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Formalization and Agility in Military Headquarters Planning

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Abstract

In the conduct of operational planning in military headquarters, formalization of organizational structures and processes and the requirement for agility are often in tension. Adaptation to contingencies can, however, be achieved by manipulating the degrees of formalization, decision centralization, and distribution of skill specializations such that innovation is not suppressed. To this end, we suggest complementary additions to the variables in the NATO C2 Reference Model and propose their relationships in light of Structural Contingency Theory, Perrow's "Normal Accident Theory" and Rittel and Webber's "Wicked Problems." We argue that the degree of process centricity of military planning can be varied to match the contingency, while at the same time the structure of planning teams is varied between Mechanistic, Organic and certain hybrid modes, in step with the process-centricity. We also consider whether the organizational structures and processes to best respond to a variety of scenarios are discretely separate or lie on a continuum through which the same headquarters can move. The importance of this for agility is emphasized.

Introduction

Formalization, seen positively, facilitates control of quality of outputs of an organization, resolution of role ambiguities between workers and minimization of effort through reuse or automation of procedures. However, negative aspects of formalization are the inflexibility it places on workers in performance of their tasks and a potential suppression of creativity. Formalization appears antithetical to agility. This is as much a problem in industry, business and academia as in the military. A military headquarters has, as one of its key functions, supporting the Commander in the conduct of planning for operations. This paper explores the tension between formalization and agility, together with the role of headquarters structure and processes, in the conduct of military planning. In particular, we are concerned with planning for operations likely to occur in concrete contexts, as carried out by the J5 organization (as opposed to execution and crisis response which is often the purview of the J3) in joint operational level headquarters of militaries organized according to the NATO Common Joint Staff System (CJSS).

As measures of agility the NATO C2 Reference Model (NATO SAS-050 2006) includes robustness, flexibility, responsiveness, innovativeness, resilience, and adaptability. These express the capacity to cope with variety in the external environment: flexibility expresses the seamlessness between multiple ways of succeeding; innovation implies creativity; and adaptability focuses on process and organization. Creativity is foundational in Pigeau and McCann's (2000; 2002) definition of *command* and, in turn, their reconceptualization of *command and control* (C2):

> Command is the creative expression of human will necessary to accomplish the mission; control is the structures and processes devised by command to enable it and to manage risk. C2 is the establishment of common intent to achieve coordinated action.

We adopt these definitions here. A paradoxical insight arising from this is that not only the commander commands. A staff officer in a planning team, working within the bounds of commander's intent, exercises command in the generation of new ways to achieve that *intent* and satisfy legal and political constraints within which a military operation must be executed.

This paper draws on insights from the organizational science literature to present proposals for improving C2 agility in military headquarters planning. We focus on the aspects of adaptiveness, flexibility, and innovativeness within agility. The dominant body of organizational theory from which we draw is known as Structural Contingency Theory; this posits that an organization is most effective when it is fit-for-purpose for the contingencies that the organization confronts. In many respects, this is an instantiation of Ashby's (1957) law of requisite variety. Though size and strategy are two possible contingencies, within the military domain (given a headquarters with a broad strategic mandate and fixed size) we focus on the other main contingency of concern: the environment. In other words, a contingency theorist would argue that a military headquarters must change its structure and processes to match the operational scenarios it confronts. In the NATO C2 Reference Model, matching of the "C2 Approach" to the external circumstances is fundamental to mission effectiveness. This is implicitly contingency theoretic; we aim here to draw more deeply on this body of work to gain insights into what degrees of freedom are available to a military headquarters in the conduct of planning to make it a more agile organization.

In exploring the above, we seek to enrich the ideas in Atkinson and Moffat's (2005) insightful book, *The Agile Organization*. This demands that we clarify our perspective regarding concepts such as the *Edge* organization (Alberts and Hayes 2003). As a vision of the future, the Edge motivates a substantial body of necessary research. We seek to address the needs of military forces today where hierarchy and process remain necessary facts of life while striving for agility. However, beyond such pragmatism, we are motivated by thinking that hierarchies, as products not just of human modes of organizing but of the natural world (Simon 1962), will not disappear. Nor is this in conflict with Atkinson and Moffat (2005), who present a hypothesis for network evolution (their Figure 4.5) that encapsulates a fluctuating relationship between formalization and self-organization or hierarchy and "scale-free" networks. Reflecting on Simon's perspectives on hierarchy, Agre (2003) writes:

> … [H]ierarchy and self-organization are not mutually exclusive, and … neither one is necessarily destined to win a world-historical battle against the other. Although they are analytically distinct and should not be conflated, they nonetheless coexist, in both ideology and in reality, and they are likely to continue coexisting in the future. From this perspective, the models of Simon and the general systems theorists—all hierarchy or all self-organization—are models of simplicity, not of complexity. Real complexity begins with the shifting relations between the two sides.

This summarizes elegantly our perspective. Its relevance to formalization and agility in military planning is our concern.

We need one final important definition: what is planning? We adopt that of Mintzberg (1994): "planning is a formalized procedure to produce an articulated result, in the form of an integrated system of decisions."

Such decisions are statements made whose execution seeks to influence future events—for a military headquarters, an operation within a threat environment. To be concrete, we give some examples. In the civilian world (the concern of Rittel and Webber [1973]) we refer to planning to build a new subway system, a revised education curriculum or an urban renewal program to tackle inner city poverty. On the military side, we consider planning for conduct of elections for the first time in Iraq and for the Second Battle of Fallujah in 2004. In all these cases we perceive a requirement for "an integrated system of decisions" in place *before* shovels begin to move earth, books are printed, bricks are laid or soldiers' boots hit the ground. It is this planning *in advance of execution* we are concerned with. Undoubtedly, once execution begins planning activities continue to be required and must take on a new complexion. However, this type of planning is not our focus here.

We return to our opening conundrum: if planning is, of its nature, formalized what is the scope for agility? This is encountered daily in military headquarters in the tension between applying doctrinal planning processes and demonstrating agility at the strategic-operational level. Our aim here is to identify the organizational degrees of freedom in a headquarters and the circumstances under which, according to organizational theory, they should be manipulated. Several suggestions have already appeared in (Kalloniatis et al. 2009). Our purpose here is to connect these suggestions more thoroughly with both the organizational scientific and CCRP[1] literature, and in relation to the NATO C2 Reference Model. At this stage, we do not propose explicit measures of agility beyond these terms. Such explicitness requires quantitative measures of complexity which remains a subject of ongoing research. In the Appendices we discuss one path towards this goal and how it may relate both to planning and plans.

In the following we explore means of characterizing the environment in which a planned operation is to be executed. We then discuss the nature of planning, particularly in military organizations, before reviewing contingency theory in the context of the NATO C2 Reference Model and the structure of military headquarters. Thereafter we explore the types of adaptivity available to a headquarters—to structures and processes respectively. We study these in light of current military structures and processes. Finally, we explore the scope for *seamless* changes in structure and processes in a headquarters given diverse operational environments.

1. Command and Control Research Program, see http://www.dodccrp.org/

Characterizing Contingencies

Contemporary governments use their military forces in a spectrum of whole-of-government or multinational responses to natural disasters, terrorism, insurgency, piracy and drug smuggling in failing-, failed-, or non-state contexts. "War among the People" (Smith 2005) characterizes many contexts where actual force is employed. Nor is traditional state-on-state conflict a thing of the past, as emphasized recently by US Secretary of Defense Robert Gates:

> Even as its military hones and institutionalizes new and unconventional skills, the United States still has to contend with the security challenges posed by the military forces of other countries (Gates 2009).

We seek here an abstract characterization of this diversity of environments. Alberts and Hayes (2006) describe a "C2 Problem Space" with three dimensions: rate of change, familiarity, and strength of information position. Noting that the NATO C2 Reference Model does not use this aspect of their model (while using the C2 Approach Space), we seek intrinsic characteristics of the external system that determine the way the system behaves. Perrow (1984) provides a suitable framework based on two variables, *coupling* and *interactive complexity*, as summarized in Figure 1. Coupling is a measure of the degree of slackness versus responsiveness between system elements. Interactive complexity describes the difficulty of identifying causal chains in systems with multiply-connected elements serving multiple functions. Though Perrow (1984) admits to subjectivity in classifying systems in this scheme, modern complexity science can do better. Appendix A provides a precise (and computable) definition of complexity within graph theory consistent with its use herein. Coupling directly influences the magnitude and speed of propagation of a disturbance between adjacent components of a system and so manifests the rate of change, while interactive complexity summarizes a system's "opaqueness."

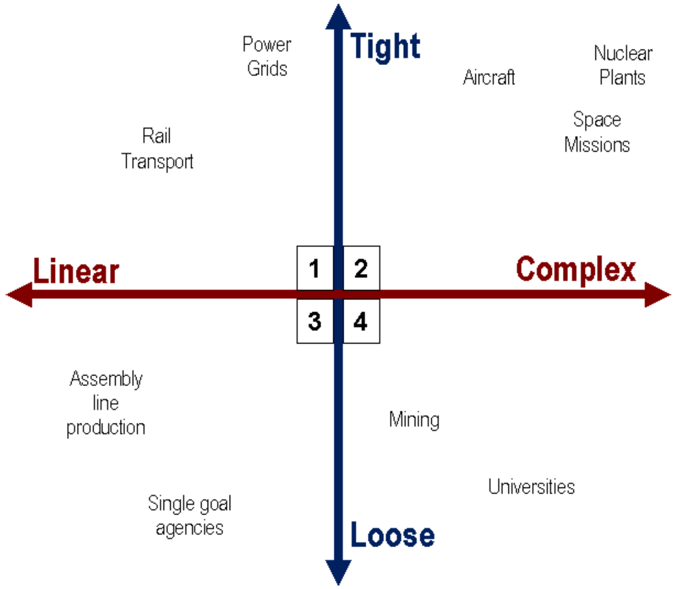

Figure 1. Perrow's Quadrants (using his labeling) and some sample systems, with the vertical axis representing coupling and the horizontal axis interactive complexity

Though Perrow sought to understand the source of accidents for high-risk technical systems, we can readily adopt his formalism to characterize environments in which military forces operate. An operation is an intervention in a system with an intention to exercise control (working within its existing structures and processes) or command (changing its structure and processes) to influence the system's future state. Note our use of Pigeau-McCann again here. Perrow's case studies demonstrate that tightly coupled, highly interactively complex systems (quadrant two in Figure 1), are those subject to systemic (or "normal") accidents where catastrophic failures are the tip of the iceberg of a multiplicity of incidents. Viewing interventions as military operations, risk (of the loss of human life and materiel) is present in every quadrant by virtue of the lethality of the military force being applied. Quadrant two systems provide an amplification of this risk due to the *intrinsic* composition of those systems.

It is worth comparing Perrow's formalism to the concept of *wicked problems* by Rittel and Webber (1973) which arose from social and urban planning. Some properties of wicked problems are: the path from problem formulation to solution is *non-linear*; solutions are not simply right or wrong (in developing solutions there is no stopping rule); every problem is essentially novel and little can be reused from solving one problem to the next; and one cannot learn about the problem without trying solutions, but every attempted solution may be both expensive and have lasting unintended consequences, likely to change the problem.

We can broadly identify Perrow's second quadrant as the domain of wicked problems. The third quadrant is the regime of *tame problems*, which are opposite to wicked problems and amenable to linear solution strategies, though they may still contain many elements. We therefore speak of problem wickedness/tameness as the degree of extremity of a system in Perrow's second/third quadrant.

Lloyd et al. (2006) already relate Perrow's quadrants to different styles of military command. Our aim is to deepen this connection with reference to planning, interpreted as decision making for an intended intervention in a "Perrow system" or for "solving" a "problem." To rephrase our scope in these terms: what are the appropriate structures and processes for a military headquarters for planning of operations that may variously lead to an intervention in tame or wicked environments? Can the *same* headquarters conduct such types of planning with only internal structural and procedural adjustments?

Planning and Plans

Military planning processes (see Guitouni et al. [2006] for an overview) have drawn heavily on developments in the business world, namely, the use of *business processes*. A business process (see Aguilar-Savén [2004]) has clear boundaries, clear input, intermediate and output products, a clear ordered sequence of activities in time and space, and a clear recipient of the process output. Each activity adds value. Finally, a business process is embedded in a definite organization calling on a diversity of specializations or functions. In their military incarnation, we can summarize the (very similar) formal planning processes of various military forces (such as NATO, the US, Canada, and Australia) as the immediate planning process—"situation based planning for the likely or certain." We do not consider here planning under heightened time pressure (crisis action planning), where doctrines may explicitly permit "steps to be done sequentially or concurrently, or skipped altogether" (Joint Staff Officers Guide 1997). Nor do we consider generic planning for non-specific contingencies (whose products are often sought as input to immediate planning).

Appendix B outlines Canadian and Australian perspectives of immediate planning. Significant in these representations is the linear cascade from trigger through a combination of serial and parallel tasks with clearly defined intermediate products leading to operational orders. Implicit to each stage are briefs to the commander that are culminations of intermediate steps in the process, which facilitate control, and indicate that, though the detailed plan development may be decentralized (in the staff work), final approval is centralized in the person of the commander.

Military (and business) processes as sets of ordered discrete non-decomposable tasks are *essentially* linear. We say essentially because "weak" *nonlinearity* occurs by simple revisiting of previous discrete planning stages. However, the nonlinearity intrinsic to solving wicked problems occurs over many scales in the space between formulation and solution. Is such "strong" nonlinearity completely absent from the doctrinal process?

Simon (1962) sees the stages of problem-solving within his theory of hierarchy: discrete stages in approaching solutions are "stable sub-assemblies" that overcome the inefficiencies of a random search and enable one to move forward without revisiting partial solutions. This stability sustains the linearity expected of a doctrinal planning process. How finely, though, can such stable states be located in planning? Mintzberg (1994) dismantles efforts at defining a detailed process for *strategic planning*. He contrasts the analysis (decomposition of something into parts) inherent in planning with the synthesis (joining together parts to form something new) intrinsic to strategy. Rather than strategic planning, he speaks of *strategy making* and its requirement for creativity and intuition. This parallels the Pigeau-McCann understanding of command and control.

For Mintzberg, strategy formation, which may be deliberate or emergent, cannot be decomposed into sub-processes but is an "impenetrable black box" (1994, 331) that resides within formal planning stages of organizations.

Conway (1968) gives another perspective on this. A plan, as an integrated system, involves elements in a whole-part relationship; a plan is a design. Conway hypothesizes that a design strongly reflects the design organization, which he proves by decomposing each into a network of nodes and links and identifying mappings between the two networks. We review this proof in Appendix C and point out a number of implicit assumptions, one being that both the design and the design activity can be completely decomposed into simple elements. This is undermined by the human dimension of design, identical to that of strategy making (Mintzberg) and of command (Pigeau-McCann). However, a design-designer relationship stands to the extent that there is a threshold below which a design cannot be decomposed commensurate with the threshold for decomposition of the design activity. In terms of execution of a plan there can be no certainty in the future state of the system, given that below a threshold of decomposition the plan/design has neither determined all the participating design elements nor their relationships.

Structural Contingency Theory and the C2 Reference Model

Structural Contingency Theory originally postulated in the 1960s that organizations undergo change to maintain fitness-for-purpose against changing contingencies, such as an organization's size and the nature of its task. Donaldson (2001) provides a thorough review of the literature here. Contingency Theory invokes two dimensions for organizational structure, the *distribution of decision-making authority*, from *Centralized* to *Decentralized*, and *organizational departmentation*, from *Divisional*, representing a separation of organizational units according to location or product they generate but integrating specializations within those locations or product lines, to *Functional*, which aggregates personnel according to specializations. Organizational structures that are centralized and functionally decomposed are *Mechanistic*. Those that are decentralized and divisional in breakdown are *Organic*. (Matrix organizations are regarded by Donaldson [2001] as another type of hierarchy and therefore as mechanistic.) Mechanistic and organic organizations are fit for quite different problems (tame or wicked) or Perrow quadrants (two or three). These are summarized in Figure 2.

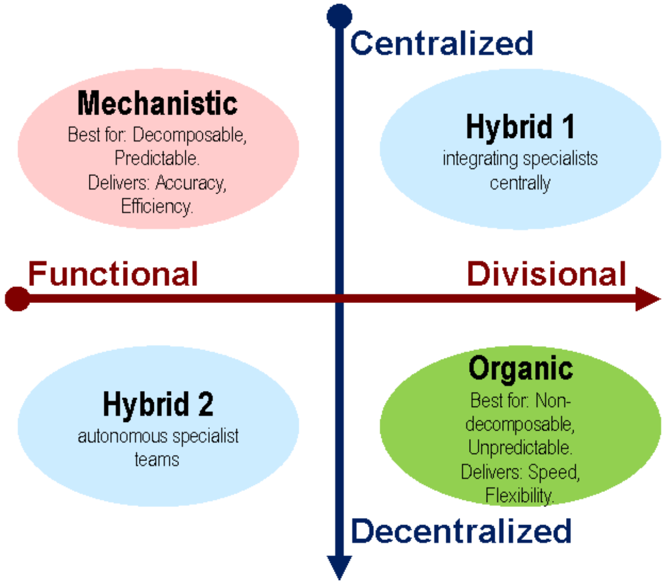

Figure 2. The two dimensions of an organization according to Structural Contingency Theory, showing *mechanistic* **and** *organic* **structures together with observed asymmetries in adaptability, indicated by an arrow with a solid circle at one end and arrowhead in the preferred direction. Also shown are two additional** *hybrid* **structures**

In Figure 3 we relate NATO C2 Reference Model variables that are relevant to planning and team composition and outputs to variables and concepts arising from Structural Contingency Theory. Other variables, such as culture and motivation, are evidently relevant to team performance but are not assessed here. Some model variables represent a rather fine decomposition while others, such as *team shape*, are rather aggregated in nature. In certain cases, apparently important variables are absent; this has the consequence that certain relationships, which are critical results of contingency theory, are not established here. We note also an inconsistency in separating allocation from restriction of decision rights, and yet only an enablement of patterns of interactions. Rather than combining the first two of these, we create a new variable for restriction of patterns of interaction. Finally, we connect these variables to properties of the environment as perceived by a commander (in the *C2 Problem Space*) rather than those intrinsic to the system (in Perrow's representation).

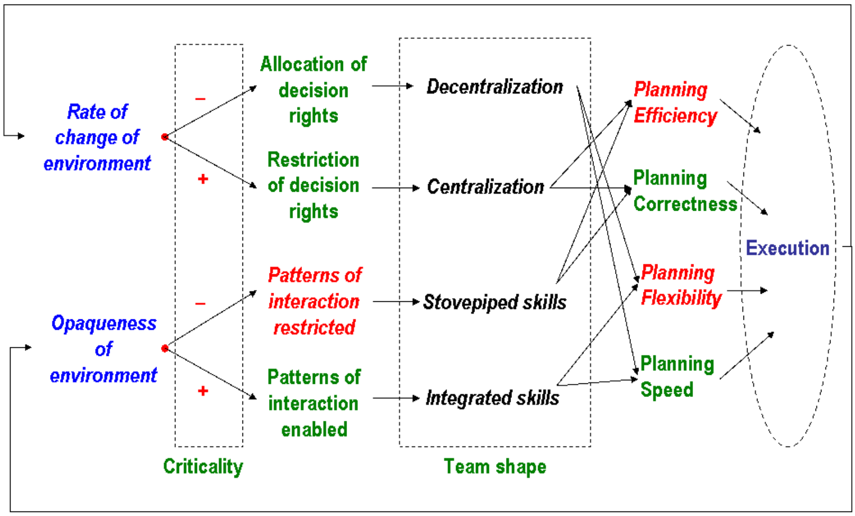

Figure 3. Completing the NATO C2 Reference Model in light of Structural Contingency Theory, with normal font indicating variables presently identified in the Model, and italics showing missing variables and those describing *Team shape*. We also include characteristics of the environment on the left, using variables close in spirit to the C2 Problem Space of Alberts and Hayes (2007). To the right, the variables connect to those relevant to *Execution* which in turn cause change in the environment causing things to loop back, as in Boyd's Observe-Orient-Decide-Act (OODA) loop. We do not attempt here to decompose these latter aspects

Donaldson (2001) summarizes the data underlying diagrams such as Figure 2 and Figure 3, largely based on statistical analysis of snapshots of many business and administrative organizations at fixed points in their histories with fixed sizes, structures, strategies, and environments. However, recent literature reports experiments with smaller teams, examining their capacity to move between regions of the Structural Contingency model (Figure 2). For example, Ellis et al. (2003) found that teams made the transition Centralized → Decentralized more readily than the reverse. Moon et al. (2004) observed a similar asymmetry for the Functional → Divisional transition while Jundt et al. (2005) observed it for the Mechanistic → Organic transition. Further evidence is provided by Leweling and Nissen's (2007) studies showing that the transition hierarchical → Edge (roughly similar to, but more extreme than, Mechanistic → Organic) was less *disruptive* to teams than the converse.

These effects have been called *asymmetric adaptability*. Jundt et al. (2005) also examine the value of *hybrid* structures that may avoid these asymmetries. For example, Hybrid 1 combines the flexibility of a divisional structure with the centralizing coordination provided by a leader, while Hybrid 2 combines the benefits of the superior cooperation that occurs in specialized teams with the motivational benefits of autonomy under decentralization. Jundt et al. (2005) find no evidence of asymmetry in adaptability of teams between these hybrid structures. These hybrid adaptation paths lend support to the view that viable organizations lie in a smooth space (*Cartesianism*, which Donaldson [2001] argues is more consistent with data) as distinct from the view that only a few basic configurations (for example, those of Mintzberg [1979]) are truly viable, separated by regions of poor fit for any circumstance (*Configurationalism*).

The CJSS and Organizational Dimensions

To tie these ideas concretely to the military headquarters context we turn to the Common Joint Staff System and recognize some J-numbers as discipline specializations, for example Intelligence (J2), Logistics (J4), and Signals/Communications (J6). Plans (J5) and Operations (J3) appear Divisional in nature by virtue of their requirement to integrate the products of intelligence, logistics, and signals into coherent Concepts of Operations and Orders respectively. In (Kalloniatis et al. 2009) we analyze several small to medium sized contemporary military organizations and observe that most are *mixed from the departmentation perspective*, thus offering a greater variety of structures and work practices. We can broadly identify a generic structure, with the commander and deputies, branch or divisional heads recognizable as a *Command Team* and the teams of J-numbered specialists serving under the deputies as *Staff Teams*. The former is intrinsically Divisional in nature while the latter may be Functional or Divisional. We therefore have a number of different organizations possible, working with the organizational types Mechanistic, Organic, Hybrid 1, and Hybrid 2.

For example, Australia's Headquarters Joint Operational Command (HQJOC) at one stage consisted of four branches (Leschen 2007): Plans, Operations, Intelligence, and Support, headed by one-star officers under the Chief of Joint Operations (CJOPS). While clear J-function specializations are recognizable here (J5, J3, and J2), Support branch aggregated (at the time) the J1, J4, and J6 and other functions (Health, Legal, and Finance). The structure exhibits both Functional and Divisional aspects. In the conduct of the type of planning we describe herein, work may be apportioned and sequenced by the command team, conducted autonomously and in a specific sequence in the separate staff teams in their separate branches and then aggregated and endorsed through the command team. J5 staff develop a draft *mission analysis*, which J1 and J4 use to develop draft personnel and logistics estimates. These in turn are used by the J5 team to finalize or revise the mission analysis for presentation to the command team for scrutiny or endorsement before moving on to courses of action. This is the Mechanistic mode in operation. Conversely, the nature of the problem may lead to constant reworking of drafts: the J5 cannot even propose a stable draft mission analysis without a logistics estimate from the J4 staff—attempting to do work compartmentally and sequentially leads to constant revisitation of products. The appropriate mode here is that working level staff be called into a single mixed team of planners, logisticians, intelligence, and other specialists developing a CONOPS collaboratively in the same physical (or virtual) environment before presenting to the command team for endorsement. This is an Organic organization in action. The command team may engage directly at the working level for periods of time, immersing itself in, and engaging with, detail. This is the Hybrid 1 mode in action. Our concern so far has mainly been with the degree of mixing of specializations though already we have partially touched on aspects of the process. This is our main concern in the following.

C2 Approach Space I: Process Adaptability

We touched earlier on the manifestations of *weak* nonlinearity as feedback loops between discrete, well-defined process steps in immediate planning. The human-centricity of military planning stands in contrast to the manufacture of a physical product. The fundamental components of human creativity remain obscure (but subject to ongoing research), so that specifying the order in which they occur in time and space in solving a wicked problem is not yet possible. The difficulty of mapping such "strong" nonlinear paths is the reason a certain level of *aggregation* is assumed for representing traditional planning processes: aggregation hides microscopic details of which analysts and military professionals are well aware but cannot *exhaustively* specify. In other words, *nonlinearity is already present in traditional military planning*: it is aggregated inside the discretely identifiable stages of planning, such as those presented in Appendix B. We represent this nested nonlinearity diagrammatically in Figure 4. The boxes in this figure can readily be identified with Mintzberg's (1994) "impenetrable black box" of strategy making into which we now, albeit impressionistically, have penetrated by representing the zigzag path between problem formulation and solution.

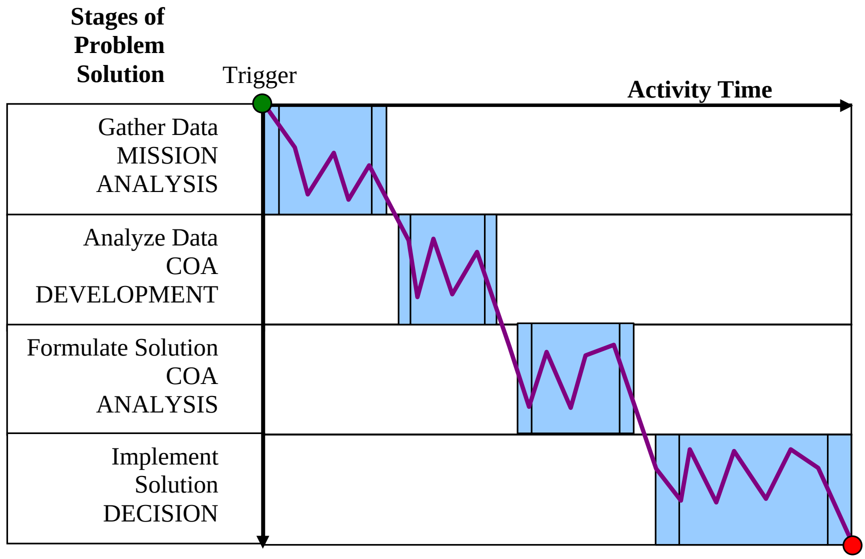

Figure 4. A representation of a nonlinear (zigzag) path between problem formulation and solution in the course of traditional military planning. Mild deviations from a linear path are contained within the discrete planning activities that represent an aggregation of human creativity. This would be appropriate for solving tame problems or intervening in a system lying in Perrow's third quadrant. The planning phases are shown both as regions between problem formulation and problem solution and formalized process steps (boxes).

What bounds the nonlinearities, particularly in the path through problem space? It is in large part common intent (Pigeau and McCann 2006), including the commander's intent, the explicit planning doctrine, and the organizational standard operating procedures, as well as the diverse sources of implicit intent discussed by Pigeau and McCann. Thus common intent is active as much in coordinated military planning as in coordinated action (which is more Pigeau and McCann's focus). The flexible, creative engine of staff planning work is nested within an overarching structure of a process, whose *intent* and *degree of structuring* demand creative thinking from the commander.

Moreover, we argue that *level of aggregation* of the collaborative activity is a *lever* that can be selected by the commander to adapt the planning work practice according to the tameness/wickedness of the problem to be solved by the plan or the position in Perrow's space of the system in which the operation is intended to intervene. Process-centric work practice defines an *outer envelope* for conduct of the work. Flexible work practice takes place within the steps of the process envelope, guided by the glue of common intent.

In the presence of *mildly* wicked problems this localization of nonlinearities in the path towards a solution still occurs mildly but straddles regions of problem space. This is shown in Figure 5. Process steps are largely definable, but there is freedom to permit stronger deviations from linearity: occasional jumps ahead to trial solutions or backtracking to problem redefinition. The "porous" nature of process steps reflects some degree of opportunity-driven problem-solving (Conklin 2005). Each step is a "stable sub-assembly" (Simon 1962) in the progress towards a solution. The presence of common intent among collaborators enables the occasional adventurous jumps ahead and back to converge again and the work to progress. Figure 5 already reflects, to some extent, current military practice as we illustrate in an example below.

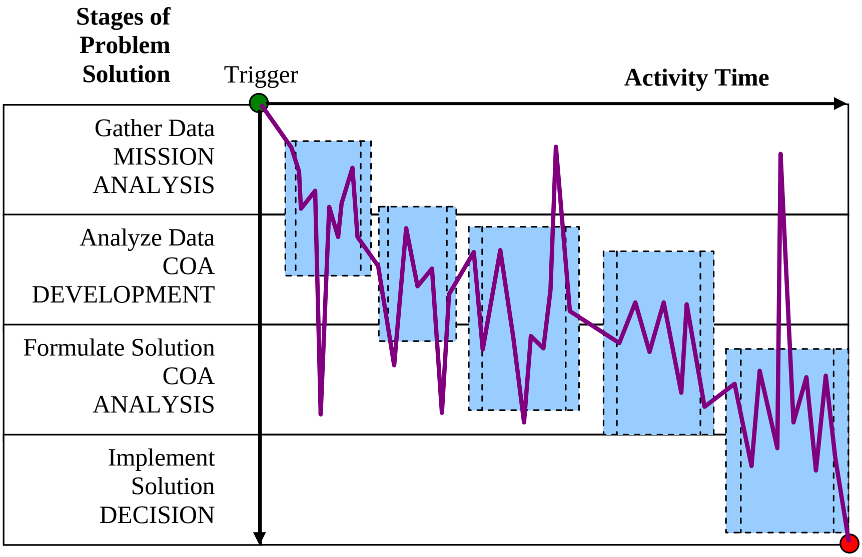

Figure 5. A planning activity of intermediate-level process-centricity. A zigzag path with strong deviations from linearity progresses from formulation to solution. This would be appropriate for a problem with some degree of wickedness or an intervention in a system lying towards the center of Perrow's two dimensional space

With a truly wicked problem the path through problem space is entirely *chaotic,* see Figure 6. No steps with clearly definable purpose or products, or stable intermediate states (in Simon's terms) can be localized within the path. Only non-descriptive breakdowns in the time available provide a way of decomposing this path.

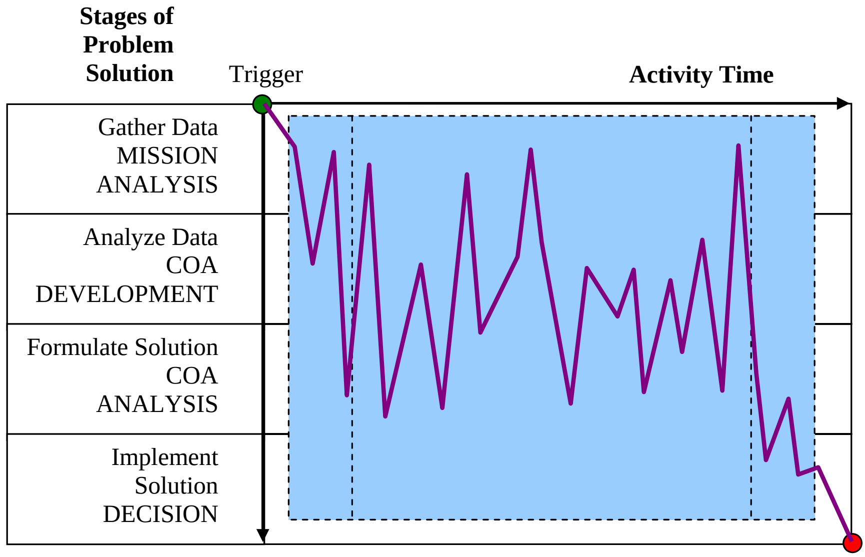

Figure 6. A planning activity that cannot be decomposed into an orderly progression from problem formulation to solution: the path has no underlying linearity. This would be appropriate for a genuinely wicked problem or intervening in a system lying in Perrow's second quadrant.

Concretely, how may a commander manipulate the degree of process centricity? Mintzberg (1994) lists increasing degrees of formalization of planning activity, reproduced in Figure 7. In (Kalloniatis et al. 2009) we give a list that roughly corresponds to Mintzberg's. However, Mintzberg identifies a point, the *formalization edge*, beyond which intrusive control threatens to "kill" the essence of strategy. This is echoed by Adler and Borys (1996) who distinguish *coercive* from *enabling* bureaucracies: the former type formalizes work with the intent of suppressing operator innovation, seen as a source for error, while the latter formalizes with the intent of liberating innovation, seeing it as a source for solutions. Pigeau and McCann (2006) similarly speak of a commander's need to balance explicit and implicit intent in bounding the solution space to enable subordinate "creative command" while recognizing that, for the military, this balance point may shift according to circumstances. Unlike Mintzberg, we therefore argue that the point at which the degree of formalization turns from supporting to hindering depends on the nature of the operational environment: the peak in Mintzberg's curve of Figure 7 shifts according to the wickedness ↔ tameness of the planning problem.

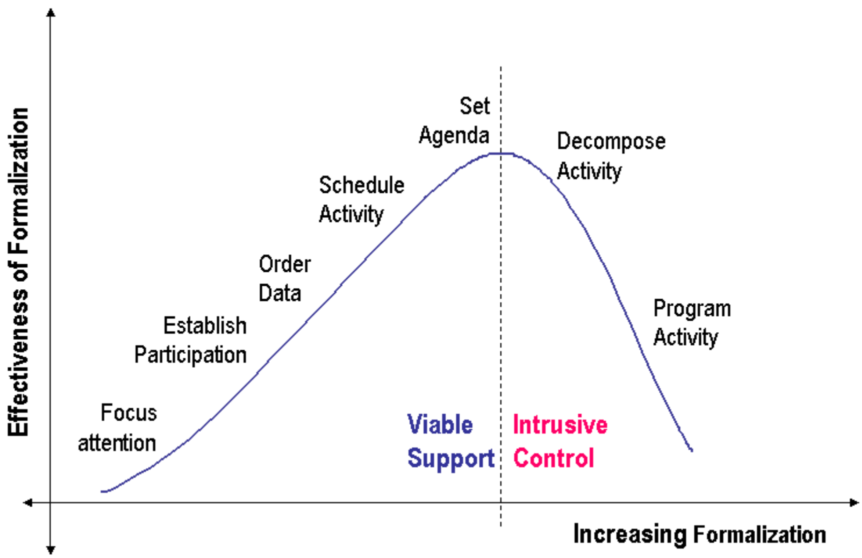

Figure 7. Mintzberg's Formalization Edge (1994)[2]

The degrees of formalization in Figure 7 offer a single military headquarters organization the capacity to tackle planning tasks that vary from tame to wicked. Such an organization may assume, in the first instance, traditional military structures, for example the CJSS. Indeed, we argue below that a well-defined overarching hierarchical structure is necessary. However, the manner in which elements from the defined organization are used can change according to the nature of the problem.

2. We [the authors] have added the vertical axis.

Our experience in analyzing planning in an Australian operational headquarters suggests that military planners intuitively know that different types of planning tasks require different degrees of structure and process. However, additional elements are required to fully enable such process adaptability:

- A capacity for commanders to recognize and gauge the degree of wickedness in problems and thereby adapt the process by which military planning is to be conducted. This must occur early in the planning activity (at a scoping stage)—early enough that, if the problem is sufficiently tame, a doctrinal planning process can be initiated. This would involve, essentially, a trial attempt at problem solution to probe the tameness/wickedness.

- Promulgation, as part of the commander's intent/guidance, of the degree of formalization of planning to all units relevant to the planning activity. This is because we expect that the *perception of inefficiency* in flexible, unstructured problem-solving will generate friction between collaborators that undermines the formation of common intent between participants.

- A capacity for commander and staff to switch between different degrees of planning formalization.

We now turn to the appropriate structures for such process adaptations.

C2 Approach Space II: Structural Adaptability

Given the loose coupling and low interactive complexity of a tame problem context, business processes are effective and efficient in Mechanistic structures. In military planning this is achieved by partitioning of the problem, delegation of detailed work to stovepiped specializations, and subjecting each stage to approval by centralized control: the briefing of the commander by headquarters staff.

Planning for operations in tightly coupled, interactively complex, wicked environments, is difficult to specify as a well-defined business process, requiring a richer, flexible and peer-to-peer spectrum of interactions than can readily be specified in a workflow chart or checklist. Such work practices are naturally enabled in Organic structures, with their interacting mix of specializations and decentralized control. In terms of our adaptation of Conway's Law, the difficulty of decomposability of the interactions in such a system implies an equivalent surrender of decomposability of the planning activity and *therefore of the organizational mix of planners*. One must provide sufficient richness to the team, a broad boundary to the problem (guidance), and then step back. This is the essence of the Organic organization.

Our suggestion that a military headquarters adapt the degree of process-centricity according to the nature of the problem therefore dictates a corresponding ability to adapt its structure between Mechanistic and Organic modes. The gradations can be achieved by the twin levers of degree of autonomy in decision making and the distribution of skills specializations in the task.

As mentioned earlier, possibly complicated tame problems remain relevant to military forces. It is *unnecessarily* inefficient to pit Organic planning structures against tame problems, while the perceived inefficiencies of Organic structures solving wicked problems are necessary. Mechanistic structures and therefore process-centric modes of planning must remain viable options for a military headquarters. This is also the import of Adler and Borys' (1996) clarification of the types of bureaucracy. Moreover, possible asymmetries in team adaptation suggest it is reasonable to maintain traditional structures for a military headquarters as the *default* mode of planning. How can the transition back (according to contingency needs) be achieved?

One proposal involves command and staff teams working temporarily in Hybrid 1 mode: centralized decision making but divisional structure. Specialists, such as J2 and J4, engage in the detailed planning together with the commander and/or divisional heads. We stress this is temporary because sustaining central coordination by a star-ranked officer of rich specialized discussions for the entire course of planning will be undermined by cognitive demands and other concurrent operational or administrative tasks. Work will eventually be partitioned with outcomes to be reported back or the commander surrendering the centralizing role in the interactions; the system decays back to Mechanistic or Organic modes. The hybrid mode serves as an intermediate state in facilitating the return of staff teams from Organic to Mechanistic structures. This interesting dynamic is illustrated in Figure 8.

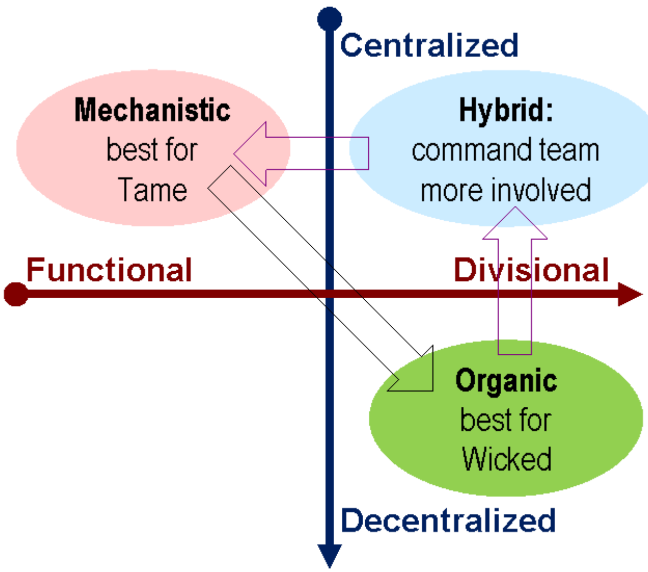

Figure 8. The path for returning to Mechanistic organizational mode via the Hybrid 1 intermediate mode. Three stages are indicated at which, respectively, tame, wicked and then tame problems require operational planning. Initially a Mechanistic organizational mode is adopted, which adapts later to the partially-structured Organic mode. To return to process-centric planning, the command team engages centrally in the planning initially before delegating down and reinitiating planning processes

We stress that the key variables in this transition are the degree of centralization and the time for which it is maintained before *recovering* to the mechanistic mode. These are the levers a commander and the leadership team can manipulate to negotiate these structural transitions, over and above the means provided by training and military culture.

Finally, we observe that these transitions represent a type of flexibility, over and above that which is available within Organic organizations: they provide a capacity for seamless adaptations across the entire space of configurations mapped by Structural Contingency Theory. A commander need not "rebuild" the organization with its different degree of formalization and structure for each new contingency. The import of this is that planning approaches such as "traditional" to "collaborative" and "network centric," as used in Figures 8, 10 and 11 of Alberts and Hayes (2007), might not be entirely separated by quantum jumps but connected through a continuum of intermediate organizational modes. Correspondingly in their Figure 5, the extreme corners of the "planning cube" may not be isolated; a military headquarters can, according to the levers discussed herein, steer itself through the space or at least a substantial part of it. The existence of such paths in organizational space suggests an even greater scope for flexibility, to include doing "old things old ways" if appropriate.

Historical Example: Iraq, 2004

The above discussion has been rather abstract. We now give examples of how certain aspects of this process-structural adaptability in a single headquarters are manifested in an historical example. We draw on the case of the headquarters Multinational Force in Iraq (MNF-I) in the critical year of 2004, as reported by Australian Major General Jim Molan (2008) who served as the Deputy Chief of Operations (Civil Military) under US General George Casey. Formally, Molan's title saw him (according to the CJSS) as the

Strategic J3, although his duties, as he describes them, indicate significant responsibility for strategic planning, squarely a J5 function. This already indicates that this headquarters was a very mixed beast. Two operations for which Molan had significant responsibility were conduct of Iraq's first free democratic elections (January 2005) and the Second Battle of Fallujah (November 2004)—two very different events planned within the same organization but undertaken in very different ways, as we summarily explore below.

We turn to the example of the Iraqi elections first as it displays the breadth of civil-military engagements that are perceived to be the model of the future. Within the headquarters, Molan had a small team of seven planners of US and Australian personnel working to the timetable dictated by the United Nations of working with the interim government of PM Iyad Allawi from July 2004 to Election Day, 30 January 2005. The scale of the task was massive, to enable 7000 candidates to go to 14 million voters in the heat of a violent, destructive insurgency. The mission involved far more than provision of security to voters and candidates on Election Day itself; in addition there was assembly of voter lists, conduct of campaign activities, and production and distribution of electoral information. Molan's organization offered the eight commissioners of the Independent Electoral Commission of Iraq (IECI) a skill that the military had in great store: the ability to plan. Molan's description of the planning aptly captures the nonlinearity of the "problem solving" activity—"there were no neat answers. Often we thought we had answers, but as the election came closer, the answers changed" (Molan 2008, 261). Molan's team was tackling a problem with genuinely wicked aspects.

A particular phase of the election planning resonates with our earlier analysis. In December 2004 a critical point was reached where the head of the Iraqi police, Major General Ayden Khaled Quadir, had "ceased to communicate with the other parties who were going to make the election occur" due to the killings of electoral workers and bombing of facilities by insurgents. Molan felt he "had to get everyone talking again.” Molan established the Iraqi Election Execution Committee (IEEC) embracing the range of Iraqi, coalition and diplomatic agencies that had a relationship to the problem. A South Korean, Colonel Chun, was to direct it in its twice-weekly meetings. Entering one of these routine meetings, Molan encountered a room set up in traditional military briefing style with a table for Principals and a crowd of observers around the walls, except there were no Principals present. Evidently, despite the physical room configuration, the planning had fallen into an Organic mode of organization but was failing to progress. At this point Molan injects himself into the organization, pulling himself away from his other commitments, insists on the presence of the Principals at the next meeting and begins working directly with his staff and Colonel Chun. At the next meeting of the IEEC he scrutinizes the need for participation of everyone present apart from the Principals (who were now all present), and eventually culls down the participation significantly. He directly chaired subsequent meetings. We cite this as an example of an organization being steered, perhaps somewhat brusquely, from organic mode through Hybrid 1 and, we suspect, to a point where the commander could step back to Organic mode (rather than Mechanistic, where formalized processes would operate). From a process perspective, we perceive a highly nonlinear path as in Figure 6.

Just prior to the IEEC meetings, Molan’s headquarters was engaged in planning the Second Battle of Fallujah. In contrast, with the shaping operations around Fallujah (the city where the insurgency first began) this operation was very much seen as a traditional military operation: by encouraging the civilian population to leave and perceiving the desire of insurgents to stay in the city to defend it, it was very much a force-on-force affair. Molan himself gives little detail of the planning here (writing, as he is, for non-military readers) apart from oblique references to intelligence and logistics estimates (Molan 2008, 176-177), mentioning that there was a phased planning process and noting that General Casey was briefed at each stage for his “imprimatur” (Molan 2008, 183). The planning involved all levels of command (MNF-I and the subordinate Corps); higher fidelity insight is provided by Lieutenant Colonel John Reynolds (2006) who served as the S3 in Task Force 2-2. Reynolds gives explicit references to classical operational planning products as Requests for Information (RFIs), mission analysis and COAs together with the sequence of briefings that took place from late September (initiated by a warning order) up to D-day, 7 November 2004—a two month planning cycle. However, the planning process was not entirely sequential as evidenced by references to concurrent development of the mission analysis and COAs. The reason for this eventually becomes clear: a change of mission for his specific task force from blocking positions to the south of Fallujah and maintaining security of the *main supply route* to active penetration in order to secure a major industrial area in the city. Within the limits of "data" we have on these events, we can conclude that the degree of process in the planning was *intermediate*, along the lines of Figure 5, with some back-tracking between otherwise clearly defined process steps. The execution was very much a "plug and play concept," with three companies coming from different locations, indicating that to a high degree the planning had been decomposed and delegated down by the senior MNF-I officers. The explicit references to specialist planners (in Reynolds), and specialist intelligence and logistics products (in Molan) indicate a degree of the Mechanistic structure at play. However, the masterful aspect of this planning was its concurrency with the shaping operations, enabling Fallujah II to be conducted as a conventional urban operation: "We might be able to turn [the insurgents] strength in Fallujah—their solidification of the city into a base—into a weakness" (Molan 2008, 175). This was a classic application of operational art in the modern era.

Though Reynolds' description is dominated by the Brigade and Regiment levels, we get sufficient from Molan's account to sense that MNF-I had the capacity to work within the Mechanistic, Organic and Hybrid I constructs both concurrently and shifting between them. The cost on Molan to achieve this is evident from his book: "a significant dedication to the task, at least during daylight hours. This still left the rest of my 20-hour day to run the war" (Molan 2008, 276).

Organizational Culture and Headquarters Adaptability

We have not discussed the dimension of organizational culture thus far but it is worth exploring briefly how it impacts, either positively or negatively, on our concepts of organizational agility in military planning. Culture in organizations is a vast diffuse field in itself, but we consider only the perspective offered by Bureaucracy Theory (Weber 1947). The concern here is whether the perceptions of legitimacy, normative behavior, and authority within an organization are consistent with the efficiency in output generation expected of it by bodies or individuals to which they are subordinate. In the context of International Organizations (IOs), Barnett and Finnemore (1999) apply Weber's theory to explain why IOs often act autonomously or even inimically to the national governments that they are intended to support in the peaceful resolution of disagreements between nation states. The parallel with a military headquarters may be seen in that it is ostensibly an extension of the person of the commander, and yet, as an entity in its own right having the potential to develop its own autonomy and legitimacy independently of the commander. As emphasized by Barnett and Finnemore, bureaucracies garner their legitimacy and power through the Weberian de-personalization of the offices in the structure, through their ability to classify and standardize meanings, information, and processes. These effects can also occur in the military C2 context. Indeed, within the narrow perspective that the (charismatic) commander is the sole source of "human creativity and will" (command) and the headquarters is primarily the site of a "structure and process" (control), it is the latter that can be perceived as the impersonal source of "jurisdictional competency" according to Weber's theory.

Within the Mechanistic mode, traditional military planning arguably carries few cultural misalignments through the connection between the commander and staff in the exchange of higher guidance and back briefs. According to Weberian categories, one should see staff and commander cultural dimensions aligned. The historical unity of traditional military culture through the command chain attests to this alignment.

The challenge arises when the military organization transitions between Mechanistic and Organic modes, as we have discussed. What cultural tensions can this generate? Certainly there is a very prevalent history of cultural misalignment in other institutions of an organizationally mixed nature, such as universities. In our collective forty-five years of experience in this sector, we have observed cases of what Mintzberg (1994, 404) describes: management's requirement for the Mechanistic constructs of counting of outputs (research publications), regulated work hours, formal budget categories, and standard operating procedures. Upper management will even restructure university departments, amalgamating disciplines on the basis of budgetary constraints rather than on the basis of prevalent research collaborations. This contrasts with the Organic nature of innovative scientific research collaborations. The cultural tension, from a Weberian perspective, lies in the conflict between management's autonomy and legitimacy as the source of normative processes and categories and researchers' autonomy and legitimacy grounded in their specialized expertise and international prestige. We do not judge one side or the other here; both have legitimacy within their organizational constructs. Due to the historical origins of universities (as communities of scholars) and the requirement to fund their (increasingly expensive) work there are no easy solutions to this coexistence of organizational modes. In the military context, however, particularly with the Mechanistic mode *as the default*, the scope for minimizing such misalignments is increased as the interdependent relationship between staff and commander is recognized as normative. We argue further that transition from Organic back to Mechanistic mode via the Hybrid 1 configuration helps facilitate this alignment of culture between commanders and headquarters staff. *Within* the Organic mode itself the final anchor for cultural consistency is the significance of commander's intent as an active ingredient in the formation of common intent.

This brings us back to Pigeau-McCann. At its core, their definition of C2 provides the insight into the nature of command that ameliorates the perception of "loss of power" in organizational adaptations such as we are proposing—staff and commander all exercise degrees of command (creativity and will) in every possible organizational mode: Mechanistic, Organic, or Hybrid. It is the nature of the contingency, and not the arbitrary whim of an individual, that should determine how these varying manifestations of command should merge. Although these cultural dimensions deserve further exploration, this lies beyond the scope of the present paper.

Conclusion

In this paper we have sought resolution of the tension between organizational agility and planning as a formalized procedure. To this end we have analyzed the degrees of freedom in achieving agility in a military headquarters for the conduct of its planning, drawing on existing research in the business and administrative contexts. Though much of the literature on NCW assumes that an extreme form of the Organic mode, the edge organization, will be the dominant paradigm for the future, we have presented a spectrum of organizational types and argued that a contemporary military organization can (and partially already does) move between these modes, which are valid for the right contingency. We have characterized the problem space within which such contingencies lie by using the categories of wicked problems and Perrow's quadrants.

Drawing on the organizational science literature, we have suggested complementation of the NATO C2 Reference Model—the existing model lacks variables to specify organizational structures that facilitate planning for a variety of contingencies. Formalization has its place in military headquarters given the spectrum of threats, traditional and novel, that confront their planning. This formalization can be adjusted to enable adaptation and flexibility, and to facilitate innovation. Within this adjustable context, an overarching hierarchy, commander's intent and the formation of common intent enable working level activity to reach consensus without constraining creativity. Culture is an important issue but we give reasons for optimism that the culture clashes between higher management and worker-level staff experienced in other mixed Mechanistic-Organic institutions will not be so evident in a military HQ context because of closer engagement between command and staff in the conduct of planning.

Research to refine the levers of organizational adaptation we have discussed is ongoing—in the military, business, administrative, and academic environments—confirming the multidisciplinary nature of C2 science.

Appendix A: Off-Diagonal Complexity

This appendix may seem somewhat mathematical in comparison with the main body of the paper. Our aim here is to give a flavor of the progress in understanding complexity through concepts such as entropy and information which utilize the logarithm of an appropriate probability distribution. We represent a *design*, a *plan*, a *problem*, or an *environment* as a graph of nodes and links, consistent with Conway (1968) whose approach is outlined in Appendix C. Obvious candidates for the probability distribution to define complexity, such as the degree distribution or the link distribution, generate complexity measures that are maximal for uniform distributions rather than ostensibly complex graphs, such as the power law or scale free graphs of Albert and Barabási (2002). The solution is through the notion of off-diagonal complexity, *OdC*. Let A_{xy} represent the adjacency matrix of an undirected graph, with value unity if nodes x and y are connected and zero otherwise. Let d_x be the degree of node x. Claussen

(2007) introduces a matrix C_{mn} whose entries count how many nodes of degree *m* are connected to nodes of degree *n*. Formally, the definition is

$$C_{mn} = \sum_{x,y} A_{xy} \delta_{md_x} \delta_{nd_y} H(d_x - d_y)$$

with δ the Kronecker symbol and *H* the Heaviside step function. Claussen's motivation comes from the observation that for scale free graphs the non-zero entries of *C* are spread across the off-diagonals while for regular graphs the entries lie on the diagonal. The normalized quantity

$$a_d = \frac{\sum_m C_{mm+d}}{\sum_{m,n} C_{mn}}$$

measures this spread across a diagonal of distance *d* from the central diagonal of *C*. This quantity describes the distribution of off-diagonal entries. The off-diagonal complexity can then be defined via entropy:

$$OdC = -\sum_d a_d \ln a_d$$

OdC vanishes for regular graphs as only a single a_d occurs with value unity whose logarithm vanishes, and is small for large random graphs because of many small entries on the off-diagonals leading to small a_d. The power law distribution of link degrees for scale free graphs represents a balancing point: a hub generates many off-diagonal entries due to its non-uniform connectedness (it can be connected to many nodes which themselves are also highly connected, as well as to nodes of otherwise poor connectivity) but not all the corresponding a_d will be vanishingly small for large networks.

Appendix B: Military Planning Processes

Figure 9 portrays the immediate planning process for Canadian Forces in great detail, including tasks, products, and related workflows.

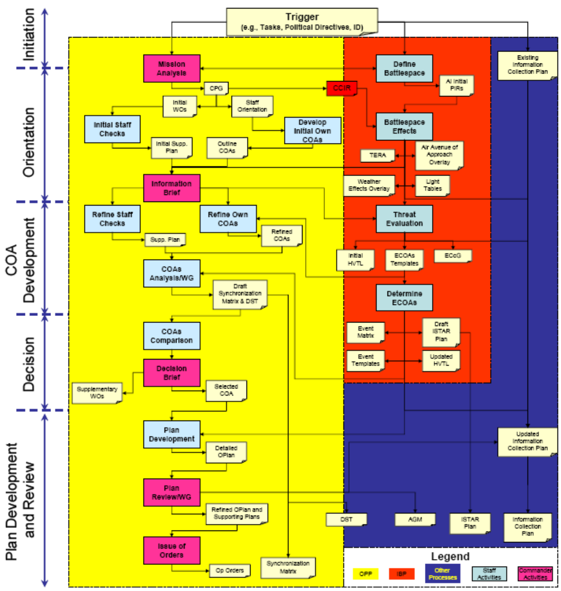

Figure 9. An example of the detail in a typical military planning processes, here that for Canadian Forces (from Guitouni et al. 2006)

Some features in this representation are common to all traditional planning processes: mission analysis, the development of courses of action, the delivery of information and decision briefs, and the issuing of orders as well as interactions with other organizational processes, such as *intelligence preparation of the battlespace*. The essential linearity and discrete decomposition of the activity into tasks is highlighted in the body of the current paper.

The Australian Defence Force uses the Joint Military Appreciation Process, which consists of several steps: Mission Analysis (MA); Course of Action Development (COADEV); Course of Action Analysis (COAAN); and Decision (DEC). The resulting product is a Concept of Operations (CONOPS) with various briefs appearing at intermediate steps and feeds taken from corresponding intelligence processes. A coarse view of the immediate planning process is illustrated in typical waterfall fashion in Figure 10.

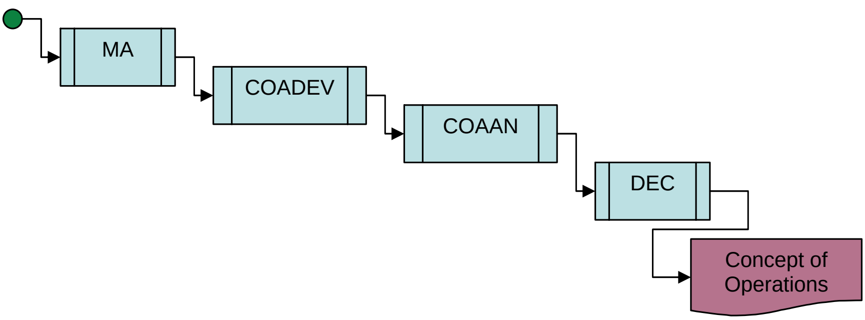

Figure 10. The Joint Military Appreciation Process (JMAP), used by the Australian Defence Force for operational planning.

Appendix C: Conway's Law

Conway (1968) identifies two entities: a system design, which is a document of coherently structured information reflecting the integration of a collection of parts into a single whole, and the design organization, the team producing the design. According to Conway, the stages of design are five-fold:

1. drawing of boundaries,
2. choosing a preliminary system concept,
3. organization of the design activity and delegation of tasks according to that concept,
4. coordination among delegated tasks, and
5. consolidation of sub-designs into a single design.

The hierarchy of sub-systems implicit in any substantial system motivates its representation as a graph of nodes and links, with nodes representing subsystems and links their communications. This graph of the design system can be mapped to the corresponding design organization:

- Any node of the design x corresponds to a unit or individual of the design organization X responsible for generating x. The mapping need not be one-to-one.
- Any link of the design $l(x,y)$ can be mapped to a communication path $L(X,Y)$ between design groups who must negotiate and agree on the establishment of the interface in the design.

This mapping establishes a homomorphism between designer and design. In particular, it shows that elements of the design will not have an interface unless the units of the design team have engaged in a negotiation to establish that interface.

There are limits to the validity of this Law. One is the degree of fidelity of the design, namely that some design elements will not or cannot be decomposed beyond a certain point and therefore designer interfaces may not all be anticipated or documented. This is clearly relevant to the discussion in the body of the current paper. A second limit is the dimension of past history: that links in the design may be in place because of links between design groups established in a previous design activity or established practices (doctrine, culture, procedures) that transcend the particular design activity.

The value of Conway's approach is in enabling implicit understanding about designing and planning to be made explicit and offering a mathematical framework for representing planning and plans which may offer explicit measures through future research.

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