

Cover Page

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Learning to be Adaptive

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Abstract

This paper builds on earlier work ¹, where we investigated the adaptive use of networks to generate an Adaptive Task Force. Several of the conclusions dealt with the rich set of possibilities to use feedback and lessons learned to increase the effectiveness and adaptivity of the force generation process, an aspiration embraced by most defense organizations, including our own.

We here develop more detail about the distributed learning processes that are necessary to foster a learning culture throughout the organization, and in particular, to extract lessons from deployed operations and training exercises, explore, refine and assess these lessons and implement them in an appropriate way.

Drawing on the problems defense organizations face today in their complex endeavors, and inspired by theoretical understanding of adaptation and the principles and practice of learning organizations, we discuss the factors that impede or facilitate learning, and learning to learn.

A key approach which we will discuss in some detail is the Adaptive Stance. Our focus is specifically on fostering the forms of adaptivity that complex defense challenges demand, and on the particular role of C2 in enabling them. Although we recognize that top-down design alone is not sufficient to create an adaptive organization with the desired properties, we propose a set of principles which may guide organizational design decisions along a growth path towards greater effectiveness in a dynamic and complex environment.

1 Introduction

The focus of western Armed Forces on preventing a large-scale military intervention from the Warsaw Pact has now shifted towards coping with a wider variety of threats including terrorism, failed states, international crime networks, ethnically and religiously inspired insurgencies, and potential threats arising from migrational pressures and natural disasters. No longer being able to rely on a relatively structured approach based on war fighting principles, military organizations are now challenged to be effective in a complex, dynamic environment, where they simultaneously have to deal with for example fighting insurgents, providing security for the population, supporting restructuring and rebuilding programs for the population.

Although military operations have always been complicated in detail, complex in their entangled interactions, and dynamic in multiple dimensions, the end of the Cold War accelerated two major interrelated trends that increased the dynamics and complexity of military missions.

Firstly, one consequence of the new reality described above, is a trend towards current and future missions involving more collaboration of military forces with both military coalition partners and non-military actors such as local governmental entities and national and international non-governmental organizations than ever before. Although these actors are dependent on each other for accomplishing some of their desired results, each has its own goals, ways of working, assets and perspectives on the situation. Moreover, there is generally no unified command driving these actors, who can at best focus on the problems as they see them.

The second trend has to do with the outcomes that the above described coalition of actors try to accomplish. These obviously require more than just military actions. Furthermore, the various kinds of effects that need to be produced are not independent. In fact, they influence each other heavily – eg the intended high level effect of the ISAF mission in Afghanistan is a secure and stable environment. Although this sounds straightforward, on a more detailed level this consists of dozens of mutually interrelated effects and influencing factors, ranging from neutralized Taliban to a good health care system, a good education system, social stability and economic growth. Of course this reinforces the first trend since it requires actors that are able to address such diverse tasks as conducting Security Sector Reform and Disarmament, Demobilization and Reintegration programs.

Thus current and future missions can increasingly be characterized as complex endeavours, and there is growing recognition that traditional military approaches, in particular for command and control, are no longer adequate. Since dealing with complexity of both the environment and the coalition of actors is a main requirement in order to

be successful, the traditional paradigm of planning, optimizing, organizing and controlling is less and less suitable in these missions. New approaches have to deal with less predictable and more rapidly evolving environments.

We have previously argued that these complex challenges require our armed forces not only to be effective, integrated, adaptive, deployable, and sustainable, as has always been necessary, but now also to be able to support organizational learning to a far greater extent than has previously been achieved, and in particular, to cultivate all the dimensions of adaptivity described in DSTO's Conceptual Framework for Adaptation² in order to be able to improve and maintain a high level of effectiveness as situations and their contexts rapidly, and often unpredictably, change.

In this paper we explore what this means in more detail, and how the desired degrees of adaptivity can be developed. We examine in detail the distributed learning processes that are necessary to foster a learning culture throughout a defense organization, and at every scale of the organization.

A particular focus given the current high operational tempo, is how the organization can best extract lessons from deployed operations and training exercises, explore, refine and assess these lessons and implement them in an appropriate way.

As a first step, in Section 2 we review the space of possibilities for learning and adaptation that follows from comprehensive application of the Conceptual Framework for Adaptation. Our approach, which we term the Adaptive Stance, is then described in Section 3.

In order to situate our approach in the existing organizational learning literature, and to relate our arguments to others' perspectives, we briefly review a few key concepts from selected works in Section 4.

We then develop the application of our approach to adaptive organizations and organizational learning in Section 5. Every defense force already has many learning processes in place, but there is generally much scope for further improvement. We draw on our respective experiences with our own defense organizations in Sections 6 and 7 to illustrate the extent to which the concepts we present are already being implemented, and the opportunities for more effective or more comprehensive exploitation.

Finally in Section 8 we summarise and make some concluding remarks about the challenges of learning to be adaptive.

2 Being Adaptive – the space of possibilities

What does it mean to be adaptive?

At its core, adaptation is the iterative execution of a basic cyclic algorithm:

variation → interaction → feedback → selection → (repeat)

such that those variations that tend to increase success (assessed by the feedback from the interaction) are selected (retained) and those that decrease it are selected against (discarded).

The changes that are continuously incorporated into the system amount to encoding informationⁱ in a way that modifies the future behavior of the system. As a result, an adaptive organization has the ability to improve its success in a given context and to maintain success when the context changes.

A full discussion of the theoretical underpinnings of adaptation is beyond the scope of the current paper, but it should be noted that being successfully adaptive is not trivial, and that when the environment is sufficiently challenging, the system or organization will in general need to be adaptive not just in limited specific ways, but throughout the design space implied by the principal dimensions of our Conceptual Framework for Adaptation, i.e.:

- at a number of scalesⁱⁱ (from individuals, through dynamic teams, teams-of-teams, and enduring groups of various sizes, up to the whole organization and the enterprise within which the organization acts),
- in all the relevant outcome dimensions:

ⁱ The term *information* is used here in a very generic sense – it is not necessarily symbolic representation, it can also include the fact that system properties that result from the selection process carry implicit information about what worked well in the context in which the selection occurred.

ⁱⁱ A scale is determined by both the scope of what is considered (which gives the maximum range of effect that can be seen at that scale), and the level of detail of the description (which specifies the types of interaction that can be seen at that scale)

- continuous *improvement in effectiveness* of every success-relevant function, at every scale (eg better tactics in the field, better asset management in the barracks, better organizational architecture etc, where 'better' is judged by impact on overall high-level success);

plus the four Classesⁱⁱⁱ of adaptation that enable robustness to various internal and external changes:

- *Responsiveness* to unexpected threats and opportunities,
- *Resilience* to damage and shocks,
- *Agility* in changing strategy and posture when significant changes in the perceived and/or actual, situation call for it and
- *Flexibility* in dealing with unexpected future operational contexts by reconfiguring structure and capabilities to do different things, under different sets of conditions; and

- at each of the five Levelsⁱⁱⁱ of adaptation, which enable:

Level 1 *adaptive action* in the world (→ context-appropriate action within existing system capabilities),

Level 2 *learning* (→ improved system capabilities in sense, decide and act functions),

Level 3 *learning-to-learn* (→ improved ability to adapt i.e. in how the adaptation algorithm is implemented),

Level 4 *defining success* (→ improved alignment of adaptive processes to overall organizational success), and

Level 5 *co-adaptation* (→ improved own system-of-system design and improved anticipation of others' adaptive responses to our own changes)

Level 1 changes what the system is doing in its interaction with its environment. This is where success or failure outcomes are generated. Decisions made at this level are action decisions – their primary intent is to influence the development of the situation.

Levels 2-5 on the other hand can be thought of as addressing the design of the system. The intent of decisions made at these levels is to impact on what future action and design decisions are going to be possible or how they are made. Level 2 directly changes the system's design by changing its sensing, decision and action capabilities, while Levels 3 and 4 target the system's adaptive properties. Level 5 targets the design of the larger system within which the system of interest is embedded, and its 'internal model' of other adaptive entities in its environment.

But exactly what is adaptation? It obviously involves change, but it is more than just change in response to a changing environment. A rock that heats up as the day gets warmer is not adaptive. Neither is adaptation just self-initiated change. The breakdown of an unstable molecule is not adaptive. These examples lack the two defining features of adaptive change:

- [a] the existence of an *internal yardstick* for judging variations for their impact on success or fitness^{iv}, and
- [b] the *encoding of information* into the system, i.e. the adaptive changes, as a result of the selected variations.

The encoded information is then used by the system in its subsequent behavior. The changed behavior will tend to increase its success as long as what was learned in the previous environment is still relevant. Because both the system and its environment are dynamic and evolving, there is no guarantee that this will be the case. A successful adaptive system therefore repeatedly seeks evidence to test the continuing utility of its adaptive changes.

In addition, adaptation requires

- [c] the ability to produce *variations* in aspects of the system – this is the raw material for selection to act on;
- [d] the ability to produce success-relevant *feedback* about the variations – required for success-linked selection – usually from realworld, or internally modelled, interaction between the varied system and the environment;
- [e] *selection* – this includes not just the use of the feedback to assess variations for their potential to aid success, but also the implementation of the selection outcome (i.e. reinforcement and propagation of selected variations and elimination and suppression of discarded variations); and

ⁱⁱⁱ see reference 2 for fuller discussion of the classes and levels of adaptivity.

^{iv} *Fitness* is a technical term which refers to how well-fitted the system is to achieving success in its environment.

[f] *iteration* – this is necessary for two reasons. Firstly, in a complex situation it is not obvious how to be successful, so we have to learn from many adaptive cycles in order to create the adaptive changes that bring about the successful outcomes we seek. Secondly, the environment will keep changing, so to maintain success, an adaptive system can never rest on its laurels.

These are the basic properties of adaptive processes that we need to look for if we want to recognise adaptation happening in the systems of interest to us, if we want to examine how they are working and look for ways to improve them, and if we want to foster new ones where they are needed.

There are many options for how the elements of the basic algorithm are implemented, for example whether variations are produced randomly (as in natural evolution) or whether they are biased or directed in some way (as in human learning), whether the adaptive cycle is being executed within a single adaptive system that tries one variation after another (eg how a child learns to talk) or whether it is operating in a population of systems, each of which is a simultaneous experiment with a different variation (eg how genetic algorithms work).

There are many more aspects of adaptation where choices have to be made, for example, to do with how each of the properties [a] to [f] are implemented. Furthermore, when we add the dimensions implied by our conceptual framework for adaptation, we have a very large number of parameters that have to be chosen to specify a particular instance of adaptation.

Clearly, the design space for adaptive processes is vast, but only an infinitesimal fraction of those possible designs are potentially useful. Adaptive processes with randomly chosen design parameters are therefore almost certain to be useless. Even intelligent and careful human choices are likely to be problematic because of the complex interdependencies of many parameters, stemming from the details of how the properties that they determine relate to other aspects of an adaptation process. However evolution - itself an adaptive process - is capable of overcoming these odds and developing adaptive mechanisms that are effective, through incremental improvements in design over many generations of large populations.

What this means in practice is that if we wish to learn to be adaptive in new ways, or to greater extents than previously, we cannot expect to simply decide how we think it should be done, put it in place and expect it to work well. In most cases, we will also have to use an adaptive process to develop our new adaptive abilities to the level of effectiveness that we seek. This is the rationale behind Level 3 of adaptation (learning-to-learn, or evolving the ability to adapt) described above in our Conceptual Framework for Adaptation.

As its title implies, the main focus of this paper is this Level 3 *Learning to be Adaptive*, because understanding how to use it gives an organization the ability to improve every other aspect of its adaptive properties, and therefore ultimately, every aspect necessary for its success.

In summary, the Conceptual Framework paints a large space of possibilities for an organization to exploit adaptivity, and in particular, Level 3 addresses how we can enhance organizational adaptivity and learning across the entire space. These are the keys to *Learning to be Adaptive*.

3 The Adaptive Stance

The foregoing sections are quite abstract, and become even more opaque for the non-specialist if we add the next level of detail about actual parameters and the complex relationships between them. If we hope to produce insights that are practical and can be confidently applied by large organisations such as our defence forces we need to convey the key insights in a way that is readily appreciated and implemented by a broad audience.

The Adaptive Stance is an attempt to operationalize the imperative to be adaptive and to embed it in a familiar military context, where the many existing strengths of military thought can be acknowledged and built upon, and new ideas can be understood in relation to them.

The Adaptive Stance represents a convergence of thinking from two very different origins – one is the detailed conceptual understanding of adaptation sketched out here, and the other is several decades of empirically-based⁶ and theoretically-grounded³ work on complex decision-making by Professor Dietrich Dörner at the University of Bamberg in Germany. Dörner's work will be discussed in the following section, where it will be evident how his discoveries and insights are incorporated into the Adaptive Stance. Here we just acknowledge his work as a key source of insight and empirical support.

Basically, the Adaptive Stance is an intellectual stance that creates the preconditions for being adaptive for individuals, teams, and larger groups throughout an organization such as a defense force. In a very important

sense, the Adaptive Stance is the necessary complement of Mission Command^v. What we mean by this is that it both depends on, and is essential for, Mission Command. Neither will work without the other. Mission Command describes how orders should be *given* to enable those on the receiving end to use their capabilities, initiative, and local knowledge to advance command intent. Conversely, the Adaptive Stance describes how Mission Command should be *received* and how to make best use of the autonomy and responsibility it confers.

At an individual level, the Adaptive Stance embodies the military ideals of initiative, flexibility, resilience, integrity, mental toughness, cool-headedness, and objectivity and includes the following personal qualities:

- *Ambiguity tolerance* – the ability to resist the urge for closure and certainty;
- *Openness to learning*:
 - accepting the possibility of being wrong, letting go of having to be right;
 - resistance to loss aversion and commitment bias^{vi}: not falling in love with one's own ideas;
 - accurate persistent awareness of one's assumptions and hypotheses;
 - simultaneously entertaining the possibility of alternate versions of one's assumptions and hypotheses;
 - continuously seeking ways to test them and being prepared to revise them as a result;
 - willingness to try new ideas;
 - whenever an *explicit* prediction is made, being willing to observe the real outcome when it transpires and to objectively assess what can be learned in order to improve future predictions and to gain a more accurate sense of the quality of one's predictive ability; and
 - doing the same with *implicit* predictions, by realizing that every decision or action taken contains an implicit prediction, and making those predictions explicit;
- An ingrained habit of thoughtful *self-reflection* about the effectiveness and appropriateness of one's beliefs, actions and decisions, and ever-present consideration of the question: "how would I know if I was wrong about this?"
- *Supporting others' learning* by appreciating that it is much more important for them to be prepared to be wrong so as to be open to learning, than to feel that they always have to be right (which would require them to either be risk-averse or in denial); therefore 'decriminalising' others being wrong, making it ok for them to acknowledge when they make mistakes or are proved wrong.

These qualities and behaviours massively increase the quantity and quality of learning by leveraging the opportunities inherent in every action and decision.

Although we have described the Adaptive Stance at an individual level, it is clearly a stance that would be difficult for an individual to cultivate in an organizational culture which was punitive and blame-oriented, and which insisted on unattainable standards of performance. To empower the individuals in an organization to adopt the Adaptive Stance it is necessary for their senior leaders to lead the way by example, thus demonstrating that the organisation really does value adaptivity and learning for tomorrow more than it values a perfect score for today.

It is also a stance that requires some autonomy – clearly it would be difficult to practise it in an organization which demanded conformity and used prescriptive command. Such an organisation would be incapable of utilising the vast learning and adaptive potential of its members.

Similarly Mission Command would be disabled by the absence of an Adaptive Stance, which equates to a stance of waiting to be told what to do, following orders without question, assuming others know what they're doing, and not taking responsibility.

At higher scales: the Adaptive Stance can also be adopted at higher scales than an individual. For example, an organization that adopted an Adaptive Stance would be open to the possibility that any element of its hardware and prized codified knowledge (in the form of rules, procedures, tactics, doctrine etc) and its operational knowledge (objectives, plans, situation awareness pictures etc) might be wrong in some ways, or in some

^v "Mission command is a command approach that is based upon the exercise of local initiative within the framework of command intent. This is enabled by an appropriate delegation of authority and responsibility that allows subordinate commanders the latitude to plan and conduct operations based upon their understanding of the local situation." Stewart. K. *Mission command: Elasticity, equilibrium, culture, and intent*. Technical Report DRDC Toronto TR 2006-254 November 2006

^{vi} **Loss aversion** refers to people's tendency to strongly prefer avoiding losses to acquiring gains. **Commitment bias** describes the phenomenon where people justify increased investment in a decision, based on the cumulative prior investment, despite new evidence suggesting that the decision was probably wrong.

circumstances. If it was important to know, it would then deliberately use some of its resources to look for evidence of being wrong, and revise its knowledge as a result.

It is not easy for a larger entity like an organization to cultivate the corresponding Adaptive Stance qualities at the scale of that entity. Effectiveness in pursuing a given course of action may partly depend on the level of commitment to it, which constant questioning may undermine. It may be better in that case to dissociate responsibility for execution, from responsibility for questioning and looking for contrary evidence.

Across different scales: We cannot fully discuss nor resolve all the issues in taking an organisational Adaptive Stance here, but there is one example where the adaptation and learning of the individual and the organization intersect, and considerable learning potential results for both.

In the table below we illustrate all the possible combinations of an individual’s action or decision and the apparent outcome. Assume that the ‘rightness’ of the decision or action in the circumstances can be judged by a Subject Matter Expert who is familiar with all the organization’s codified and operational knowledge. The outcome can similarly be judged as catastrophic, not what was sought (wrong), or what was in fact sought (right). Of course the individual’s action is not the sole determinant of the outcome so we expect all the boxes to be populated.

Individual decision or action \ Outcome	“Unacceptably” wrong	“Acceptably” wrong	Right
Catastrophe	<p>Sanctions or punitive Measures</p>	<p>Learn about context. Learn about the boundaries of what is/isn’t acceptable</p>	<p>DON’T SCAPEGOAT!! Review boundaries between “wrong” and “right”. LEARN RESILIENCE Learn about complex dynamics that led to outcome</p>
Wrong	<p>Sanctions or punitive Measures</p>	<p>Corrective measures (individual learning)</p>	<p>DON’T SCAPEGOAT!! Review boundaries between “wrong” and “right”. Improve decision process and support. Learn about complex dynamics that led to outcome</p>
Right	<p>Review how ‘unacceptable’ is defined. Sanctions or punitive measures</p>	<p>STOP BLAME GAME “near misses” Learn about tolerances, and robustness of processes. Learn about complex dynamics that led to outcome</p>	<p>Confirm what is already known, or guessed</p>

Table 1 An individual action or decision can be judged by the organization according to its codified knowledge, as having been the right choice in the circumstances, or not (either ‘acceptably’ or ‘unacceptably’ so, in the latter case implying serious consequences such as court-martial). The consequences of the decision or action can be catastrophic, wrong (not what was wanted), or right (what was wanted). Because the individual’s action is generally not the sole determinant of the outcome in a complex situation, every box in the matrix can be populated. See text for discussion.

The boxes on the diagonal represent those cases where the organization's expectation is met – so the individual's behavior is not creating a learning opportunity for the organization here (this is an oversimplification for the sake of the point being made). However the center and upper left boxes do represent learning opportunities for the individual – the organization will teach him what they expect of him. The bottom right hand box reassures both the individual that he did the right thing, and the organization that its judgment of the correctness of his action is also correct.

The interesting boxes are the yellow-shaded off-diagonal ones because here the outcome does not match the organization's expectations, so there is the possibility of organizational learning.

When the individual has done the 'right' thing according to the organization's knowledge at the time, it should not turn around and pillory him if the outcomes turn out to be unsatisfactory or worse. Blaming the individual is a natural reaction, but very damaging for all concerned because it precludes organisational learning, and erodes personal confidence, goodwill and trust in the organisation. The learning opportunities relate to why the unwanted outcomes were produced and how with hindsight, they might have been avoided, and whether the codified knowledge that judged that action as 'right' before the outcomes were produced, needs revision in the light of what happened. These are rich and valuable learning opportunities for the organization in both operational knowledge and codified knowledge. These opportunities are denied to an organization that has a scapegoating culture.

The bottom left box is an interesting case. If a successful outcome results from an individual's action that is deemed unacceptable, the organisation has to decide if the judgment of "unacceptable" still stands because it is based on fundamental values or principles, or whether it was based on a more pragmatic criterion which might be revised in the light of what happened.

Finally, the most important box is the middle of the bottom row. This is the case where the individual has not completely observed the organization's expectations but nevertheless a good outcome has been obtained. These are the *near misses*, where mistakes were made but there was no serious price to pay.

We expect that there will be huge numbers of such incidents throughout the organization, for the simple reason that we are human and we make mistakes. Near misses are a hugely valuable learning opportunity both because there are so many of them (and therefore they collectively explore a very large space of possibilities), and because they are in a sense 'free experiments' which carry potentially valuable information about tolerances and robustness of processes, and failure modes of our systems.

But these lessons are not available to an organization which does not foster an Adaptive Stance culture because if no adverse consequences force him to, the individual will not be motivated to report a near miss and incur blame and criticism for what he did wrong, when he can instead bask in his successful outcome.

Finally there is another important cross-scale opportunity for individual and organisational learning in complex operations such as our forces are currently engaged in. These situations involve a great number of diverse individual agents and groupings at various scales, and it is very difficult to identify them all, and establish the connections between them, and their multiple and shifting allegiances and networks.

Understanding this complex human terrain is crucial for successful interventions, be they peacekeeping, reconstruction, counterinsurgency or humanitarian missions, but it is simply too complex, too dynamic, and generally too obscure for the traditional approach reliant on a small number of individuals in the S2 and S3/S5 roles, supported by intelligence, surveillance and reconnaissance systems.

A complex systems perspective^{vii} suggests that the development of sufficient understanding of this complex human terrain calls for an approach with a commensurate degree of diversity – a far greater degree of diversity than is available in the traditional approach.

But the needed diversity can be found in the many individuals that comprise the deployed force. This diversity needs to be harnessed more effectively to support the necessary organizational learning about the situation. Each individual will observe a different small part of the total situation and will filter and interpret it differently based on his unique history and knowledge.

The organization needs to learn how to learn from all these individual learnings. There are of course a number of challenges in achieving this, not least, the challenge of learning to not just tolerate diversity in the force, but to foster and embrace it as a precious resource.

^{vii} In particular, Ashby's law of Requisite Variety <http://pespmc1.vub.ac.be/REQVAR.HTML>, and its generalization to complex systems, Bar Yam's Law of Multiscale Requisite Variety, Y. Bar-Yam, *Multiscale Variety in Complex Systems*, Complexity 9, 4, 37-45. 2004.

4 Other Perspectives from the Literature

There have been many approaches and schools of thought in the literature about learning organizations and adaptive organizations. We do not attempt an exhaustive review here, but we do wish to acknowledge some key sources that have contributed to our thinking, or whose independent analyses reinforce or present alternative views of the principal elements of our arguments.

Probably the best-known work on learning organizations is *The Fifth Discipline*, by Peter Senge⁴. In this landmark book, Senge argued that businesses needed to become learning organizations because their environment was becoming more complex, dynamic and globally competitive, and so traditional reductionist approaches were no longer adequate.

Senge described five dimensions or disciplines that he claims are vital for building organizations that can learn:

- *systems thinking*, – comprising two aspects: seeing interrelated connections instead of linear causes and effect chains and seeing the dynamics of the system rather than static snapshots;
- *personal mastery*, – continually clarifying and deepening personal vision, focusing energy, developing patience, and seeking objectivity. This discipline helps people realize the results that matter most deeply to them and become committed to their own lifelong learning;
- *mental models*, – influence how we understand the world and how we make decisions. The discipline of working with mental models starts with learning to surface our mental models and hold them rigorously to scrutiny. It includes the ability to carry on “learningful” conversations that balance inquiry and advocacy, where people expose their own thinking effectively and make that thinking open to the influence of others;
- *building shared vision*, – in response to surfacing these mental models, involves the development of shared “pictures of the future” that foster genuine commitment and enrolment; and
- *team learning*, – addresses the fact that collective IQ of a team is often lower than the lowest individual IQ. Team learning start with dialogue, with members suspending their assumptions and entering into genuine “thinking together”, avoiding the usual competitiveness and defensiveness of discussions. The aim is a free exploration within the team, allowing it to discover insights not attainable individually. The ability to recognize and surface patterns of interaction in teams that undermine learning can accelerate learning.

Each of these is critical for the others’ success so they need to be developed as an ensemble, and together they contribute to the development of three core learning capabilities:

- fostering aspiration,
- developing reflective conversation, and
- understanding complexity.

Systems thinking - the fifth discipline - provides the integrating context for the other four. Feedback is a central concept in systems thinking and leads to recognition of system archetypes that recur in many different kinds of system. Examples described by Senge include “a balancing process with delay”, “limits to growth”, “shifting the burden”, “eroding goals” and “escalation”. These archetypes show us for instance that each action is both cause and consequence, and that small countering actions can sometime be far more effective than strong reinforcing actions. Understanding and exploiting these archetypes can help organizations deal more effectively with the problems they encounter and therefore enable better learning.

Otto Scharmer is another organizational learning pioneer. He worked with Peter Senge and delivered award winning leadership programs to client organizations around the world. In his book *Theory U*⁵, he claims that most institutions and societies are unable to deal with the challenges of today’s complexity and dynamics and are therefore trapped in producing results that nobody wants. Scharmer proposes what he calls the U-process to enable teams and their leaders to be more effective. Complementary to learning methods that are based on learning from the past (e.g. after action reviews), Scharmer introduces the notion of “learning from the future as it emerges” and defines five phases that are necessary to accomplish this:

- Co-initiating: build common intent among the team members. This requires team members to dialogue without immediate judgement and to avoid filtering information through old knowledge and habits.
- Co-sensing: recognize collectively and across boundaries what the emerging opportunities and the key systemic forces at issue are. This requires the ability to sense the whole complex environment and to realize that the group itself is part of it.

- Presencing: a blending of the words presence and sensing. This is the phase where the team retreats and reflects and creates the conditions to recognize an emerging future allowing them to learn from this future. Again, it requires to get rid of old views and principles that are not relevant.
- Co-creating: Explore the emerging future from the previous phase by experimenting
- Co-evolving. Design the organization and make it work, making sure that it is in line with the total environment the group or organization exists in.

Scharmer connects 24 principles and practices to the U-process. Together, they constitute what he calls a Social Technology that will help teams and their leaders to realize the best possible future. We touched on a few of these principles like observing without judgement and practicing dialogue.

Theory U is complementary to, and expands on notions of Peter Senge's work like mental models, building shared vision and team learning. Although his language is often rather esoteric, his work is based on actual experience in companies around the world.

By contrast with Senge's and Scharmer's clear focus on organizational behaviour, Dietrich Dörner addresses how individual human cognition and decision-making is limited in its ability to deal with complexity, and the consequences of these limitations. He argues that in a complex situation, because of the interdependence of the elements, it is generally not possible to affect just one aspect and no other. Every event produces multiple interacting waves of consequences through many different pathways. This is a source of difficulty for human intervention in the situation because it is likely that decisions will cause many unintended side effects and long-term repercussions.

But these are not our only problems. In his important book⁶, *The Logic of Failure*, Dörner describes a series of experiments with human subjects interacting with a computer-simulated microworld which has complex underlying dynamics. Forcing the players to play long enough for the longer-term unintended consequences of their earlier actions to confront them, he finds that most people, in spite of some early successes, rapidly descend into dysfunctional behaviours and the microworld ends up in catastrophe.

But interestingly, a small minority of players do in fact figure out how to sustainably engage with the microworld, in spite of encountering some setbacks. Dörner carefully observed the behaviors of these two groups and found many systematic differences which accounted for their different outcomes.

Some of the majority behaviors can be understood as stemming from our evolutionary legacy, where we developed heuristics that worked well enough in the environments in which we found ourselves, but which now are woefully inadequate for the level of complexity we face.

Examples include linear extrapolation of processes which in fact are not linear, oversteering in the presence of long delays between cause and effect, over-generalization, and paying too much attention to immediate local problems instead of trying to see the whole picture.

A very significant factor in poor performance was the well-documented *confirmation bias*^{viii}, which he found was taken to the extreme of *perceptual defence*^{ix} by the poorly-performing majority when they were unable to avoid bad news. They were also susceptible to methodism^x, loss aversion, ritualistic behaviors, oscillating between over-planning and major impulsive decisions, becoming engrossed in a pet project while ignoring the deteriorating situation, and failing to develop abstract goals into concrete objectives. It is not difficult to see why taken together, these behaviors amount to an almost inescapable "*logic of failure*".

By contrast, the behaviors of the minority of players who were able to achieve longer-term success are very instructive for our present purposes. They amount to taking an adaptive approach, looking at the situation as a whole, observing patterns in space and time, developing a set of interrelated specific goals, making their conjectures explicit and testing their consequences, monitoring the execution of their actions, looking for and seeking to learn from unexpected outcomes, and being prepared to revise their mental models and their strategies as a result. A significant finding was that the strongest predictor of which players would be in the successful minority was their level of ambiguity tolerance. Most importantly, these players reflected on their actions and on their thinking and were therefore able to learn. The poorly performing players avoided reflection except when an occasional temporary success gave them the opportunity to congratulate themselves. Needless to say, they learned very little.

^{viii} *Confirmation bias* refers to the tendency to only look for information that supports one's view of the world

^{ix} *Perceptual defence* refers to the tendency to deny or marginalise information that contradicts one's view of the world and to find ways to shift blame or responsibility for bad news to others.

^x Methodism refers to excessive adherence to systematic procedure, or the tendency to persist with an approach which worked once in the past, even though it no longer does.

One can see many parallels between Dörner's successful behaviors, Senge's five disciplines and three core learning capabilities, and the principles and practices of Scharmer's U Theory. All emphasise the central importance of systems thinking, developing goals, mental models, self-reflection, awareness of bias and suspending judgment.

The recent business and organizational science literature is replete with metaphors drawn from complexity, biological systems, and adaptation in particular, but one author that really stands out for a detailed and conceptually rigorous treatment of the economy as a complex adaptive system is Beinhocker⁷. His analysis leads inexorably to the pre-eminent requirement of being adaptive in quite specific ways and most of his insights are as applicable to defence enterprises as they are to business.

In brief, he defines *Physical Technologies* (PTs) as methods and designs for transforming matter, energy and information from one state to another in the pursuit of a goal or goals, and *Social Technologies* (STs) as methods and designs for organizing people in the pursuit of a goal or goals. Business Plans are then built up in a modular way from atomistic PTs and STs, and connected by the glue of strategy, which he equates to hypotheses about what combinations of modules will be successful (profitable) in a given environment.

The conventional view of strategy he argues, is inherently forward looking (one must know where one wants to be in the future) and is about creating a plan for getting to that desired future state and *committing* to a course of action defined by that plan. In fact, what makes decisions strategic in his view is that they are difficult or costly to reverse once made. The unexpected twist is that this conventional view hinges on two assumptions which are both wrong:

1. One can make confident predictions about what strategies will be successful in the future. *No, one cant.*
2. One can make strategic commitments that will result in sustainable competitive advantage. *No, one cant - all competitive advantages are temporary, rare and shortlived.*

Success then is being able to repeatedly bounce back from disadvantage and once again find temporary competitive advantage. The data he presents shows that most companies including those that are currently seen as very successful, are poor at this and most of the innovation in the economy is driven by turnover of companies in the market, not by innovation within existing established companies. In other words, the market is a competitive evolutionary environment in which Business Plans are the competing entities that get selected. Even the best companies are unable to keep up with the pace of adaptation in this evolutionary environment.

The question naturally arises: is it possible to do better? Can more adaptable companies be designed than those we have today? Can the problem of prediction be avoided by developing a more robust and adaptable approach to strategy? Beinhocker's answer is yes, and to be adaptive, strategy should be a "portfolio of experiments" rather than a single hypothesis to which all our resources have been almost irreversibly committed. To be effective in enabling adaptive strategy these experiments require a context of collective understanding of the current situation and of shared aspirations, prepared minds, a process for generating a portfolio of diverse plans which are spread across the landscape, a selection environment that mirrors the external environment in essential ways, and processes to amplify successful plans and eliminate unsuccessful ones.

Moreover, every plan must have clear thoughtful measures of success, and a plan for collecting data in as close to real time as possible. The measures should include milestone and operational measures as well as ultimate performance metrics to provide feedback for evolutionary selection, especially in the early stages. In other words, every plan needs its own customised Balanced Score Card⁸ (BSC), which he defines as a set of performance metrics designed to provide visibility into value creation in a specific business.

Beinhocker's arguments and data provide strong support for our approach, in particular for our ideas about adaptive organisational design and adaptive strategy which will be discussed in more detail in the following section.

Another important group of authors whose work is relevant to organizational learning are those who have studied how system catastrophes develop, and how the so-called High Reliability Organizations (HRO) manage to avoid their fair share of them – as it turns out, and not surprisingly, through deliberately adopting a mindful and adaptive stance.

Weick and Sutcliffe⁹, leading proponents of the High Reliability school, developed their approach by studying organizations that operate in high uncertainty environments where there is significant potential for errors to unleash consequences that can lead to disasters. They identified a number of such organizations that consistently delivered higher performance and safety than might otherwise have been expected, and found that

these HROs have different structures from other organizations, and also think and act in a different way, which they describe as mindful organizing for the unexpected as well as the expected.

They argue that through long periods of uneventful routine we may become blind to telltale signs that something unexpected is brewing, permitting potentially dangerous events to develop to the point of becoming unmanageable. HROs practise mindful organizing to maintain resilience in such situations, through two avenues:

- anticipation, which focuses on averting the unexpected event, and has three elements:
 1. *Preoccupation with failure*: To avoid failure one must look for it and be sensitive to early signs of failure.
 2. *Reluctance to simplify*: Labels and clichés can stop one from looking further into the events.
 3. *Sensitivity to operations*: Systems must be understood as dynamic and nonlinear in nature, not as static and linear.
- and containment, which focuses on mitigating consequences after an event occurs, and has two elements:
 4. *Commitment to resilience*: The organization must maintain function during high demand events. Resilience has three components:
 - i. Absorb strain and preserve function despite adversity
 - ii. Maintain the ability to return to service from untoward events
 - iii. Learn and grow from previous episodes.
 5. *Deference to expertise*: This includes deference downward to lower ranking members of the organization if they possess the needed expertise.

By contrast, studying major catastrophes in complex systems rather than exceptional safety records leads to a less sanguine view. Charles Perrow¹⁰ coined the term ‘normal accidents’ in the title of his seminal work, to denote the concept that such accidents were to be expected in tightly-coupled and complexly interactive systems reliant on high risk technologies. In Perrow’s view, the difference between his Normal Accident Theory and the High Reliability Theory is that the latter argues that by implementing their approach, such accidents can be virtually eliminated even if the system is interactively complex and tightly coupled, while he believes that “*no matter how hard we try we will still have accidents because of intrinsic characteristics of complex/coupled systems*”¹¹

James Chiles¹² adds some weight to this position with vivid accounts of how many such disasters have come about in complex situations. But the details in his case studies also bolster the view that in most cases, the organisations responsible could have averted the catastrophes had they developed a learning and adaptive culture.

With respect to our present goals, what this group of authors show us are examples of successful learning organizations (the HROs) and their behaviors, and also examples of organizations that failed to display those behaviors during the development of situations that in fact led to catastrophes. All the data adduced support the view that there is some correlation between taking an adaptive stance, and reduced likelihood of potentially serious system failures actually becoming catastrophic. The HRO data support the contention that serious failures can be averted by taking an adaptive stance, while the studies of actual disasters offer circumstantial evidence that in many cases they might have been averted by taking an adaptive stance.

In summary, what we find in this brief survey is repeated confirmation from independent perspectives of the need for systems thinking and for taking an adaptive approach to managing or influencing a complex organization or situation.

The importance of clarity of vision about our goals, and the importance of developing an adequate understanding of the system are also recurring themes. All these are entirely consistent with our approach. In particular, the Adaptive Stance described in the previous section was devised not only from our study of adaptation but also from Dörner’s work on the cognitive limitations of humans in complex decision-making, and incorporates an aspirational description of the essential characteristics of Dörner’s successful players.

What we believe we are able to add to this rich literature is a much more detailed and nuanced understanding of how to implement an adaptive approach, and how to learn to be more adaptive, based on our Conceptual Framework for Adaptation. We develop this understanding in the next section.

5 Adaptive Organizations

The argument that our organizations need to be more adaptive occasionally elicits a response that they already are, because organizations are composed of individuals and individuals are naturally adaptive. We claim that an adaptive organization is much more than just an organization in which the individuals are adaptive, and moreover, that the natural adaptivity of their individual members can be significantly modified by the organization they are in – both for the better and for the worse.

Drawing on the foundations laid in the earlier sections, we discuss now the ways in which an organization can empower, rather than reduce and constrain, the adaptive potential of its members, and in addition, where and how it may be adaptive at scales above that of the individuals within it.

To do this, we first need to clarify what aspects of an organization can or should be open to adaptation.

Let us consider a generic organization which we assume has both implicit and explicit measures of success and failure. These articulate why the organization exists, what roles it performs in its environment, and the positive and negative expectations of its major stakeholders.

The organization also has many internal and external functions – in various dimensions, at various scales, over various timeframes. These functions describe how the organization operates. The net intended effect of all these functions being performed is to maintain the existence and health of the organization, to deliver on its measures of success and to avert producing measures of failure.

Let us assume that the intended outcomes of the functions are articulated in a set of measures of effectiveness, while how they operate is captured in measures of performance, and measures of inputs.

The set of functions, the relationships between the functions, the ways (people, infrastructure and processes) in which they are implemented, the relationships between all these and the outside world, and the framework of measures from inputs to overall success or failure, together constitute the *design* of the organization. Obviously changes to any part of these elements will have impacts on how the organization functions and the outcomes it produces.

We now postulate that this set of elements can be logically arranged into four interdependent aspects of the organizational design:

1. The *conceptual design* or stratagem (based on conjectures about how success can be produced and failure averted in the environment)
2. The *operational design* (translates the stratagem into what the organization actually does, functions performed, relationships between them, relationships with external world)
3. The *system design* (the capability elements, infrastructure, people, roles, networks etc that can implement the operational design)
4. The *analytical framework of measures* (the observables that need to be monitored to track how well the above are working and to provide feedback for adaptive adjustments to them, i.e. a crystallisation of the stratagem and operational and systems designs at various scales)

We know that the complexity of the organization, and of the environment it is operating in, means that both are intrinsically going to have a multi-scale structure. So each of these four aspects of the organizational design must also exist at a number of scales (scope and level of detail).

Because our organization and its operation is purposeful, there are logical relationships between the scales.

At the top we have the entire picture of the organization and its environment. The overall measures of success and failure are at the top level of the analytical framework, and they describe in broad terms what the organization is expected to achieve. (In the bigger picture even these are conjectures about what will later be judged to have been of value to the external stakeholders.)

The top-level conceptual design describes, also in broad terms, the conjectures about how the organization expects to achieve its goals. It identifies the causal and influence pathways in the environment that it intends to utilise and the types of interventions it believes will produce the required effects. It also addresses links between those pathways and aims to not just minimise antagonistic interactions, but to combine mutually supportive elements into a stratagem that can exploit positive reinforcing and negative regulating feedbacks to achieve the best overall outcomes possible within the constraints of its resources.

At a similar level of detail, the corresponding system design identifies what capabilities are conjectured to be needed for implementing the stratagem, and the operational design makes conjectures about the high level functions they will perform.

The next scale develops more detail in each of the four aspects. But developing more detail means creating more information. Where does this information come from? The kind of information that is needed is more detail about what is going on in the environment, more detail about how the organization's own capabilities can be put together and how they will function, and so on.

We know that complexity means that complete understanding and predictability is not possible and that significant factors will keep changing. So every level of detail that is added to every aspect of the design is based on more conjectures, drawn from experience and judgment of course, but nevertheless still conjectures.

These conjectures are about what is going on in the current environment and how it will develop, what will be required eg what functions need to be performed, what kinds of relationships need to exist, how those functions should be implemented, what measures need to be monitored to provide feedback about the quality of execution and the outcomes produced and so on.

All these conjectures obviously depend to a greater or lesser degree on the quality of understanding of both the environment in which the organization is operating, and the organization itself, as well as on its overall high-level implicit and explicit objectives, and are moderated by what is actually feasible for it to do, given its resources and constraints.

The interdependencies of all these aspects means that a change – a new learning about, or a new development in – any one part may have consequences on any other. The table below illustrates some of these:

Impacts on Change here ↓	Understanding of own organization and environment	Conceptual (stratagem) and operational (functional) design	System design	Analytical framework of measures
Understanding of own organization & environment	Dependent aspects at same and other scales	What levers of influence exist on pathways to Success or Failure	Local conditions impacting on design	What feedbacks may be available
Conceptual (stratagem) & operational (functional) design	Other possible consequences of levers of influence	Dependent aspects at same and other scales	What actions need to be taken	What we seek to achieve
System design	What levers of influence we can exercise	What actions can be taken	Dependent aspects at same and other scales	What can be monitored
Analytical framework of measures	What the critical uncertainties are	What adaptive processes can be supported	What needs to be monitored	Dependent aspects at same and other scales

Table 2 *Illustration of interdependencies between the principal aspects of organizational design and the quality of understanding of both the organization itself and its environment. Note that we have combined the conceptual and operational designs for simplicity here, but in practice one would need to address both in more detail.*

It is essential therefore for success that the organization continuously and actively seeks to learn about its environment and about itself, and continuously co-evolves the four aspects of its design as it learns.

In other words, these are the aspects of an organization that should be open to adaptation, i.e. to being varied and then subjected to success-linked selection.

The relationships between these requirements and the levels and classes described in Section 3 are as follows:

Level 1 Corresponds to adaptive changes to execution within current capability envelope

Level 2 Adaptive changes to the elements of the system and operational design that deal with the sensing, deciding and acting functions needed at Level 1

Level 3 Adaptive changes to the elements of system and operational design that deal with the variation, interaction, feedback, selection and implementation functions needed at Levels 1 and 2

Level 4 Adaptive changes to the framework of measures

Level 5 Adaptive changes to the way all the elements of system and operational design are put together

Of the outcome classes, we single out Agility which here corresponds to the willingness to evolve the conceptual design, as the understanding of both the organization and of its environment, evolves.

Continuous improvement in effectiveness of all the functions is mainly focused on the operational design. Actually implementing the selected adaptive changes will certainly call on both Resilience and Flexibility, especially when an adaptive change near the top generates a large number of needed consequent changes throughout all the aspects of the organizational design.

So now finally we are in a position to be more precise about what we mean by an adaptive organization.

Being an adaptive organization, or a learning organization, means that the conjectural nature of all four aspects of its organizational design, at every scale, is explicitly recognised, and the organization deliberately takes an Adaptive Stance with respect to each of them.

Taking an Adaptive Stance means that for every important conjecture, contradictory evidence is actively sought, and acted upon when found, so as to evolve the organizational design to improve the fittedness of the organization to its roles in its environment.

How then can we help our organizations become adaptive organizations?

We have identified the aspects of the organization that need to be subjected to adaptation.

Taking each of these in turn, we first ask what processes already exist to allow them to be adapted, as the situation, or our understanding of it, changes. Then we examine each of these processes carefully to see how well it is working and where it could be improved.

Clues are provided by considering each of the six basic properties of adaptive processes [a] - [f] described in Section 2:

- The first, [a], prompts consideration of what criteria are used to judge whether a change option in our stratagem, or in our system design etc, is going to be an improvement or not.
- The second property, [b], directs us to consider how the result of an adaptive change is recorded in the system (and hence how effective it will be at changing the future behavior of the organization).
- The third property, [c], asks us what changes are actually possible to make, and related questions such as how many changes will be made at once, how frequently changes are produced etc – clearly the answers will delineate the range of possibilities that the adaptive process can explore.
- The fourth property [d] refers to the feedback necessary for adaptation, in other words, given our answers to [a], what is that can actually be observed about a proposed change, that can be evaluated by that criterion? And how will the feedback be produced? Are proposed changes to be experimented with in synthetic environments? Small scale field trials? or are they explored analytically by subject matter experts?
- The fifth, [e], asks how the result of evaluating the feedback against the criteria will be used to dispose of or to implement the proposed change. How reliable and effective is that process? How strict or tolerant is it?
- Finally, [f] leads to the question of how long a cycle takes, how costly they are and how frequently they can occur – again factors that have a direct bearing on the extent to which adaptation can explore the possibility space and find the desired improvements.

In other words, these six basic properties are the primary targets for variation when we are implementing Level 3 adaptation – i.e. learning to improve an existing adaptive process.

Similarly, we can use these same properties as a template for creating new adaptive processes where they are needed, and then again, over time and many iterations, for improving their effectiveness, through Level 3 adaptation.

There is much more that could be said about creating an adaptive organization, but we turn now to making a few more general remarks and connecting back to some aspects discussed earlier.

We know that adaptation relies on being able to get success-relevant feedback about the variations that are tried, and while modelling, simulation, wargaming and field experiments can all play a part, none of these can really reproduce the complex challenges of the real world, so in peacetime one has to be cautious about the lessons that can be drawn from such trials. However this is not the situation we have now – opportunities to learn and adapt abound in today's high operational tempo. Every operational tour provides many occasions to learn about what works and what does not. These immensely valuable experiences must be recognized and mined for all they are worth if the force is to keep evolving and achieving high levels of effectiveness in the rapidly evolving complex environment in which we now operate. When fully effective, such organizational learning represents a set of crucially important adaptive processes at the scales of the whole force, and at various unit and sub-unit scales.

On top of this learning from experience, the Armed Forces need to be able to apply Senge's generative learning, which addresses the outcomes that organizations, as collections of individuals, truly desire. Through the application of "art and disciplines" they must continually seek to discover and develop a shared vision of the organization, where it currently stands, what can be done to go from where they are now, to where they want to be, and what stops them from accomplishing that transition.

This process can be interpreted as an instance of an adaptive process since it focuses on the outcomes that would indicate success (the yardsticks for fitness), and calls for iterative execution of a closed loop of change – evaluate – select – implement, but rather than concentrating on adaptive changes to deal with contextual change ex post facto, generative learning focuses on creative shaping of the purposes and concepts that drive the organization. In our Conceptual Framework for Adaptation, this maps onto Level 4 (evolving our proxies for success and failure to correlate better with 'real' success and failure) and to applying all five levels of adaptation to the evolution of a stratagem for achieving success and avoiding failure.

The above discussion about how effectiveness is formulated and assessed is therefore critical to informing the property [a]. As for [b], where and how learned information is encoded can take many forms. Popular choices include publications, structural changes in organization, shared databases and incorporation into training material, doctrine and Standard Operating Procedures – but what matters is how well the system is able to use the encoded information to change its behaviour in ways that increase its likely success. The core of an adaptive process is always the cycle, [f], and the biggest pitfall in implementation for organizational scale.

The aspects described in this section are necessary points of attention to accomplish adaptive organizations. However, in themselves they do not provide the necessary techniques to make them happen or at most provide the process steps that comprise them. The work of Peter Senge and Otto Scharmer, briefly described in Section 4, (the five disciplines, the U process and the 24 principles and practices) provide a valuable collection of social methods to accomplish the aspects described in this chapter. The various teams as they consist in organisations at various levels are the building blocks for the adaptive organization in which those social techniques should be practiced. For instance let's take the point "*the measures of success and failure for the performance of the function (and rapidly-observable proxies for them) are clearly enunciated*". Applying and practicing the U process and the five disciplines can provide good methods for the team(s) dealing with the generation of these measures, making sure everybody understand how those measures are connected to the desired future, understand how they fit into a larger context, understand each other's underlying assumptions, building in moments of reflection, making sure there is a team learning process, etc. In the end this improves the chance of success that a team would end up with a sound set up measures, nevertheless realizing that those measures will have to be adapted regularly as the situation and / or the desired future changes.

6 Adaptation and Learning in the Dutch defense forces

Organizations around the world have institutionalized learning processes in their organizations. The Dutch force are no exception. The most eye catching processes are the After Action Reviews which are incorporated in daily operational tasks and the Lessons Learned processes which span different levels and departments. Although these learning processes will help to create an adaptive force (on different sales, levels and classes) and although adaptivity in operational teams and individuals have probably been a core competency since the beginning of the defence organization, no explicit initiatives have been examined or exploited in the Dutch forces

to increase adaptivity on a higher organisational scale. Nevertheless there are enough examples where Scharmer's and Senge's concepts and the adaptivity concepts like the adaptive stance are either positively or negatively encountered. Below we will give three examples of this.

1. The Dutch army is in the process to develop a new concept for a Command Post (CP). This end result of this design process will be a CP that is better suited to deal with complex endeavours using a comprehensive approach. The elements of this process are:
 - After a thorough group process to understand the requirements for the new CP, the new concept was constructed from scratch, instead of relying on small changes to the existing structures (co-initiating and co-sensing: learning from the future as it emerges).
 - Much attention was given to make sure that everybody understood each other's hidden assumptions, resulting in mutual respect to each others opinions and a high level of commitment to the transition process (co-sensing, surfacing mental models, team learning, team vision).
 - Subject Matter Experts and people with operational experience from both military and non-military organisations were invited to participate in the design processes. The process was facilitated to create the ideal creative conditions (presencing).
 - After an initial concept was chosen out of several alternatives, a set of experiments was designed and conducted with a full brigade staff to test the new concept. The experiments were and will be conducted in increasingly complex situations, giving the system the possibility to improve the concept in a number of iterations (co-creating and co-evolving).
2. The Dutch armed forces initiated a project to improve their learning processes. It was noticed that despite systemic collection of lessons learned throughout the army and despite dedicated Lessons Learned Offices, the effectiveness of the implementation of lessons learned is rather low. Instead of just paying attention to the lessons themselves, they are now paying attention to level 3 learning focussing on reasons that obstruct the learning process itself. Among other things, these obstructions are caused by the lack of a number of essential steps in their lessons learned loop that deal with 'generalizing' and 'testing' the hypotheses that are the results of observations. Also there is a cultural obstruction which is visible in the polishing of criticism as it moves up the hierarchy. It seems that the underlying reasons have to do with supposed negative influence on careers. This culture is opposite to the spirit of the adaptive stance which promotes for instance "Decriminalising others being wrong".
3. The Dutch Force Generation Processes, more specifically those that prepare rotations for the Task Force Uruzgan (TFU), pay a lot of attention to make use of the experience of previous rotations. Troops that have just returned from their deployment in Afghanistan are incorporated in the training process of the rotation following the rotation that took over from them. For instance, TFU-1 participated in the training of TFU-3, TFU-2 participated in the training of TFU-4, etc. Of course, rotations also have their regular Hand Over Take over processes to make use of the most recent experiences. It seems that the Force Generation learning processes are much stronger than the HOTO learning processes since it was recently discovered that the practices in the field developed into an 'uneven' way of working (TFU-1, TFU-3, etc.) and an 'even' approach (TFU-2, TFU-4, etc.). These relatively isolated approaches resulted in clear differences in culture, ways of working, preferred solutions, etc. There seems to be an early closure on ideas given during the force generation training processing, again contradicting the adaptive stance and the required openness Scharmer and Senge are promoting.

How should the Dutch defense forces move forward?

Increasing the adaptivity, as defined in all its dimensions, in today's missions, their military (parent) forces and their non-military counterparts, including their command and control and management functions, is offering a large potential and is probably the only way to create coalitions that are able to be effective in today's and tomorrow's complex endeavors. Although the Dutch military forces did not explicitly embrace the adaptive concepts described in this paper yet, we showed a few out of many examples that hint on the fact that more and more people within the defense organization recognize the benefit of those concepts. Recent presentations by Concept Developers within the Dutch army confirmed this. Realizing that an adaptive force is not something that can be build overnight and realizing that there is more than one single way to Rome, we would like to suggest to start with the enhancement of those processes that already had some successes on the road to adaptivity. The suggestion is to focus on the learning process and initiatives that occur and try to make them more aware of the full potential of the adaptivity and their accompanying learning concepts. In particular would we like to suggest to focus on the learning processes in current operations (fixing), the force generation process, the Hand Over Take

Over processes and the required openness in lessons learned derived from After Action Reviews. This should be accompanied with extensive training programs to the military leaders involved in those processes aimed at a change in culture where learning is even more centered than it is today. Although we realize that those leaders are not the only component of an adaptive army, neither are learning processes the only thing that matter, this angle seem to be the natural place to start. Another strand that offers opportunity is the development of the new army CP described above. This initiative, with heavy involvement of scientific support, offers an opportunity to create new processes that place adaptivity more at the center of Command of Control instead of the overly focus on planning, optimization and control.

Given the similarities between the Dutch and the Australian army and their operations, and given the experiences of the Australian Army and their scientific support it is important to continue the collaboration of the Netherlands and Australia.

7 Adaptation and Learning in the Australian Army

The Australian Army has been quick to adopt and implement insights from complexity science and adaptation theory, and in fact to partner with DSTO in further concept development, trialling and implementation. The last five years have seen several significant initiatives and achievements, and the pace of *learning to be adaptive* shows no signs of letting up for the foreseeable future. This impressive organisational Adaptive Stance is in large part due to the vision and commitment of several key officers and senior leaders, and their ability to convey that vision and inspire

A landmark development was the issue of **Complex Warfighting**, endorsed by the Chief of Army's Senior Advisory Committee (CASAC) on 7 May 2004 for use as the Future Land Operational Concept. This was followed in 2006 by the development of **Adaptive Campaigning**¹³ (**AC06**), Army's response to the challenges described in Complex Warfighting.

AC06 placed central importance on the need to embrace and foster adaptive properties to deal with operational uncertainty. Many of the essential elements of the Conceptual Framework for Adaptation were incorporated into AC06, but 'naturalised' into the terminology and context that its intended audience was familiar with. AC06 introduced the idea of an explicit 'adapt' into the usual act-sense-decide cycle (see , and developed operational definitions of the four classes. The concepts implied by each of the five Levels were included but not as an explicit conceptually related set. For example, Level 2 applied to sensing capability appeared as the injunction to "learn to see" what was important, while the intent of Level 3 was addressed by the discussion about the need to "learn how to learn."

More significantly than the actual phrases in the document, the implementation process that was put in place encouraged wide engagement in its ongoing development, leading to a major review throughout 2008 and the issue of a revised and much more extensive **Adaptive Campaigning** document, **AC09**, which replaced both **Complex Warfighting** and **AC06**. This was endorsed by the Chief of Army's Advisory Group (as it is now known) in April 2009. **AC09** has benefited from vigorous debate, extensive workshopping with the CAS research team in DSTO, and a wealth of relevant operational experience.

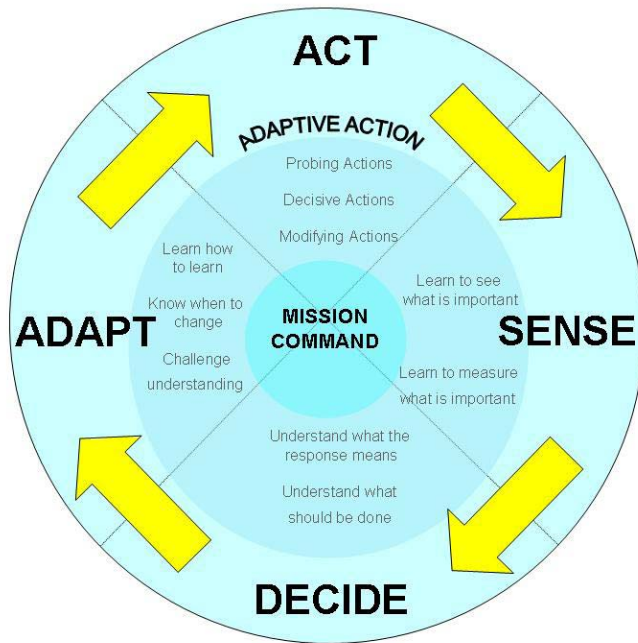


Figure 1 The Adaptation Cycle in the Australian Army's Future Land Operational Concept *Adaptive Campaigning*

Adaptive Army Initiative

The Adaptive Army Initiative (AAI) was launched by the Chief of Army in August 2008, based on the recognition that *“The success of Army in the conduct of contemporary (and future) operations, force generation and preparation will be largely determined by our capacity to learn lessons, and then adapt based on those lessons.”*

The AAI is the most far-reaching shake-up of Army structure and process in several decades, and was itself the product of many months of intense adaptive activity. It started with the more modest goal of adapting the Army systems responsible for Readiness to produce a more flexible and sustainable flow of deployable capability from the parent force to the various operational theatres. But in the process of designing the necessary adaptive processes to support that goal, it rapidly became apparent that to be truly effective, the proposed adaptive changes required the entire organization of Army to be placed on an adaptive footing.

We can only briefly summarise here some of the features of what has emerged from a period of productive ferment and internal adaptation, where many different views were expressed, acknowledged, discussed and all involved were able to learn and adapt. The success of this process is evidenced by the widespread support it has throughout the organization and the momentum being generated in the implementation of AAI – to the unheard-of extent of the target dates for implementation actually being brought forward because progress was so rapid.

A key feature is the way in which the Chief of Army articulated his intent for the AAI as having in place self-sustaining processes to continually review and adapt Army objectives, structures and processes as necessary to continuously improve in a number of key outcome areas which he identified. In other words, the endstate is a dynamic one, not a static one. Furthermore, it is stated in the context of a systems perspective on the entire organization:

In seeking to improve these elements of its functioning, we must remain cognisant of their interdependence, and the way in which they interact to produce Army's overall success outcomes. Realising these goals for Adaptive Army requires specific targets for the improved outcomes to be set and regularly reviewed by Functional Commanders. This will allow us to adapt the ongoing prioritisation of effort and resources to the best effect, and avoid diminishing returns and negative cross-impacts

So the AAI is institutionalising adaptation at both Level 3 (adapt structures and processes in order to improve how we improve) and Level 4 (adapt our objectives in order to improve alignment of how we adapt with 'real' higher-level success); and also directing Level 5 (co-adaptation of the interacting contributing elements, within an overall system-of-systems perspective).

There are many more adaptive features of the AAI, such as clearly enunciated multiscale measures of success and failure, a planned overhaul of Army Balanced Scorecard to enable it to better serve the feedback requirements of all the adaptive processes and aligning a number of existing adaptive processes with the AAI.

The Adaptive Warfare Cell

An excellent example of the type of adaptive change that the AAI intended to stimulate is found within the new Land Combat Readiness Centre (LCRC) created in Dec 2008 as part of the AAI restructure. The LCRC is responsible for the preparation and certification of force elements for deployment. As part of their strategy for executing that responsibility, the LCRC has recognized the need to address the fast learning loops that are fed by feedback from deployed forces and other relevant sources, so as to improve their timeliness and effectiveness where they already exist, and to put in place additional learning loops identified as needed.

To create this new adaptive process the commander and his staff have themselves taken an adaptive approach with a number of stages, including workshopping the emerging proposed structure and processes with a number of stakeholders and specialists.

They identified a number of issues in how the raw feedback from our own and allies' operational experience is processed into potentially valuable lessons for other currently deployed forces, the preparation of subsequent forces, the operation of the LCRC itself, and for other parts of Army and the Australian Defence Organisation (ADO) beyond their own range of authority, and proposed a number of adaptive innovations to improve the quality of learning. These included creating an Adaptive Warfare Cell (AWC) within the LCRC which would process the various insights, anecdotes, and other types of feedback, and through consultation with stakeholders and specialists would determine what adaptive actions are needed and over what timescales, and would issue Operational Adaptive Directives (OADs) to implement those adaptive changes.

Where the lesson relates to a part of the ADO outside of their authority a similar process is proposed but rather than directing what adaptive changes should be made, the AWC will issue them with an Operational Adaptive Note (OAN) to make them aware of the substance of the need from the perspective of the deployed forces and the LCRC.

AWC procedures naturally include the means to validate that the actions directed by an OAD are in fact taken, and in conjunction with higher command levels, a feedback mechanism is also being developed for the OANs to ensure that they too are appropriately dealt with, and to inform the AWC what has been done and why, and what the impact has been.

The LCRC has correctly recognized that such feedback from the OADs and OANs is essential for a number of reasons:

- to support the LCRC's own adaptive learning,
- to provide feedback to the individuals and units that were the sources of the lessons, and
- to the higher command authority to be assured that these adaptive processes are working coherently across the ADO and
- to alert them if they are not, and so stimulate an adaptive response at a higher level of authority.

Since the proposed structures and procedures are conjectures about how these intents can be successfully implemented, and since all the systems and organisations involved are complex, as are the operational situations in which lessons are identified and implemented, the LCRC has understood that unexpected problems are likely to occur and that it is important therefore to take an adaptive approach to evolving the structures (systems design) and procedures (operational design).

To support their own learning, they are therefore in the process of developing measures of success and failure for these initiatives, and putting in place the means to monitor them to generate feedback about their effectiveness.

Measures of success should capture the ultimate intended benefit of the AWC, i.e. impact on operational effectiveness [eg as reports from individuals and units which have applied the lessons and assessed them to be valuable]. Measures of failure are easier to collect [eg discovering that the same or similar lessons are being drawn again (and so obviously were not properly learnt the first time), reports from individuals and units which have attempted to apply the lessons and found them to be deficient in some way etc,] and are even more important in supporting the adaptive learning of the AWC, because they provide valuable information which can be used to learn how to be more effective.

Of course, even the ways such measures might be collected (eg through having LCRC staff deployed with each rotation, or through changes to After Action Review and Post Operation Review procedures) are also conjectures and their validity (i.e. the utility of the measures collected in these ways) therefore also needs to be tested if they are implemented, so that the LCRC can adapt the way in which feedback is sought, in order to make it as useful and relevant to LCRC's own adaptation as possible.

Further, to more rapidly evolve the AWC structures and processes, LCRC is in the process of nominating provisional targets for the measures of performance that would characterise the operation of the current system and operational design (eg execution/processing times for various steps, ratio of time/resources spent on each band of priorities etc) and will then evolve those targets in the light of relevant feedback received.

As this is being written, the LCRC is creating a secure blog system to enhance the action/feedback loop, deploying adaptive warfare teams to gather lessons during post-deployment decompression as well as to validate whether the actions that they applied were actually working, and exploring how to better use their people on the ground in selected locations to assist the working of the adaptive cycle. There is a lot of learning going on, and as theorists, we can also learn from how they are going about their own learning.

8 Conclusions

In summary, we claim that our organizations will need to use Level 1 adaptation to tune the free parameters of its current instantiation (system design) and course of action (operational design), use Level 2 and Level 5 adaptation to improve its own designs, including its own composition and architecture, its stratagem for engagement, and its multi-scale hierarchy of objectives, exercise Level 4 adaptation to improve the yardsticks it uses to drive adaptive decisions at the other levels i.e. its choices of rapidly-observable proxies for success and failure; but because being successfully adaptive is such a difficult and challenging complex problem, the most important level of adaptation is Level 3: using adaptation to improve the ability to adapt in all the above ways.

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