of action. Improvisation is needed in situations where unforeseen events occur. For this reason it cannot be determined in advance what type of work organization that will most adequately facilitate performance prior to an occurrence. The ability of a work organization to reconfigure spontaneously in demanding operating situations is a key characteristic of high-reliability organization (e.g., LaPorte & Consolini, 1991). This suggests that "improvising organizations" should allow for reconfiguration of their work organization when this is required.

## 6 CONCLUSION

Properly addressed and facilitated within an organization, improvisation could be made a booster for resilience. However, improvisation may always go wrong, thereby rendering plain and intelligible the inherent vulnerabilities in complex systems that cannot be avoided, whatever sophisticated methods we employ in order to reveal the most intricate secrets of their behaviour.

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