Avoid Predictability in COA Development for Missions Coping with Complexity

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Abstract

For many years, we have noticed that different courses of action (COA) developed by Joint Operational Planning Groups (JOPG) for solving the same mission seldom rarely differ more than marginally. This can lead to plans that are predictable for an opponent. If we want to be able to expose an opponent to surprise and complex problems, predictable plans are not good.

Planning doctrine only based on the past experience is most often not the best when preparing for missions in future operations, therefore more creative and divergent thinking is needed. In this paper we discuss conditions for COA development that stimulate creative and divergent thinking. We also discuss how planners continually alternate between divergent and convergent thinking before and during execution of operations.

Keywords: Command and Control, Complexity, COA Development, Creative Thinking, Divergent Thinking
Introduction

All military officers have been impregnated with terms such as: "it is important to get inside the opponent's OODA-loop" (Brehmer, 2005; Hammond, 2001), and "the negligence to act is the commander more to blame than the wrong choice of means" (SwAF, 2013). They are simply taught that it is more important to make quick decisions than to make the best decisions. The speed of decision making can surprise an opponent or at least put him at a disadvantage in responding to our actions. However, there are ways other than speed to surprise an opponent. Innovative and unpredictable solutions can surprise an opponent more than predictable speed.

Contemporary military operations have complex characteristics including for example the increasing challenge of non-state or lone actors; persistent rapid technological development along with its broad availability via the internet; and the advent and expansion of new domains of possible threats such as information systems, space, cyberspace, electronic warfare, and autonomous weapons (Gerry et al., 2017; Heltberg & Dahl, 2019). In recent years, major changes have been made to the organization and doctrine of many countries to meet the new complex problems (Hagel, 2014; US Joint Chief of Staff, 2017; NATO, 2013). But still today's way of planning operations is not entirely suitable for meeting this complexity. Changed organization and doctrines do not seem to be enough because we still can see linear thinking and a lack of innovation and creativity (Porkoláb & Zweibelson, 2018; Crowell, 2019).

For example, planning methods, such as NATO COPD (2013), US Joint Planning JP 5-0 (2017) and the Swedish Planning- and C2 method - SPL (2017) provide little help regarding how creative thinking can be used to develop Courses Of Action (COAs). It has proved difficult for military planning teams to generate and develop COAs that differ (Heltberg & Dahl, 2019; Crowell, 2019) and therefore, it is likely that, our execution becomes predictable. There can thus be difficulties in surprising the opponent.

As an attempt to address this the concept of military design thinking or “defence applied design” has been introduced in western military communities (e.g., Banach & Ryan, 2009; de Czege, 2009; Jackson, 2019; Porkoláb & Zweibelson, 2018). There are several accounts of military design thinking (Jackson, 2019), but it is generally associated with concepts such as innovation and creativity. Another associated concept is divergent thinking as a means to be creative (e.g., Furtado, 2019). This is contrasted with convergent thinking, which is said to characterize analytic decision-making and problem solving, but may also lead to rigidity and predictability (Porkoláb & Zweibelson, 2018).

In this paper, we first outline a conceptual metaphor of the C2 process based on the concepts of divergent and convergent thinking. Then we elaborate on the part of the C2 process that involves COA development, and specifically generation of COAs, in terms of divergent thinking. Finally, we propose an experimental design for exploring conditions for divergent thinking in COA generation. In this paper we focus on divergent thinking since we believe that despite its importance it seems to a lesser extent be developed in military practice.

Divergent and convergent thinking

The concepts of divergent and convergent thinking was brought forward by Guilford (1950) in his model of intelligence and creativity. Divergent thinking can be described as when “ideas and associations move in varied directions” (Runco & Albert, 2010, p. 34) which
results in multiple or alternative ideas or solutions to problems that are novel or unusual (at least seen from the perspective of the individual that generates them). Important for the present paper, divergent thinking generates variability in ideas (Cropley, 1999). Many studies have showed that performance in divergent thinking tests predicts performance on creative problem-solving tasks (Runco, 2010) specifically on the idea generation phase in such tasks (Vincent, Decker, & Mumford, 2002).

In successful creative production also convergent thinking is involved however (e.g. Cropley, 2006; Lonergan, Scott, & Mumford, 2004). Convergent thinking can be described as trying to identify a correct solution or answer to a clearly defined question. Convergent thinking may involve rational decision-making or recognition of solutions based on previous knowledge. In contrast to the variability among ideas or solutions produced by divergent thinking, to rely solely on convergent thinking tends to lead to similar ideas. Performance on creative problem-solving tasks and creative achievement is related to domain-specific knowledge and expertise (e.g. Vincent, Decker, & Mumford, 2002; Weisberg, 1999). For instance, experts’ ability to identify relevant but anomalous information is found to be related to creative problem solving (Mumford et al., 1996). Too much expertise in a domain may however hamper the ability to generate novel ideas, which may be explained by the convergent process of pattern recognition, including learned solutions to the problem at hand (Cropley, 1999).

Convergent thinking is also associated with critical thinking and valuation and is needed in creative production for recognition of what is novel, original and useful among the ideas that resulted from the divergent phase (Cropley, 2006; Runco, 2010). Thus, in order to produce both novel and useful ideas, divergent thinking is needed for generating variability and novelty, whereas convergent thinking is necessary for exploring the generated ideas. Without accompanying convergent thinking, divergent thinking might lead to “reckless variability” (Cropley, 2006).

In next section, by a metaphor we attempt to relate divergent and convergent thinking to a C2 process.

Breathing Approach

Almost all living things need oxygen and for mammals it means breathing. If we think of an organization that breathes, we get a living organization. Oxygen for an organization is new knowledge and creative ideas that can be turned into successful actions. As a way to conceptualize an ongoing C2 process, including both planning and execution phases, we utilize the Breathing Approach as a metaphor in which inhalation symbolizes divergent processes and exhalation symbolizes convergent processes (see Figure 1).

During the first inhalation, before the execution of the operations starts, divergent thinking help to discover the situation and find possible scenarios. During inhalation to find possible future scenarios can scenario thinking based on what’s driving the situation (Shell, 2008;

1 The Breathing Approach metaphor is similar to the “Breathing-In, Breathing-Out Model” presented at 16th ICCRTS by Pepper and Markham (2011). In our case, however, we specifically utilize the model for illustrating the interplay between divergent and convergent thinking.
Wulf et.al. 2010; Turner et al., 2013) be useful helping the planners to think in a more abstract way and thereby stimulate divergent and creative thinking (see below). Wulf et.al. (2010) says that the scenario based approach is an open and creative approach that considers multiple strategy options and takes multiple perspectives into account. Turner et.al. (2013) means that generation of future scenarios enables participants to develop more complex mental models of the situation – including models about what might drive future outcomes.

After inhalation, we have to breathe out. In the first exhalation, before the execution starts, convergent thinking helps us to frame or define the problem we have to solve in the actual situation.

During the second inhalation, before the execution begins, divergent thinking helps us to discover potential solutions (COAs) to the framed problem. During this inhalation, planners need to be able to travel between the abstract and the concrete (Jackson, 2019). Metaphors can support abstract thinking (Zweibelson, 2011) and can be seen as conceptual vehicles to communicate abstract ideas to the planners. The metaphors can be used as a bridge between divergent and convergent thinking, a beginning to express possible solutions without putting too much restriction on COA development. Finally, before the execution begins, convergent thinking is helpful in choosing a solution and planning the execution of the operation.

During execution of the operation, divergent thinking is helpful to, based on previous knowledge, discover new possible scenarios as a base for reframing the problem. During the exhalation phases, both to frame the problem and to select action options as a solution to the framed problem, we need to make assumptions on which the solution rests. These assumptions must be assessed continuously during the execution of the operation.

![Figure 1 The Breathing Approach introduction](image-url)
However, it is not enough to understand if we are solving the right problems and does the right things. We must understand if the things we choose to do are done in the right way. We may also use the Breathing Approach with divergent and convergent thinking to illustrate this (See Figure 2). While the deep breaths help us to understand if we are solving the right problem and if we are doing the right things to solve that problem, the organization also needs to take short breaths to understand if we are doing things the right way. The short breaths mainly help us to adjust the coordination of the operation during its execution, while the deep breaths help us to keep the right direction for the operation.

What is the scope of the Breathing Approach?

As indicated above, the Breathing Approach may be seen as a metaphor of the C2 process as conducted by the C2 system during planning and execution of operations (see also Pepper and Markham, 2011). However the metaphor should, in our case, foremost be seen as an illustration of the cognitive processes of the humans involved, specifically the staff involved in planning both before and during execution. The divergent and convergent phases may then be taken quite literally, in that staff members need to alternate between divergent and convergent thinking.

In the remaining of the paper, we focus on the divergent phase in the second “inhalation”, that is, the part of the C2 process that concerns COA development and in particular the generation of COAs.
Courses of Action Development

Course of Action is defined to be an option that will accomplish or contribute to the accomplishment of a mission or task, from which a detailed plan is developed (NATO, 2013). Since the process of COA development provides the groundwork for further planning, the variety and quality among the COAs are essential for successful planning and execution.

Current Planning Doctrines

Three planning doctrines are studied to understand how COA development are described in current planning doctrines; the North Atlantic Treaty Organization (NATO) Comprehensive Operational Planning Directive (COPD) (2013), US Joint Chief of Staff Joint Publication (JP) 5-0, Joint Planning (2017), and Swedish Armed Forces Handbook Swedish Planning- and C2 method (SPL) (2017). All three planning doctrines prescribes collaborative (NATO, Sweden) or integrated (US) planning between strategic and operational levels. Moreover, the three planning doctrines emphasis the importance to understand the emerging crisis and frame the problem.

The strategic level provides a Strategic Planning Directive (SPD) to initiate operational levels planning (NATO, 2013; Swedish Armed Forces, 2017) or a strategic guidance (US Joint Chief of Staff, 2017). The SPD include provisional missions with objectives, for the operational commander and the selected military response options strategic framework (NATO, 2013; Swedish Armed Forces, 2017). The strategic framework include military strategic objectives (MSOs), military strategic effects supporting the objectives and criteria for success (NATO, 2013; Swedish Armed Forces, 2017). At the operational level, once strategic guidance is given, planning translates this guidance into specific activities aimed at achieving strategic and operational level objectives and attaining the military end state (US Joint Chief of Staff, 2017).

Since the SPD include so much guidance for the operational commanders planning it means limiting freedom for COA development. The NATO COPD (2013) has a footnote that describes that the SPD are not to be construed to have the intent of constraining the operational commander in the conduct of the operational estimate, including the development and selection of an operational level course of action.

After understanding the problem and understanding what needs to be achieved begins COA development. Planning translates strategic guidance and direction into campaign plans and operational orders state (US Joint Chief of Staff, 2017). All three planning doctrines describe that after analysis of the SPD or strategic guidance, the operational commander provides his or her guidance for COA development. This imposes additional restrictions on COA development.

All three planning doctrines prescribe that the joint operational planning group (JOPG) should appreciate possible actions within the operational framework. The operational framework is a result from the factor analysis, system analysis, Centre of Gravity analysis, the analysis of the mission with objectives and the determination of the conditions to be established (NATO, 2013; Swedish Armed Forces, 2017). The operational framework include decisive conditions to be established, operational effects, operational actions, lines of operations and sequences (NATO, 2013). The NATO COPD (2013) states that the development of the operational framework, and its elements, is iterative, while the Swedish Planning- and C2 method (2017)
states that the operational framework before the COA development should only contain objectives and decisive conditions to not impose restrictions on the development of COAs. A very detailed operational framework would probably limit creativity and divergent thinking for COA development.

All three planning doctrines states that own COA development, guided by the initial operational design (or operational framework), the appreciation of opposing COGs and the Commanders Planning Guidance, should encourage creative thinking to open up the range of possibilities that could be considered. The variety of COAs is developed during COA generation, which is a step procedure during COA development. The NATO COPD (2013) and the Swedish SPL (2017) stipulate that JOPG should use the brainstorming method to develop own COAs. SPL (2017) gives a short guidance how to apply the brainstorming technique during COA development while NATO COPD (2013) only prescribes the planning team to use brainstorming. US JP 5 (2017) recommend that a step by step approach which uses a reverse planning technique and do not mention anything about techniques to stimulate creative and divergent thinking. All three planning doctrines stipulates that the planning group should consider as many COAs as possible but none of the three planning doctrines provides a clear description of how creative and divergent thinking can be stimulated in COA development.

However, we wonder if there is still room for creative thinking and operational art with the many limitations for the COA development.

**Improving COA generation: Mindset or methodology?**

As shown above, the current process of COA development may hamper the creativity among planners. In particular, COA generation process, with respect to divergent thinking, may need to be enhanced.

How to encourage a mindset that enhance divergent thinking and creativity? There are numerous techniques for enhancing creativity (see for example de Bono, 1995), many of which are applied in business settings, with more or less scientific support. Within the scientific realm, studies have shown that a simple instruction to participants in experiments to “be creative” increases the creativity of responses (e.g Harrington, 1975; Runco, Illies, & Eisenman, 2005). For our purpose, this seems however to be a too trivial to act as an enhancer. As mentioned above, there are already instructions in planning doctrines “to be creative” during COA generation.

Another common technique for creative production, both in military and in civilian contexts, is brainstorming. Brainstorming, if conducted in groups, do have limitations though due to hampering group mechanisms, and is even shown to be counter-productive for production of original ideas (e.g., Runco, 2010, but see also Kalargiros & Manning, 2015). Also, in a study of brainstorming in COA development Heltberg and Dahl (2019) showed that the process did not result in the intended co-creation and progressive development of new ideas but instead resulted in an assembly of separate concepts.
There are other possibilities however, which are more directly addressing divergent thinking. Studies have shown that level of abstraction versus specificity in creative generation tasks influence the generated products (Ezzat et al., 2018; Ward, 1994; Ward et al, 2004; Welling, 2007). When generating new ideas in a particular domain, there is a tendency to first retrieve specific exemplars from memory as a starting point. The new ideas that thereafter are generated often resemble the retrieved exemplar, the path-of-least-resistance-model (Ward, 1994). To test how abstraction in problem formulation influences creativity, Ward et al. (2004) conducted a series of experiments in which participants were asked to imagine a creature living on an imaginary planet. Some participants were asked to use familiar animals as starting point for idea generation (specific approach), whereas other participants were asked to think of the conditions on the other planet and the attributes creatures would need to adopt to the planet, or to consider fundamental properties of creatures (abstract approach). In both cases, the abstract approach led to more novel responses.

Thus, there seems to be possible to enhance divergent production of ideas by encouraging a more abstract mindset among planning teams.

Another possibility are by modifying the formal planning instructions. As shown above, too much detailed instructions for the COA development probably restricts the planning team’s creativity. In line with the findings of abstraction versus specificity on divergent thinking, higher abstraction in planning instructions may provide greater opportunity for the planning teams to use divergent thinking, thereby increasing the variation for possible COAs. Very concrete instructions, on the other hand, may limit the possibility of using divergent thinking (see figure 3).

Currently we are developing an experiment to test contributions of mindset and formal planning methodology on the process of generating COAs and the resulting quality of alternative COAs. The results will be presented in a future paper.

Figure 3 Degree of abstraction and its effect on variety for possible COAs
Below is an outline of our experiment.

We are not interested in creativity or divergent thinking per se, but are instead aiming to find possibilities for improvements in C2 methods. Hence we do not apply any of the common tests of creativity or divergent thinking. Instead we will try to create an ecologically valid situation that will mimic a real-world planning and/or re-planning situation (e.g. during an exercise or in conjunction with military education), focusing on the process of COA generation.

**Independent variables**

We will vary planning restrictions (restricted and less restricted) and mindset (abstract and specific). The planning restrictions will be given to participants through the planning instructions. The mindset manipulation will be elicited by meta-cognitive instructions (“think of…”) and/or examples of abstract properties provided to participants.

**Dependent variables**

Common measures of divergent thinking involves fluency (number of responses), originality (uniqueness or unusualness of responses), flexibility (the number or uniqueness of categories of responses), and elaboration (the extension or “filling out” of the ideas generated) (Plucker & Makel, 2010). In keeping with our goal to improve C2 methods, we will measure relevant qualities of COAs generated under the different conditions. Relevant qualities will involve originality of the COAs because we assume that unique or unusual COAs could contribute to success of the operation. In addition, we will measure flexibility, which we define as variability among the COAs generated. We assume that a set of COAs that differs from each other will provide a richer basis for subsequent COA selection which in turn ought to contribute to success.

The proposed experimental design is our first step to experimentally explore and test the potential of divergent thinking and ways to enhance it in selected parts of the C2 process.

**Conclusions**

We recognize the need for new C2 approaches to be able to be meet new challenges and to act unpredictably. To improve the circumstances for divergent and creative thinking during the C2 process may yield a broader understanding of possible future scenarios and thus makes us better prepared to face the future, and assist in the development of creative and innovative COAs.

In this paper, we expand on the notions of divergent and convergent thinking and we illustrate this by the Breathing Approach metaphor (cf. Pepper & Markham, 2011), which illustrates how planners continually alternate between divergent and convergent thinking during planning and execution. The Breathing Approach provides two perspectives:

- An effects perspective to examine possible futures, frame the problem, explore many possible solutions to the problem and finally find a solution describing what must be done in order to fulfill the received mission.
An execution perspective to examine the execution of our actions and adjust them when necessary.

We believe that the Breathing Approach, with its base in the concepts of divergent and convergent thinking, may be a helpful metaphor when further examining of current C2 processes, and to inspire to further studies on how to take advantage, of and facilitate, the varieties of human cognition during the complex process of planning both before and during execution of operations.

References


