



Australian Government

Department of Defence
Science and Technology

UNCLASSIFIED

Next Steps in the 5th Generation HQ Concept

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DST
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Science and Technology for Safeguarding Australia

Overview

- Review: C2 Agility and 5th Generation HQ
- Models of Human Cognition and AI
- Mintzberg on Planning
- What it might really mean: “The Plan As App”
- Conclusions

Review: C2 Agility

NATO C2 Reference Model (SAS-050):

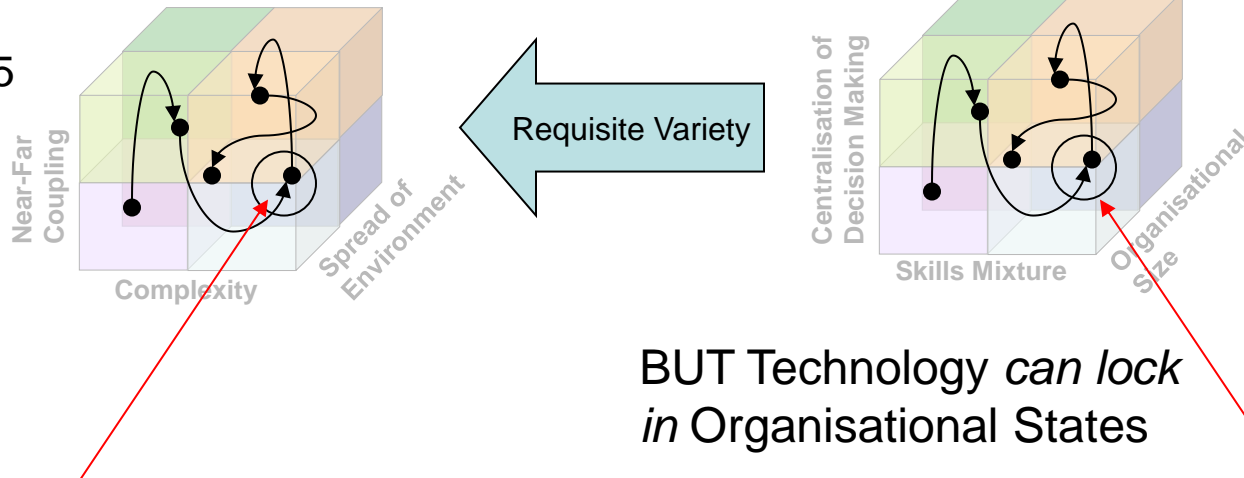
Ability to be robust, flexible, responsive, innovative, resilient and adaptive.

Geometrical Model: Kalloniatis, Macleod, Kohn – ICCRTS, 2010

Environmental State

Organisational State

See also:
NATO SAS 085



BUT Technology *can lock in* Organisational States

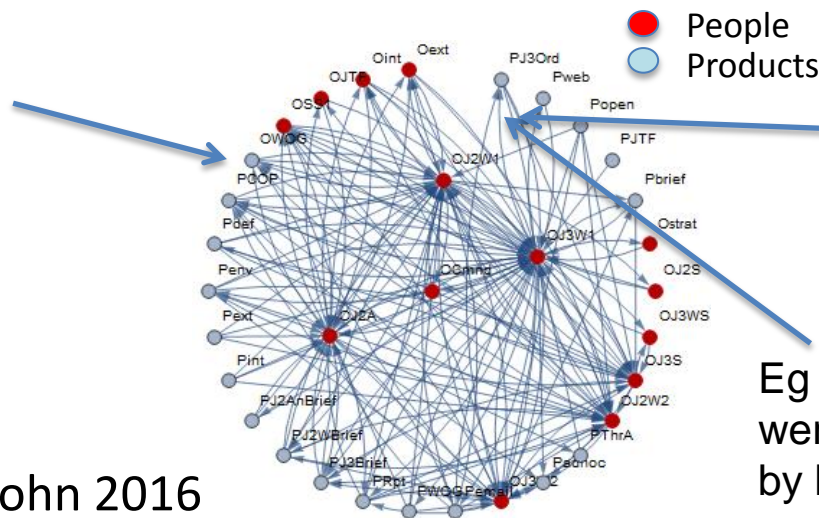
High complexity + tight coupling = turbulent environment – requires *short time scale* C2 change. *Wasted human effort in battling the technology as well as making the C2 change.*

Can an ICTSys as an eco-system of (eg) bots and apps overcome this?

Review: 5th Generation HQ

- Key Principles: Requisite-Variety – Agile C2 – Tailorable distribution of SA/Decision Authority – *guided by AI and Data Analytics*
- **Encode multiple organisational modes – technology aids each distinctly, but also aids transitions between modes**

Eg what if these were bots/apps?

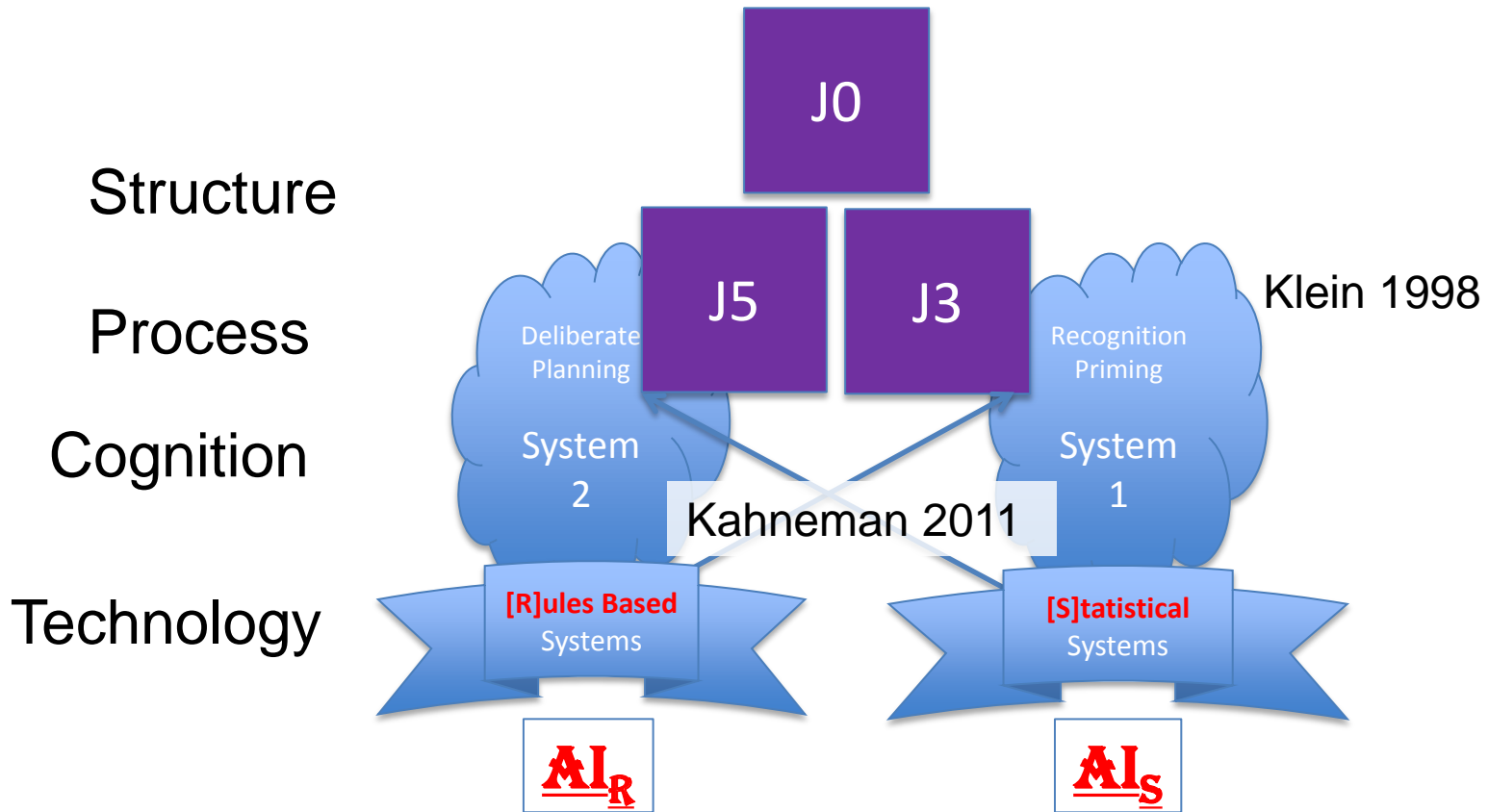


Eg what if mediated links could have traffic *micro-regulated* to 'nudge' to synchrony?

Eg what if links were recommended by bots/apps?

Yue, Kalloniatis, Kohn 2016

The Next Steps: Human Cognitive Models



Left-Right brain in organisational harmony: the Mintzberg framework for Planning

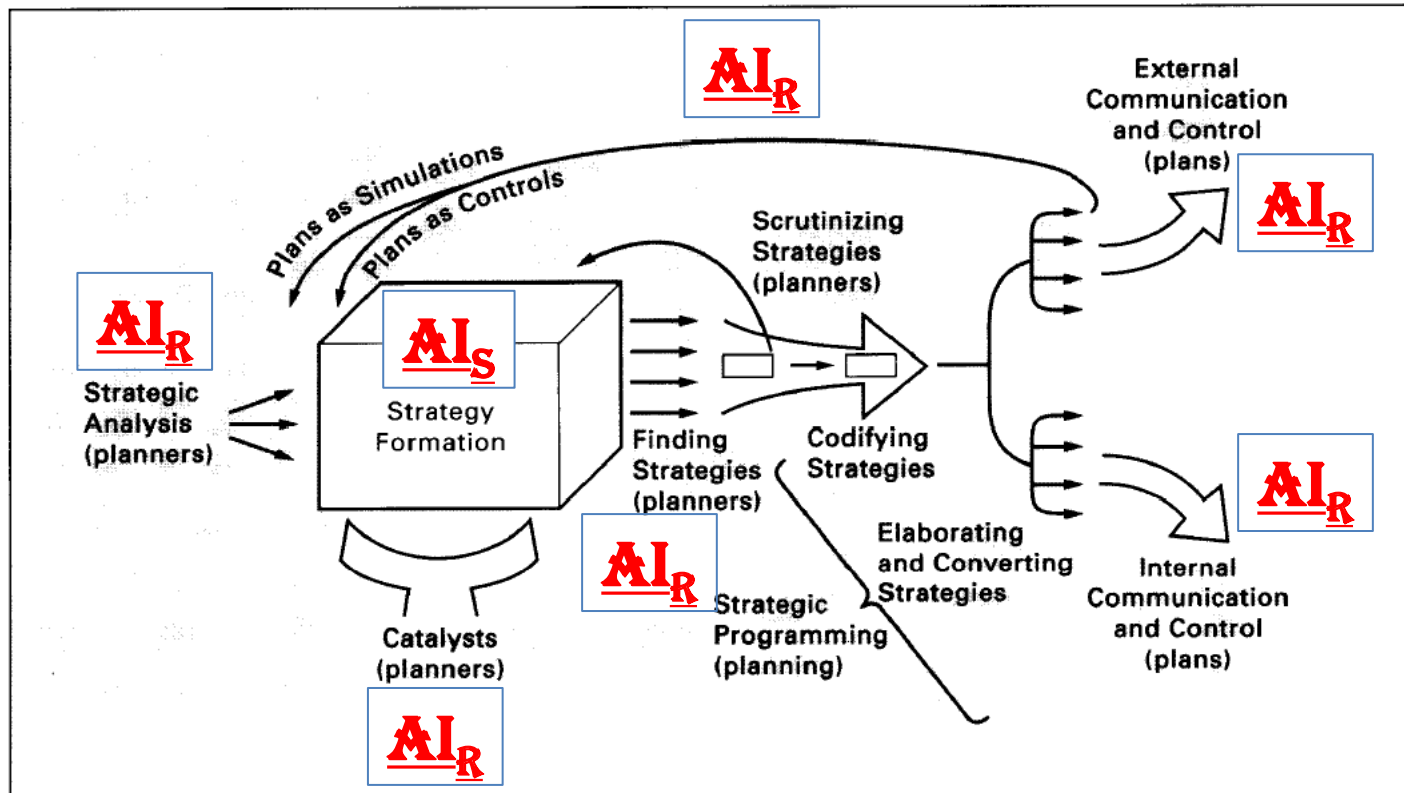
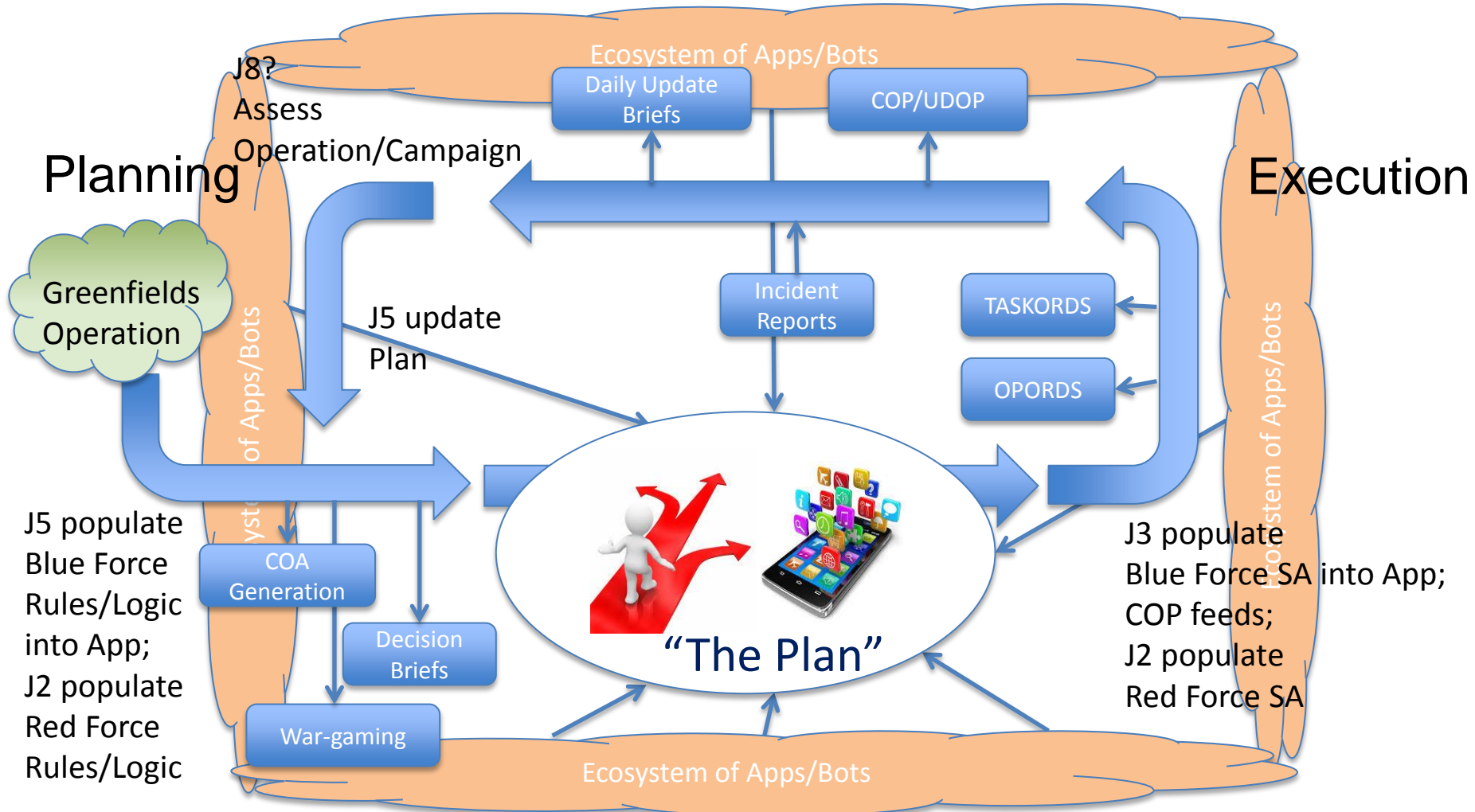


FIGURE 2. A framework for planning, plans, and planners.

Plan-as-App

Thanks to discussions with Hing-Wah Kwok, Mark Unewisse, Nik Luketic



Conclusions: While not the ‘silver bullet’ to a 5th Gen HQ, Plan-as-App ...

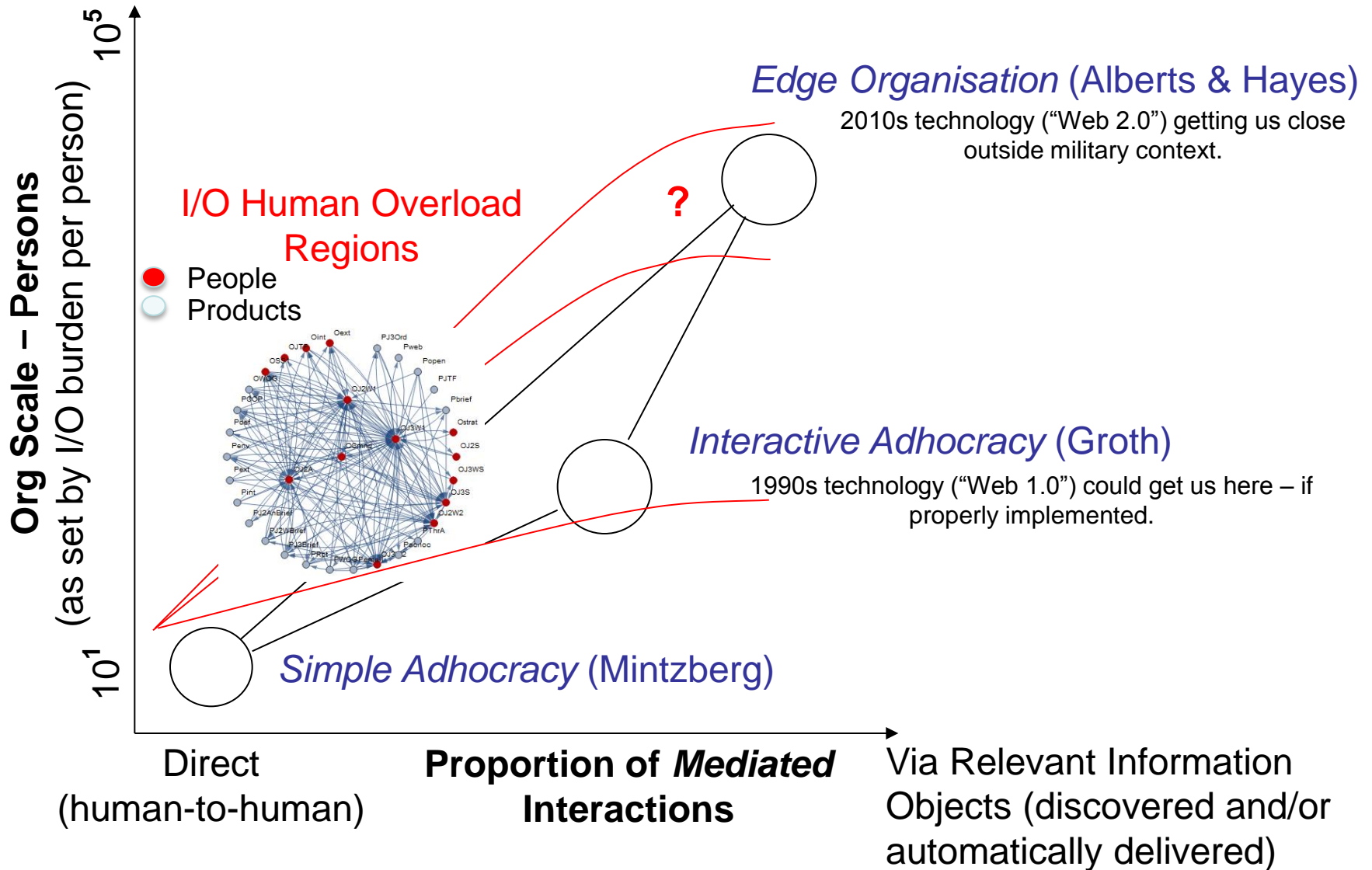
- Embodies the Left/Right\System1/2 Distributed Cognition of Headquarters
- Embodies the Mental Models of both Planners and Operators, permitting externalisation and resolutions of inconsistencies
- Enables continuity across J5-J3 handover, and entire life-cycle of an operation/campaign
- Enables strategic judgements about how to integrate diverse types of task specific AI
- Enables integration across multiplicity of specialised tools/apps from enabling staff areas J1, J2, J4, J6; includes *purely procedural/administrative* tasks
- Enhances Mintzberg’s ‘Divisional’ Organisational Type:
 - it is the single integrated output across all Branches of HQ;
 - It can be embedded in as little, or as much, hierarchy as appropriate;
 - hence it enhances HQ Agility.
- Enables deployed C2-Agility by encoding/generating large numbers of COAs and alternative Control arrangements models, allowing real-time interrogability and forecasting.



Appendices



Scalability of the Edge

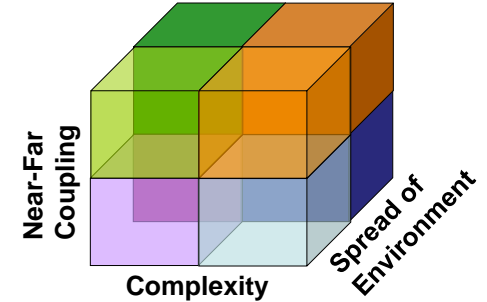
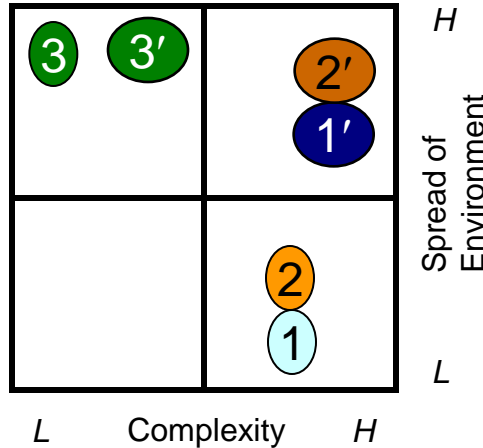


ICT, Organisations and Contingencies

Geometrical Model: Kalloniatis, Macleod, Kohn – ICCRTS, 2010

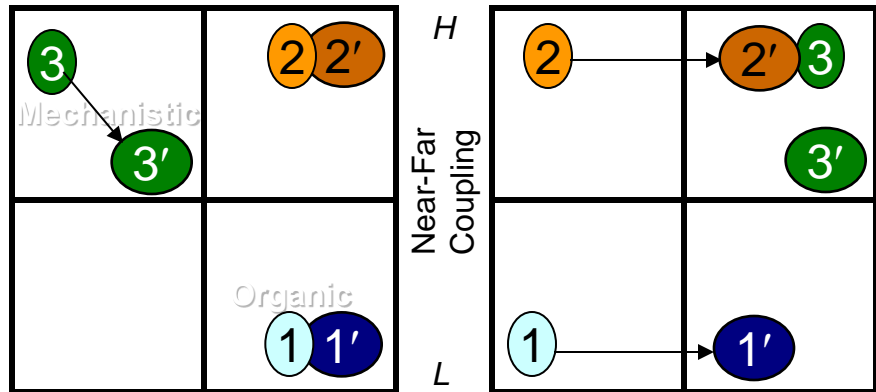
Mintzberg Types (1979)

- ① Adhocracy
- ② Simple
- ③ Machine



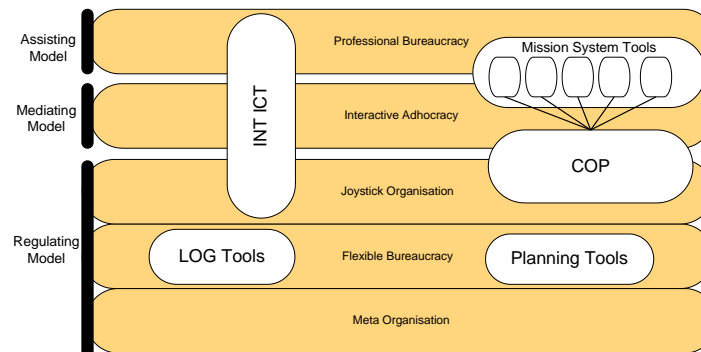
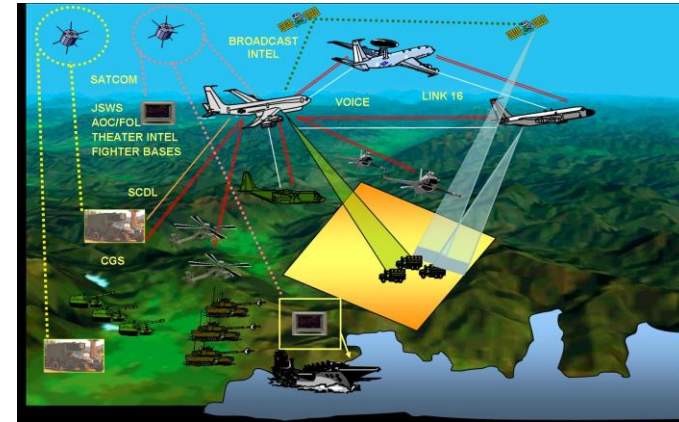
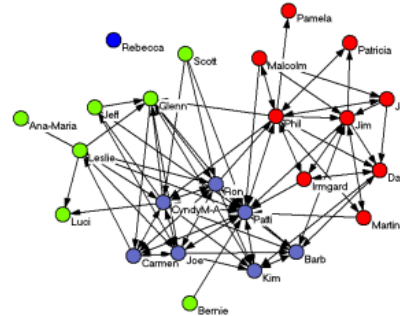
Groth Types (1999)

- ①' Interactive Adhocracy
- ②' Joystick
- ③' Flexible Bureaucracy



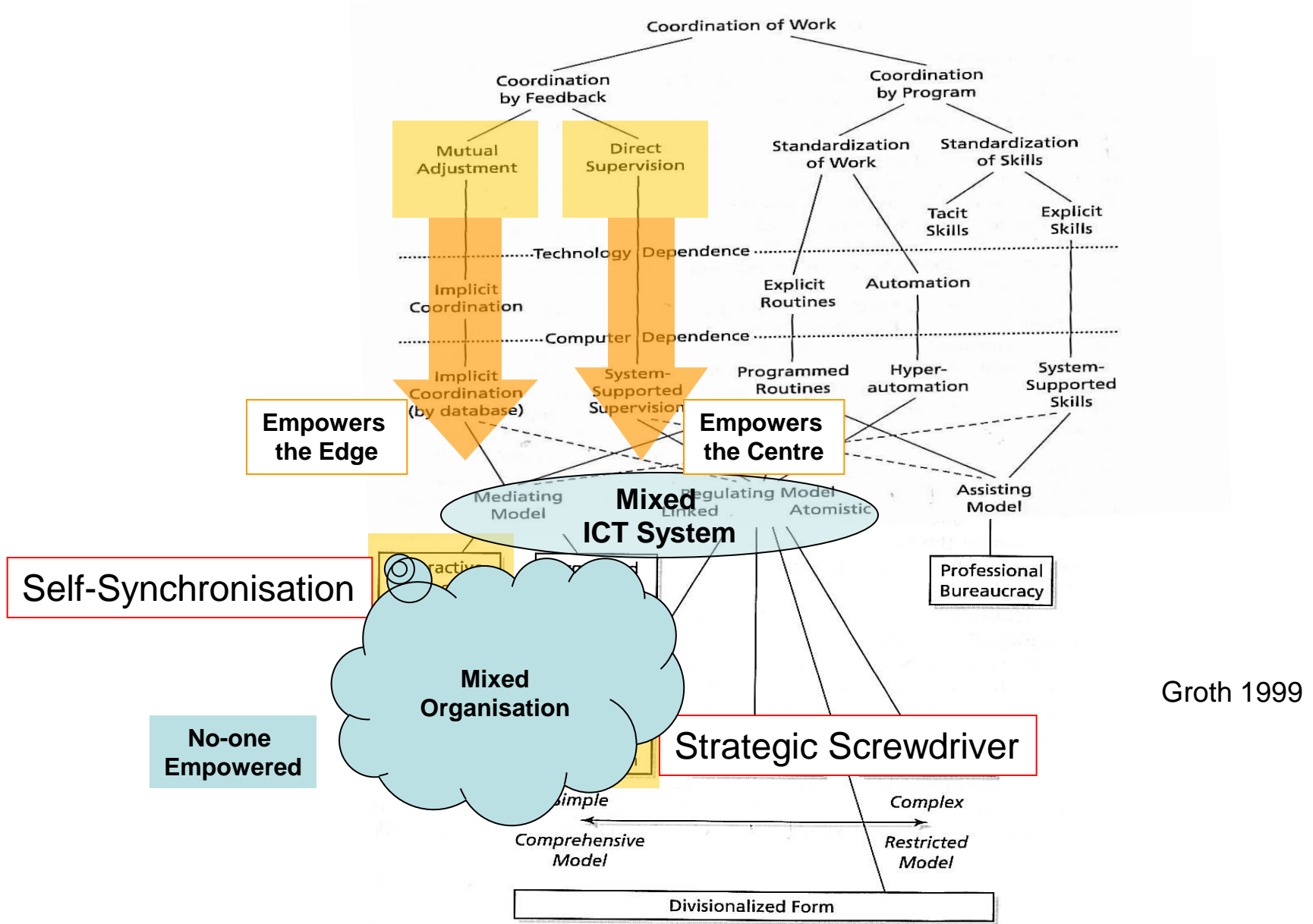
Why not Network Centric yet?

- Collaboration with peers in other HQ branches – limited. Why?
 - Power “I am the C2”
 - Tribalism is instinctive
 - Busy people don’t pull
 - Legacy IT systems mired in bureaucracy
 - Lack of unified-consistent *Organisational Concept* behind enterprise IT procurement



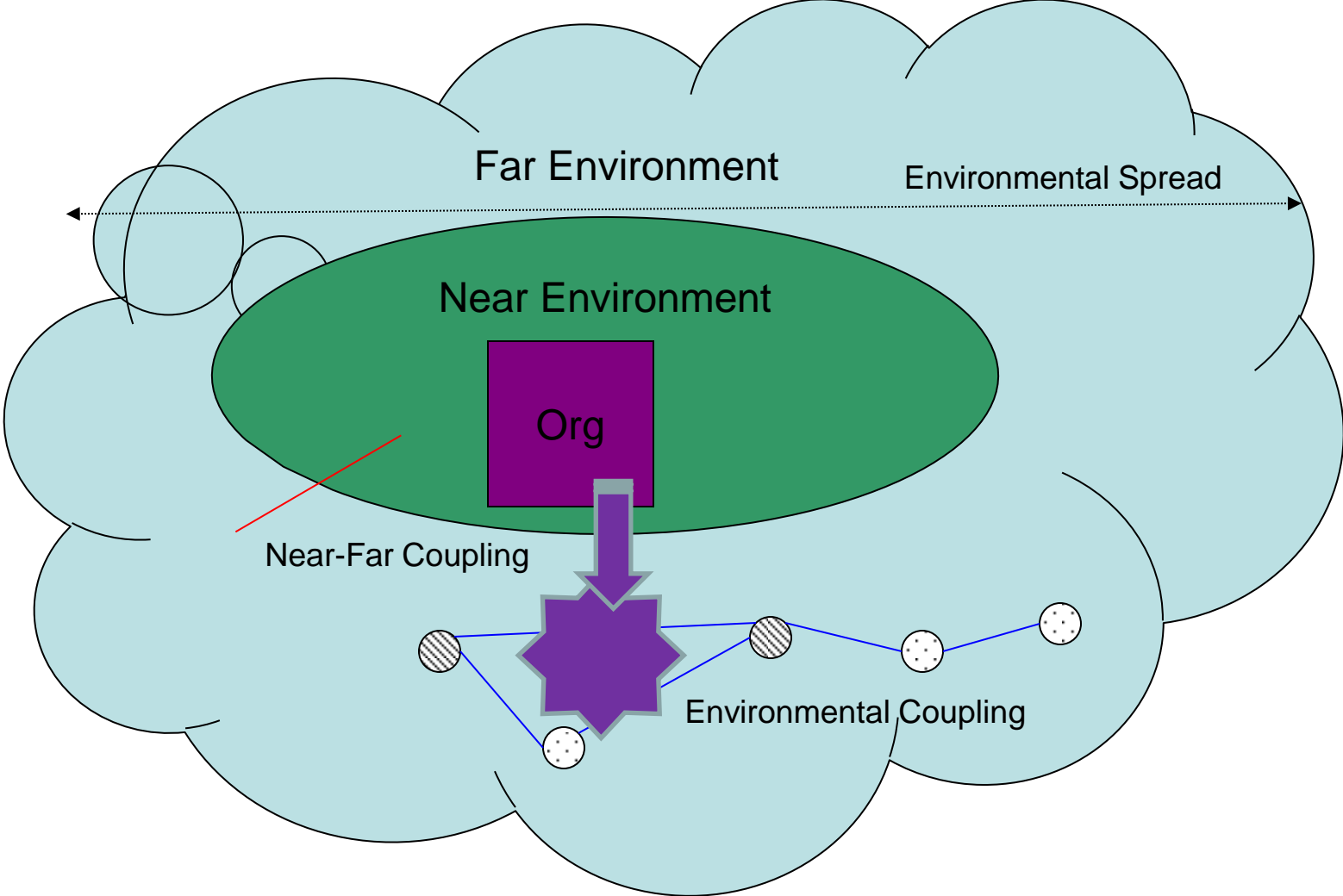
Kalloniatis, Kohn & Macleod 2010

Can ICT challenge Agility?



Groth 1999

Representing the environment



Background Principles

- *Principle of Requisite Variety (Ashby)* applied to Organisations: Orgs must have internal variety \geq that of environment in which operations conducted.
- *C2 (Pigeau-McCann)* as
 - Command = creativity & will – fundamentally human
 - Control = structures and processes – place for technology
 - Command and Control = achievement of common intent for coordinated action
- *Contingency Theory (Burns & Stalker, Mintzberg, Donaldson, Groth)*: there is no universal form for an organisation making it fit-for-purpose for all contingencies. Therefore parts of organisations must adapt to enable operations for differing contingencies.
 - ***This theory provides the variables to characterise both organisation and the environment.***

Contingency variables

Lex Donaldson, *The Contingency Theory of Organisations*, 2001

- **Environmental Complexity**: how inter-connected are entities in the environment?
Correlates with Internal Organisational Variety
- **Environmental Coupling**: the strength of interaction along connections, how fast do changes in one entity trigger changes in another?
Correlates with internal coupling, ie speed of responsiveness between organisational entities
- **Problem Size/Scale**: how wide-spread are the fluctuations in the environment requiring control?
Correlates with Organisational Size
- **Near-Far Coupling** aka Public Accountability [Pugh et al, 1969, Arambula, 2008]: how much does the local organisational environment influence its conduct in the operational environment? Is the organisation judged by measures natural to the operational environment?
Correlates with Vertical Centralisation

Planning versus Intuition – Mintzberg models

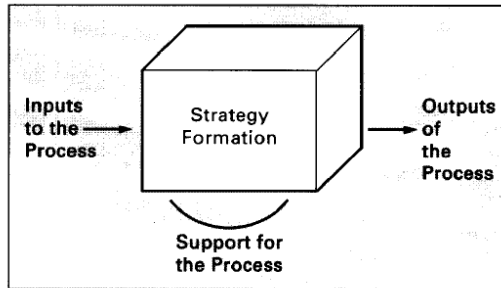
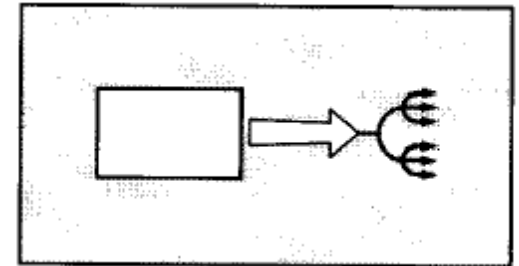
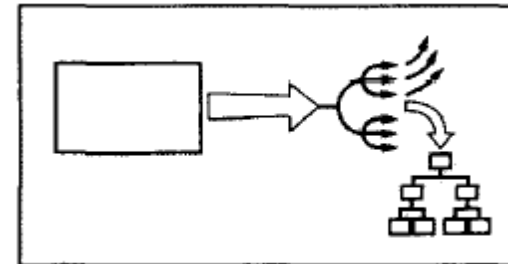


FIGURE 1. Planners operate around the 'black box' of strategy formation.

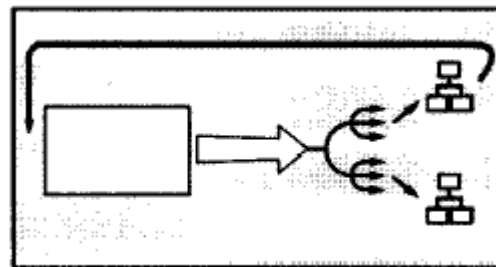
Strategic programming



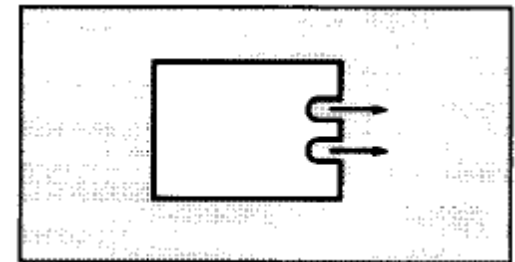
Communication media



Control devices



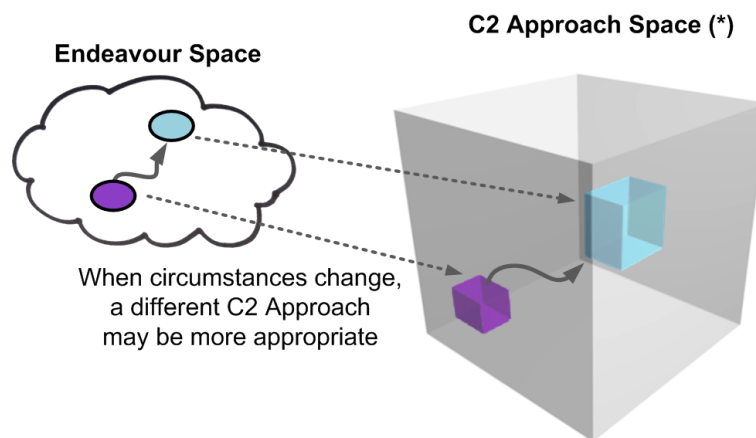
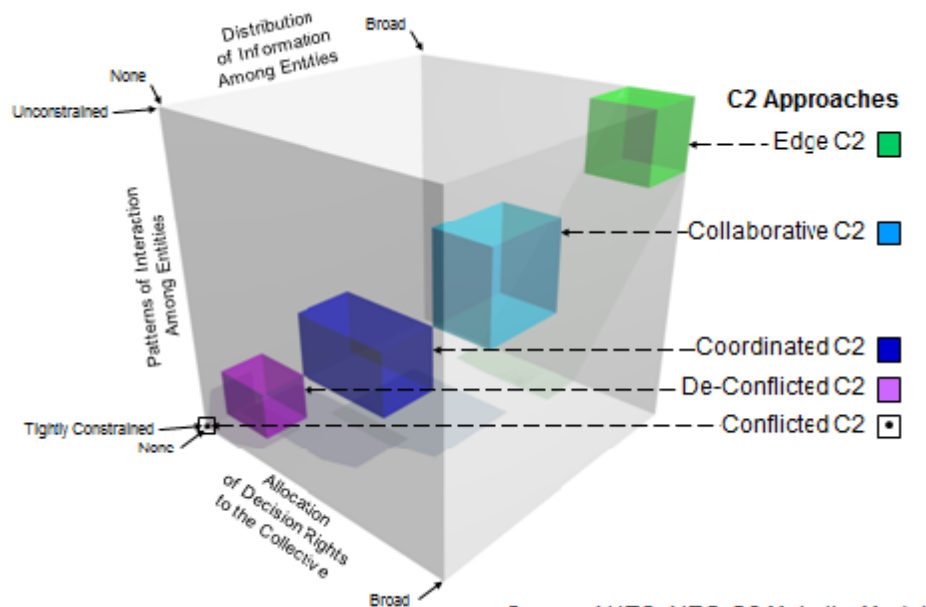
Finders of strategy



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NATO-SAS-085

Final Report, 4 October 2014



NATO-SAS-143 (Kalloniatis is participant) objectives:

- Understand the C2 implications of a social-technical organization employing entities that possess different degrees of autonomy
- Understand the C2 implications of embedded intelligent software
- Understand the C2 implications of operating in a contested cyber environment
- Extend C2 Theory and metrics to encompass and integrate across
 - C2 of Autonomous Forces
 - C2 of Cyber
 - C2 of Intelligent Systems
 - C2 of Kinetics Forces (Air, Land, Sea, Space)

C2 of Non-kinetic, Non-cyber instruments of power