

DRAFT

Complexity concepts for Command and Intelligence

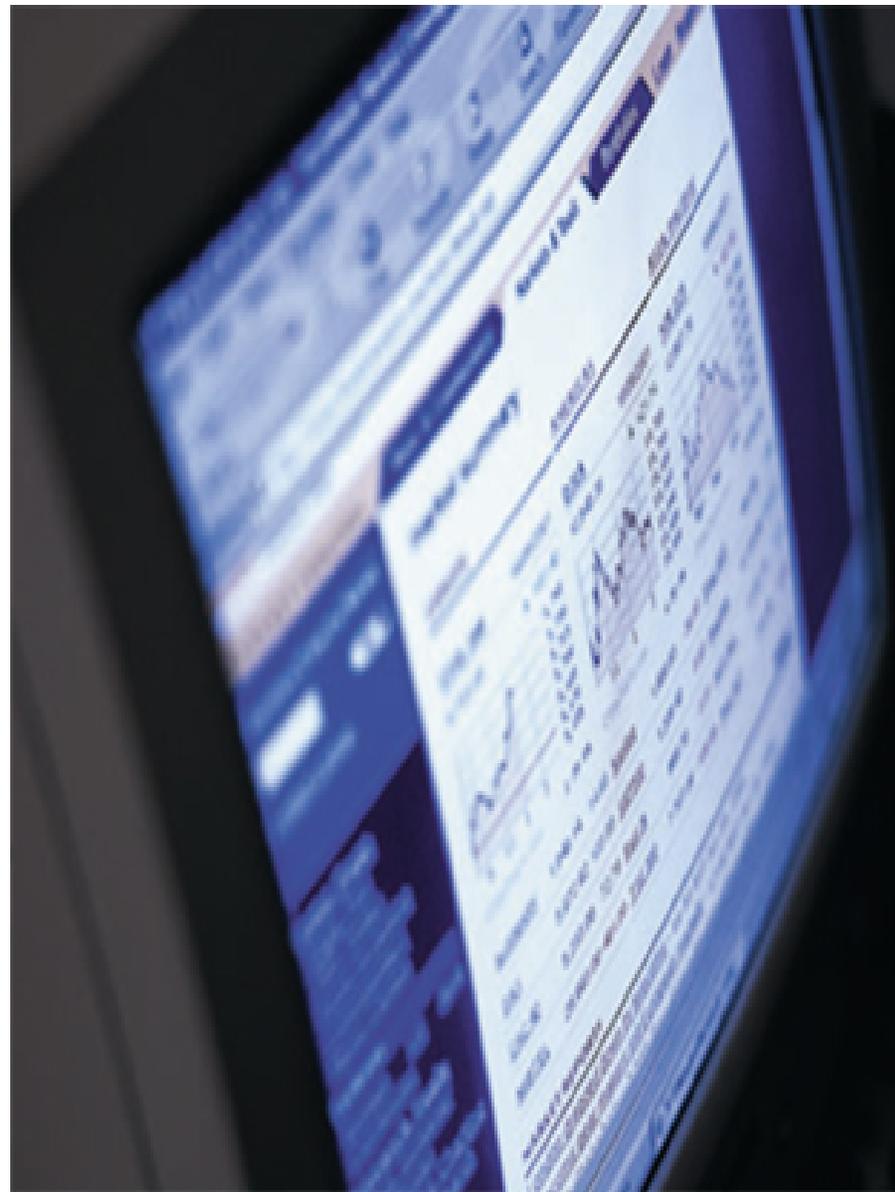
Dr DJ Marsay, CMATH FIMA

A presentation to:

13th ICCRTS: C2 for Complex Endeavors, 2008

QinetiQ, Inform, Command and Security

Date: June 2008



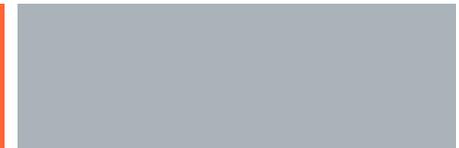
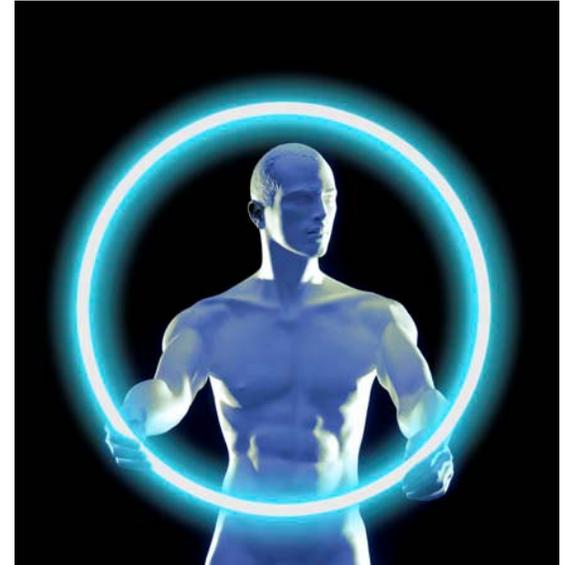
DRAFT

Contents slide

- 01 Introduction
- 02 Metaphors
- 03 Problem Characterisation
- 04 Playground Metaphor
- 05 Implications
- 05 Summary



01 Introduction

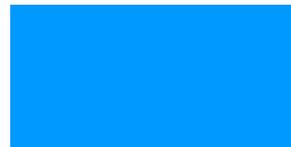
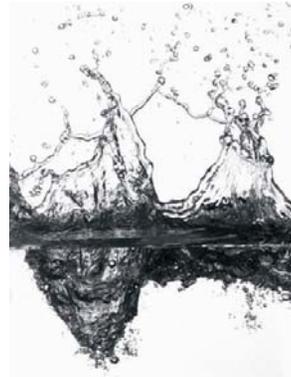


01 Introduction

This presentation:

- Argues that an understanding of complexity is essential to effective Command and Intelligence.
- Discusses the desiderata for such models and metaphors.
- Describes a tentative model of complexity based on a playground.
- Gives some deductions for the nature of uncertainty, collaboration, adaptation and consideration of effects. □

02 Metaphors



02 Metaphors

Command and Intelligence in complex situations are not simple, and attempts to 'capture' their requirements in straightforward 'logical' statements have had only limited success.

Previous work has argued that in complex situations Command and Intelligence need a kind of agility that entails a 'liquid' structure that is not amenable to conventional development or management approaches. It needs a 'new logic'.

Metaphors provide a way of 'getting a handle' on such complex needs.

The metaphor of a playground is offered – but it may need some explanation. □

03

Problem Characterisation



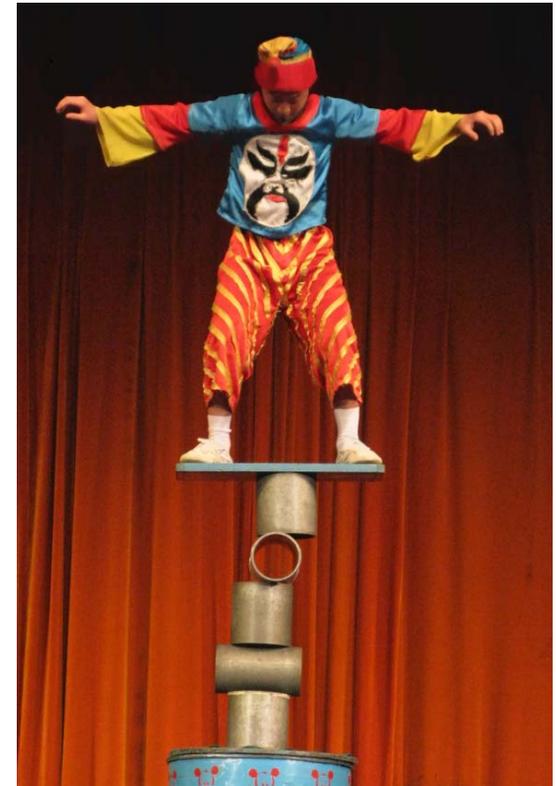
03 Problem Characterisation

A metaphor should show that the problem is 'wicked', and include complex uncertainties, such as 'reflexive probability' and those of gaming.

Practitioners in particular emphasised the 'nested' nature of the problem. A problem-of-problems?

03 Problem Characterisation

A metaphor should show that it is often necessary to 'balance' or 'juggle' issues across different 'levels of the fight', or between conflict and confrontation, focusing on key issues while at the same time keeping one's eye on the 'bigger picture', and having the 'cognitive agility' to be able to switch from fight to fight or confrontation as circumstances occur, either to avoid being caught out or to exploit an emergent opportunity. □



03 Problem Characterisation

A metaphor should be able to draw on, and relate to, best practice in this area, such as science advisers (e.g. Bernal) and practitioners (e.g. Smuts, Mao, Smith).

It should reflect the 'liquid' metaphor, revealing the need to moderate the balance between fluidity and cohesion, and the difference between cohesion and classical coherence. □

03 Problem Characterisation

It should recognise that:

- Sufficiently complex situations are not analysable as combinations of definite parts.
 - They continually change, invalidating any definite understandings and requiring an on-going process of appreciation
- There is an uncertainty principle at work.
 - Like adaptive systems, the more closely adapted they are, the less they are exploring their environment, and hence the less robust they are. □

03 Problem Characterisation

If we think of Command and Intelligence roles as, broadly, operator, expert or generalist, then our metaphor should reflect that in complex situations:

- It is not sufficient to 'operate' a given 'system'.
 - New 'systems' are continually needed to meet new challenges.
- It is not sufficient to be an expert in some definite, bounded, domain.
 - Complex situations are always challenges bounds and assumptions.
- A generalist approach is needed – leaning on a different kind of logic and math from operators and specialist experts.

A metaphor should give some view of what generalists are faced with. □

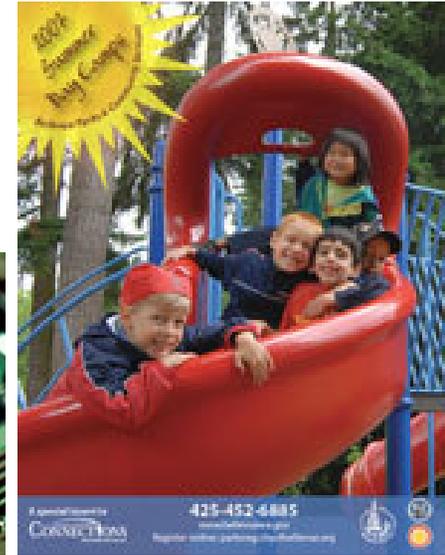
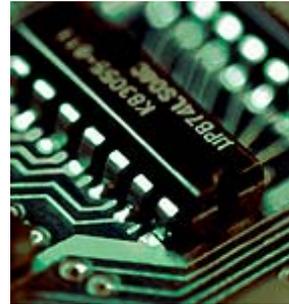
02 Playground Metaphor



04 Playground Metaphor

A playground is not like a conventional system.

- Has a range of collaboration, confrontation and conflict.
- Has structure – but not a classical one.
 - Has nested ‘games within games’.
- Is rich in uncertainty
 - Including reflexive probability.
 - And deception and cheating.
- Children need to have regard for ‘the level of the fight’.
- There are no fixed solutions.
 - A generalist approach is needed
- Yet (some) teachers can be helpful. □



05 Implications



05 Implications

Sense-making challenges.

Like a playground:

- “In war everything is uncertain and variable, intertwined with psychological forces and effects, and the product of a continuous interaction of opposites. (Clausewitz 1832)”
 - Including something like collaboration but with no clear context to inform a ‘common purpose’.
 - More like a collaboration of artists.
- “Such operations also tend to highlight the **shifting overlap** that always exists in practice between the various levels, the **constantly evolving** nature of operational art, and the fact that the operational level is **not tied to a particular level** of command or even to location. (Kiszely 2005) □

05 Implications

Sensemaking processes:

- “Data, when placed in context such that it reduces uncertainty, becomes information, while information becomes awareness when it passes from information systems into the cognitive domain.” (SAS 050).
 - In what sense is this true of a playground?
 - Creating confusion could be an effective strategy for gaining influence.
- “One has the vague feeling that **information and meaning may [be like] ... conjugate variables ...** being subject to some joint restriction that condemns a person to the sacrifice of one as he insist on having much of the other.” (Shannon & Weaver 1963).
 - In the playground, the more one plays a fixed game the more one can gain information about it, the less about the broader game.
 - Similarly in the military (Boyd’s law).
 - In particular the search for coherence at an information level, or between levels, may be detrimental to broader coherence. □

05 Implications

Sense-making models:

- “Game theory has a problem to extend its techniques to understand how to approach games where the rules change, and the game is open. ...”

“This [need] flies in the face of standard system engineering. .. one may need to demonstrate processes that have good asymptotic properties, and that can evolve to keep performing in unstable environments.” (S Popper et al 2004)

- In particular:
 - Notions of probability, information, categorisation, ontology, likelihood, causality, value and optimisation are all problematic, lacking a clear context to give them meaning. □

05 Implications

Innovation:

- We should expect the novel, and be wary of the 'unknown unknowns'.
 - These are often not totally new, but new combinations.
- We should be concerned with
 - the potential for existing components to form new combinations
 - the 'forces' that encourage or inhibit such combinations
 - the potential for positive or negative reinforcement of new behaviours.
 - The potential for 'spin off' (or 'secondary effects'). □

05 Implications

Innovation:

- We should (with von Clausewitz and Turing) recognize complex innovations as arising from :
 - A 'healthy' mix of Drive, Order and Variety
- We should privilege sustainability over 'optimisation'.
- We should be concerned with 'frustration' in systems that may drive change
 - Where a large re-adjustment would be advantageous to a player, but is currently blocked.
 - Look for factors that may change the frustration and its barriers.
- We should be looking for unnecessary sources of order / regularity
 - Orderliness can be used against us.
- We should be seeking to remove unwarranted sources of variety
 - Discrimination □

05 Implications

Innovation:

- We need to identify the key 'level' at which innovation is happening (or needs to happen) and deal with it.
- The rest can probably be dealt with more simply, most of the time. □

06 Summary



06 Summary

This presentation:

- Has argued that an understanding of complexity is essential to effective Command and Intelligence.
- Discussed the desiderata for such models and metaphors.
- Described a tentative model of complexity based on a playground.
- Gave some deductions for the nature of uncertainty, collaboration, adaptation and consideration of effects, and their implications. □



QinetiQ

www.QinetiQ.com

© Copyright QinetiQ limited 2008

QinetiQ

The Global Defence and Security Experts