

Combining Social Network Analysis with the NATO Approach Space

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University of Southampton



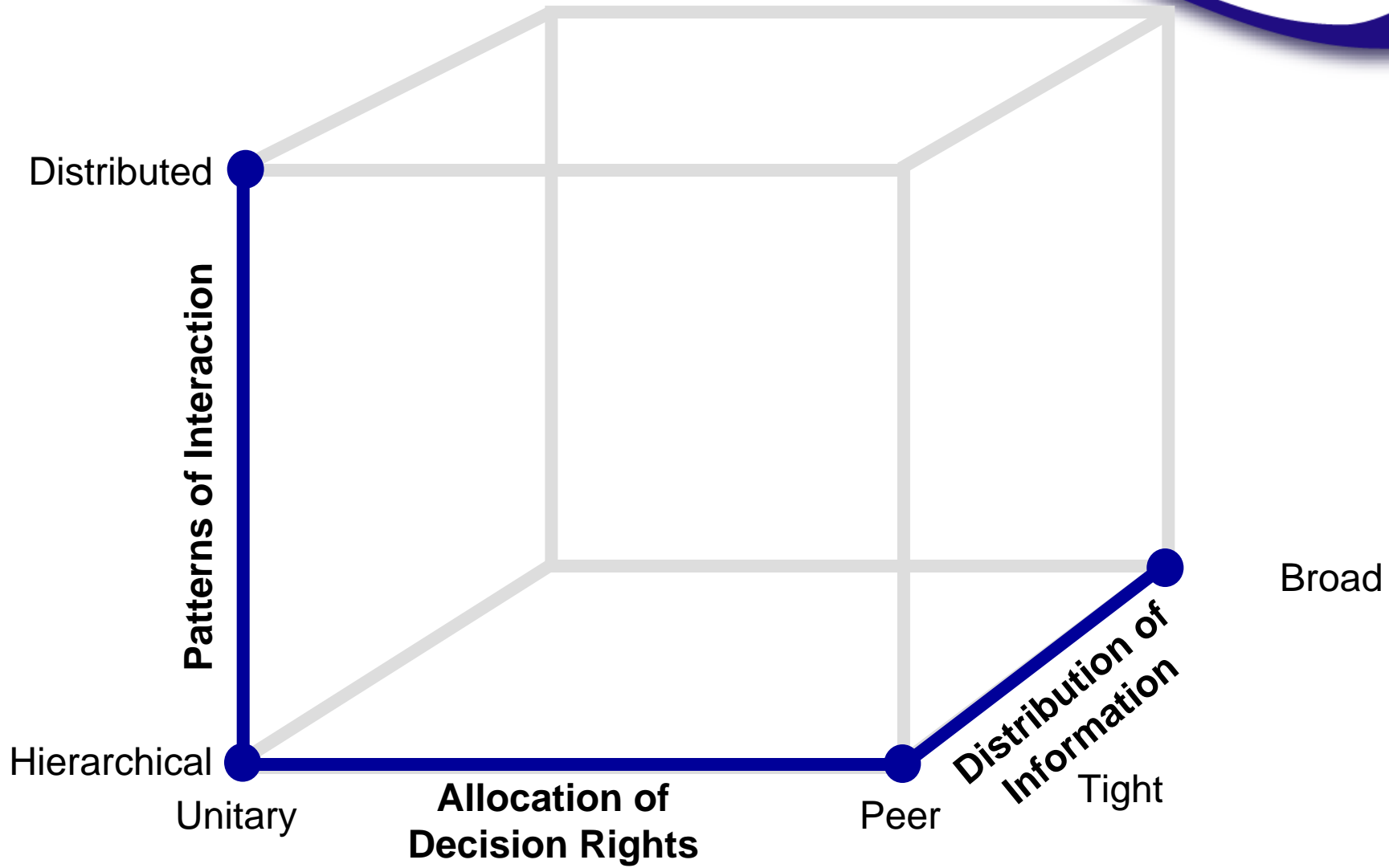
www.hfidtc.com

Human Factors Integration Defence Technology Centre



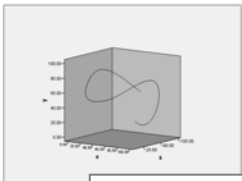
The NATO Approach Space

Approach Space



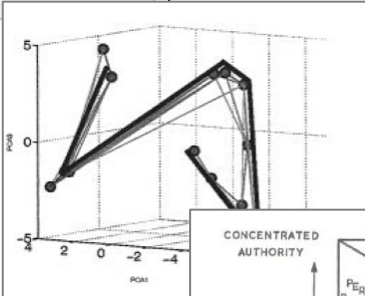


Interesting Legacy



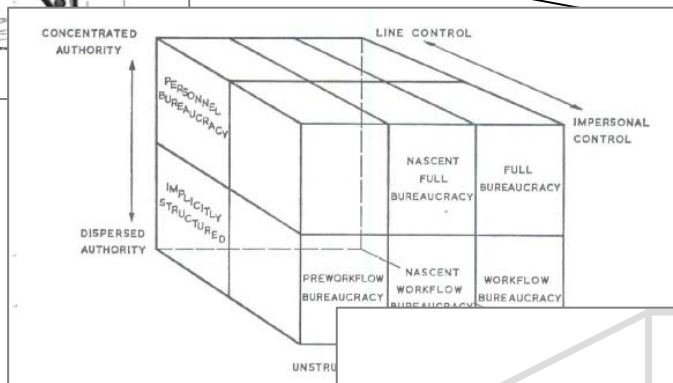
Phase Spaces

(e.g. William Gibbs, 1901)



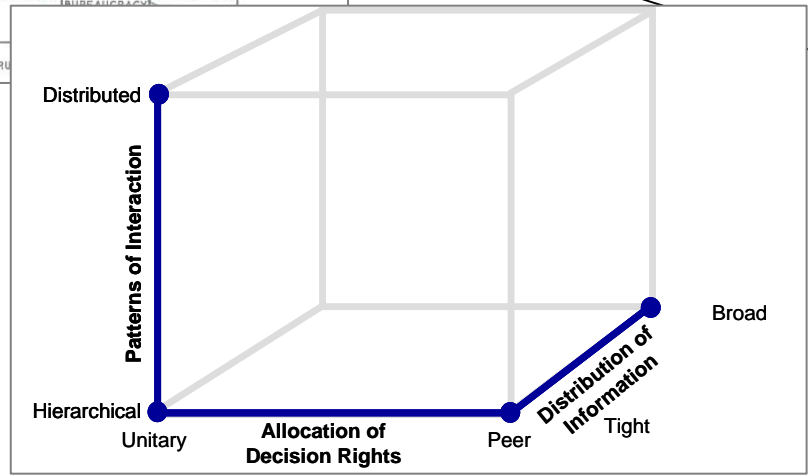
Functional Holography

(e.g. Baruchi et al., 2004)



Contingency Theory

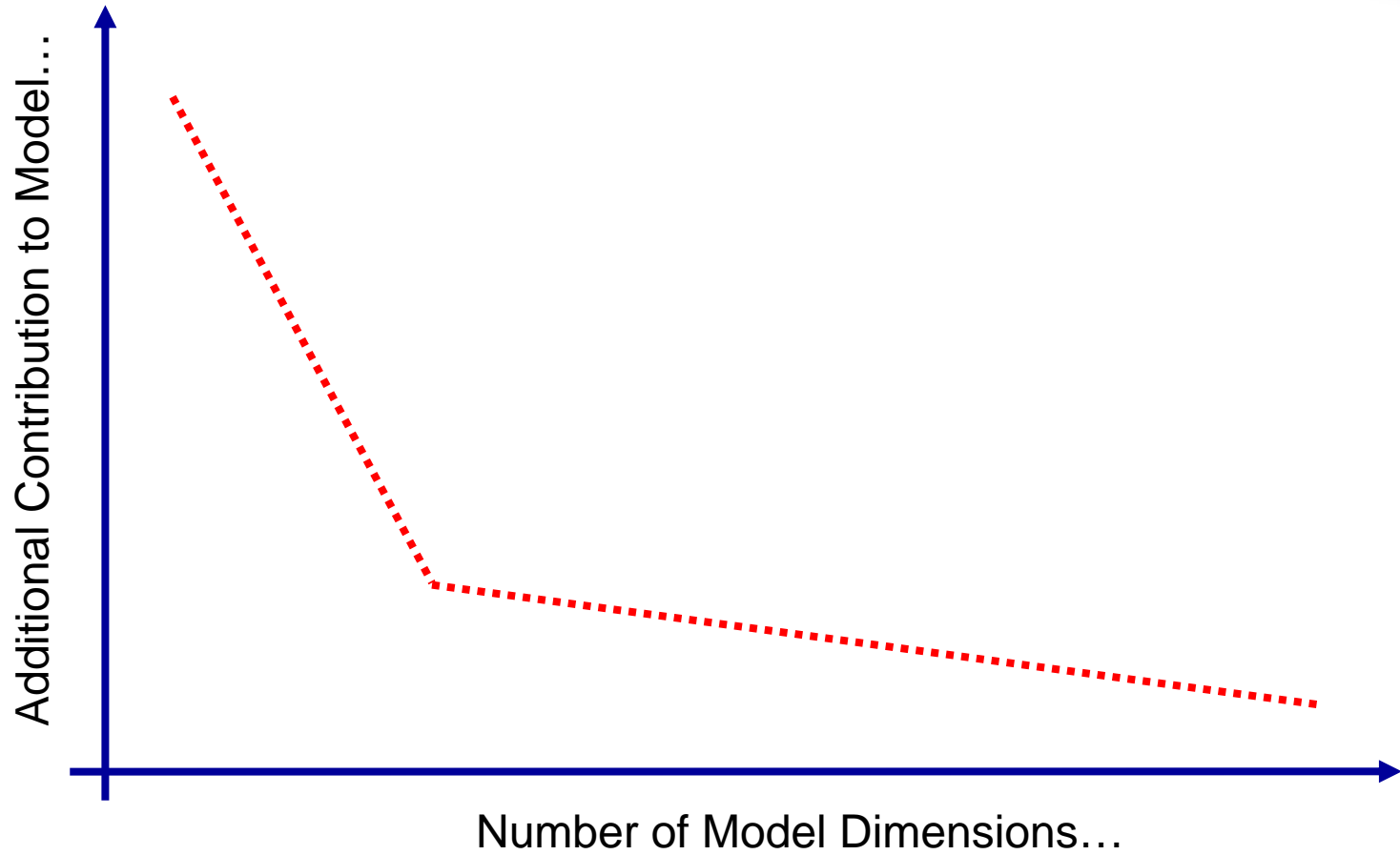
(e.g. Pugh et al., 1968)



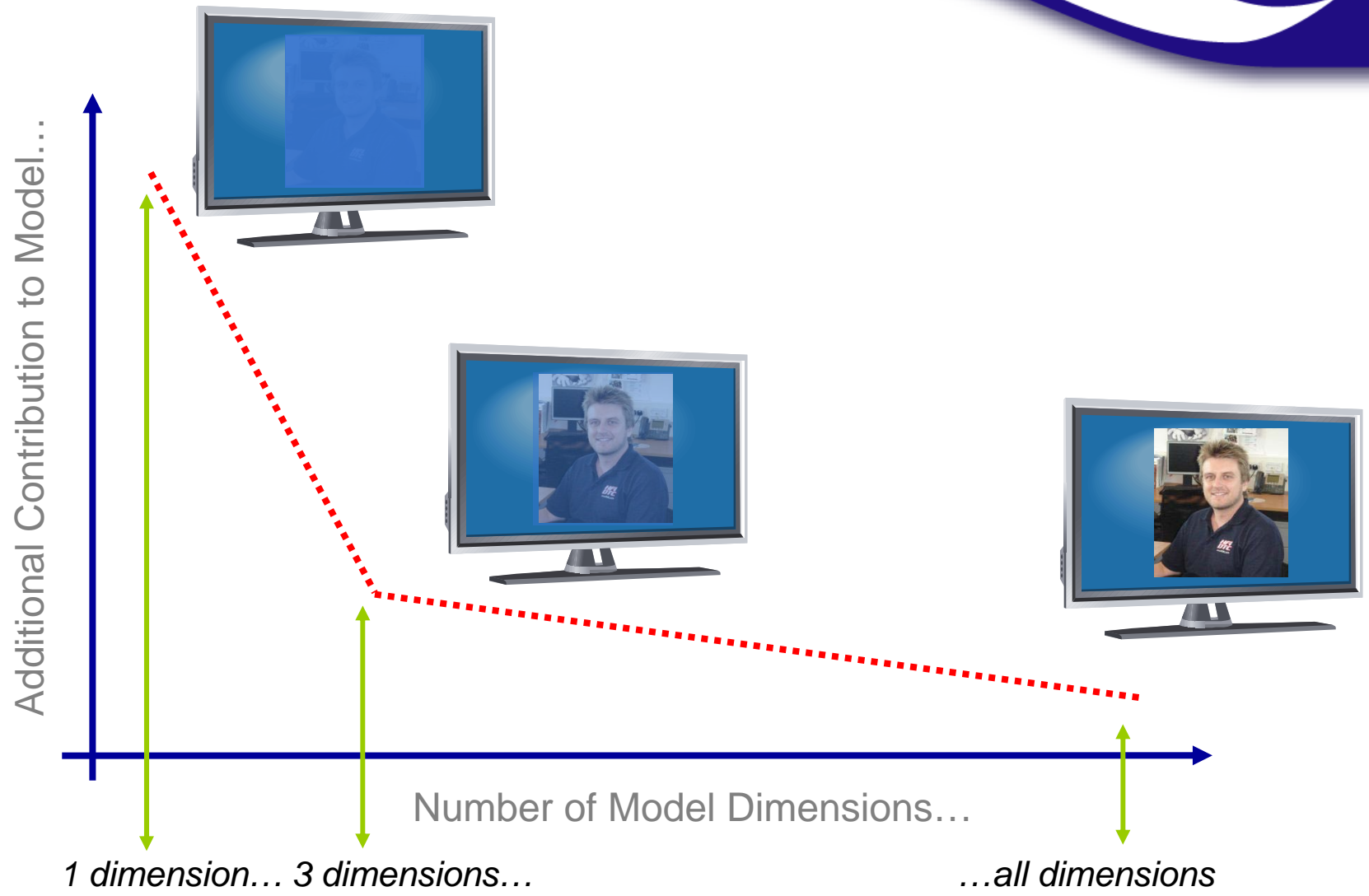
Military Theory

(e.g. NATO, 2007)

Premise



Premise



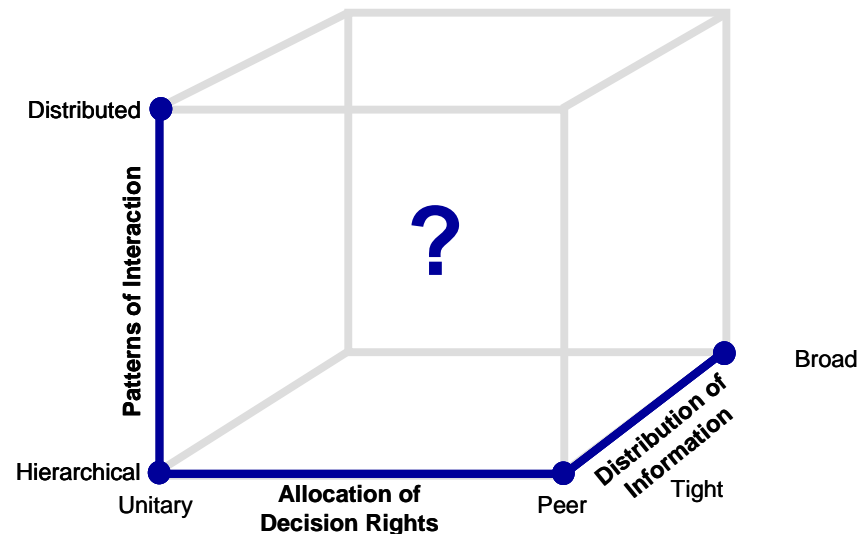


NATO Model Aspirations

NATO Approach Space

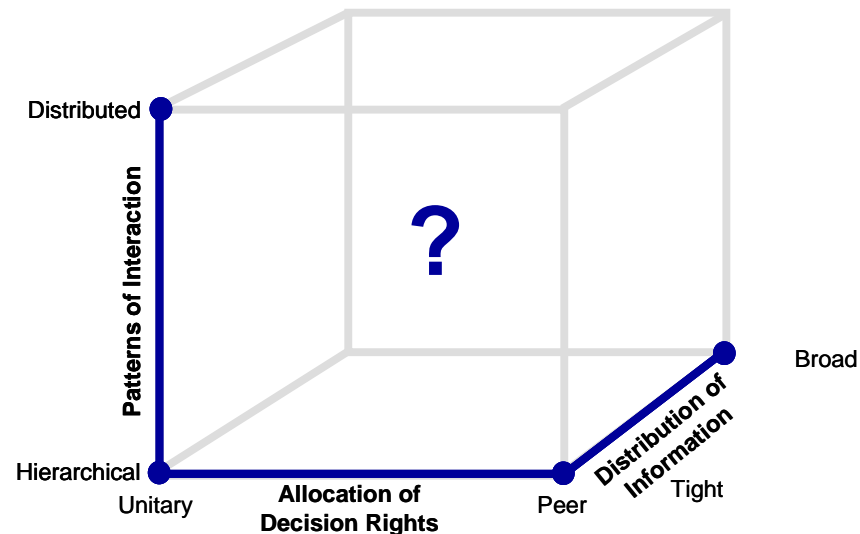


“We are interested in the **actual place or region** in this space where an organisation operates, not where they think they are or where they formally place themselves” (Alberts & Hayes, 2006 p. 75)





“An organisation’s location in the C2 Approach space usually ranges across both **function and time**” (Alberts & Hayes, 2006 p. 76)

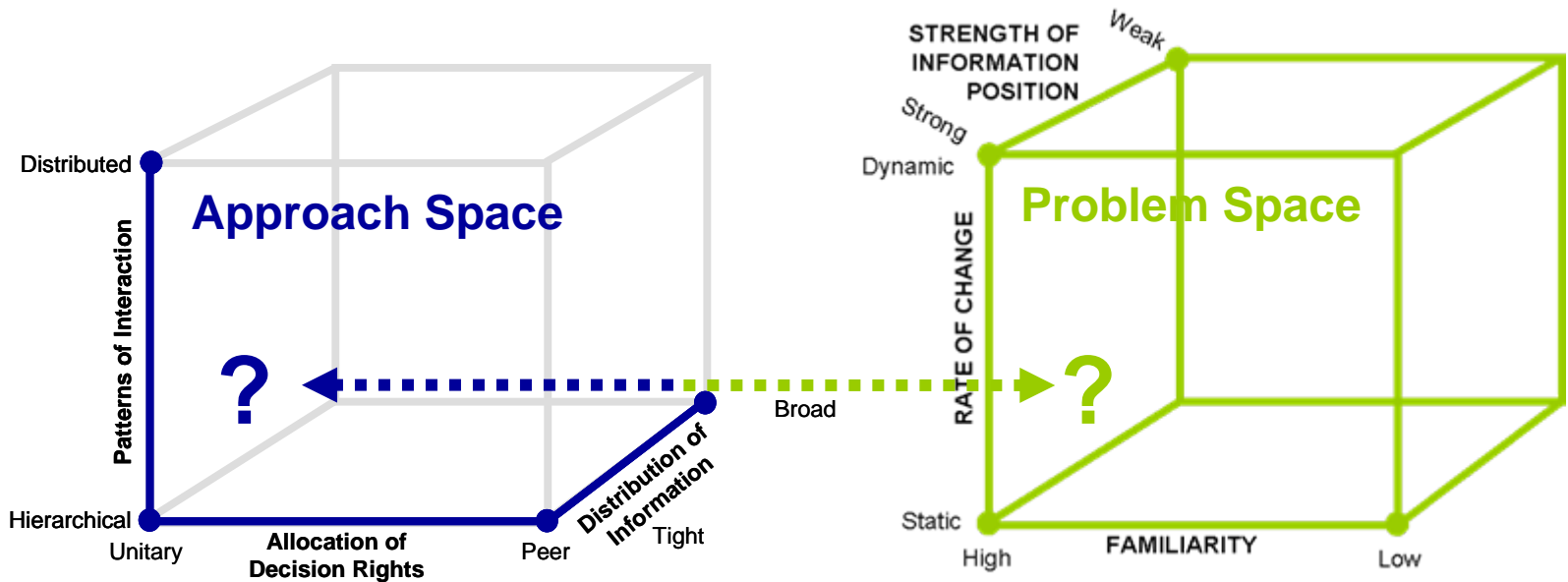




NATO Approach Space

“Identifying the crucial elements of the problem space and matching regions in this space to regions in the C2 Approach **is a high priority**”

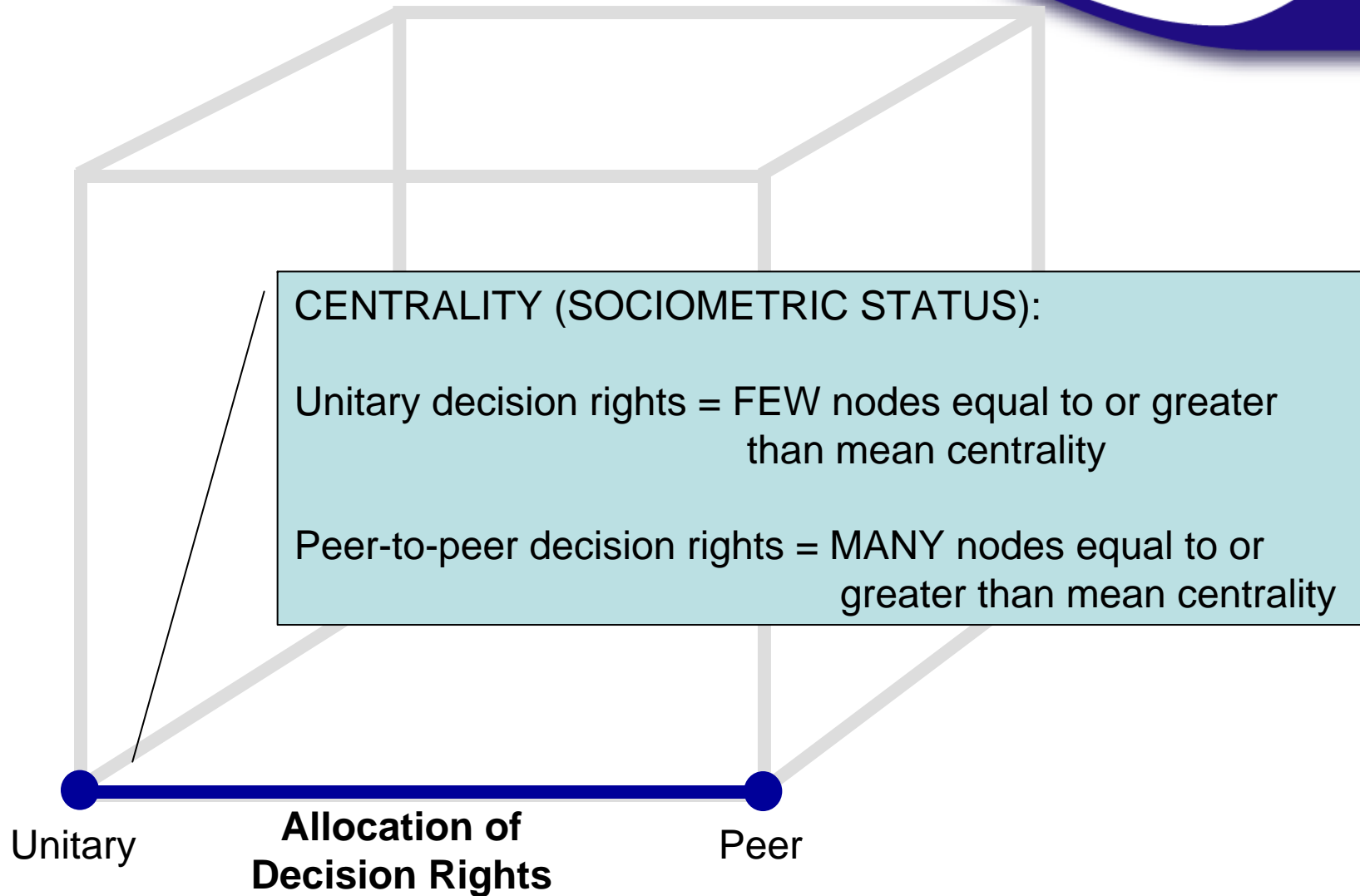
(Alberts & Hayes, 2006 p. 80)



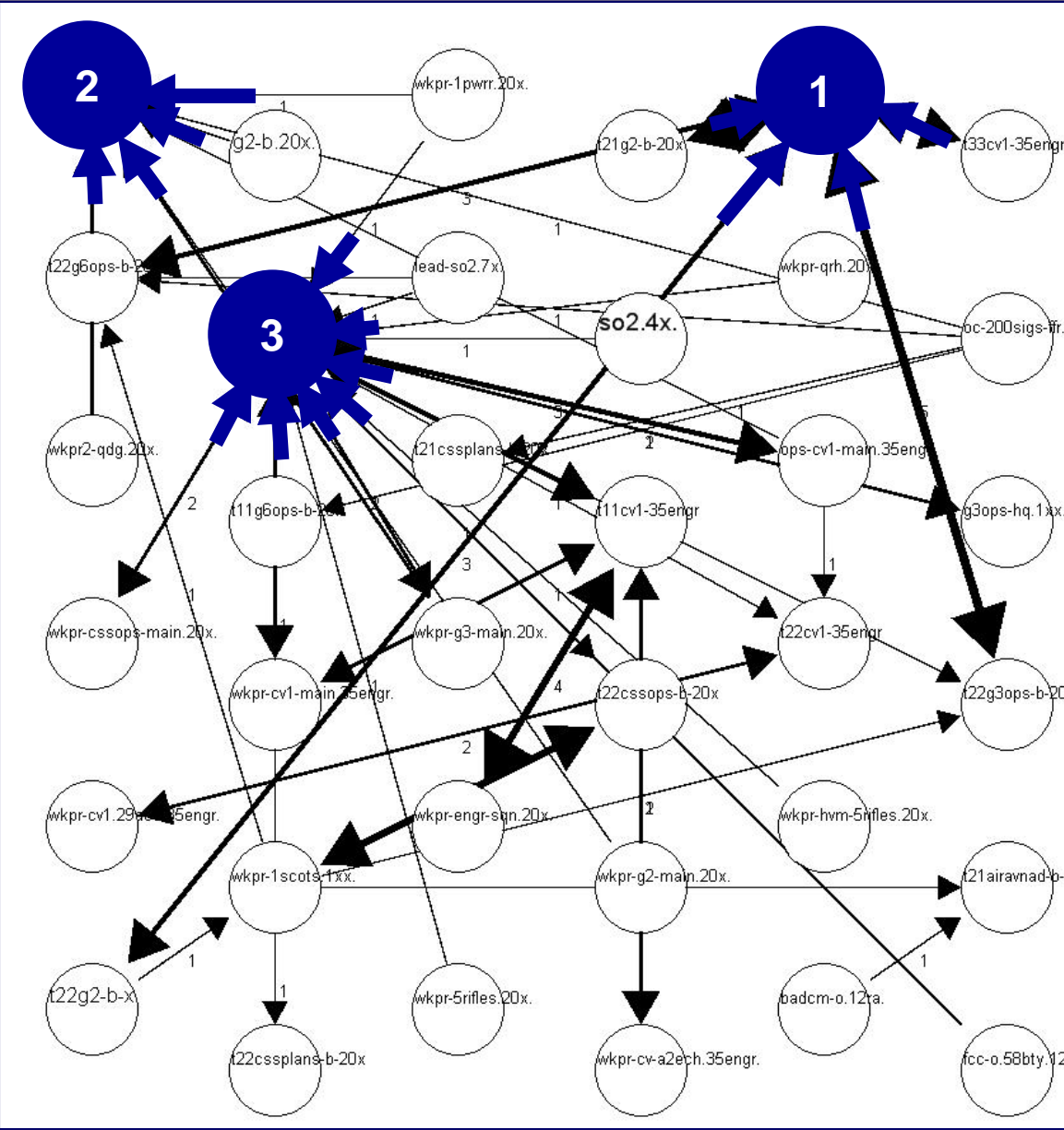


From Typology to Taxonomy

Approach Space

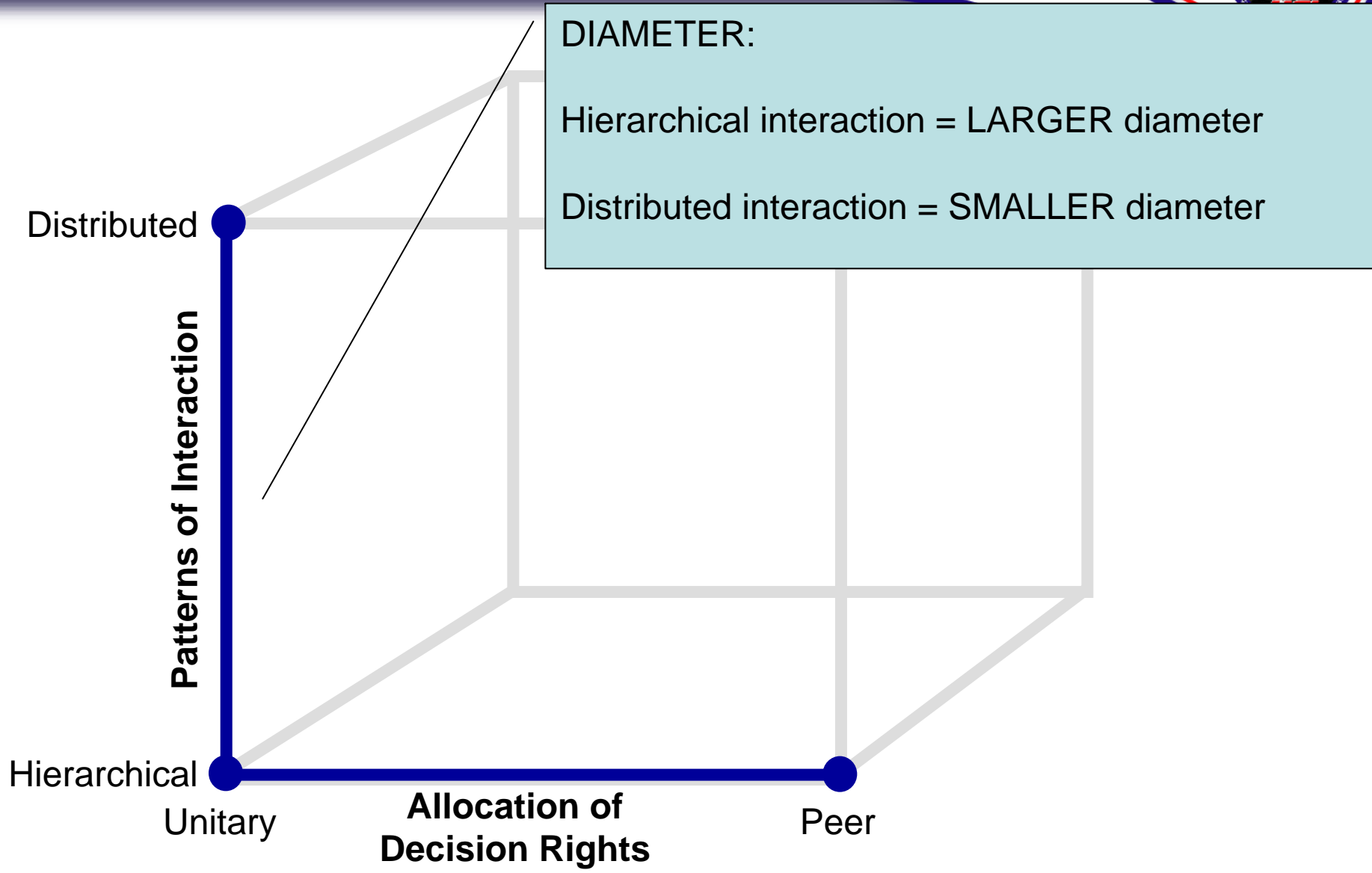


Centrality

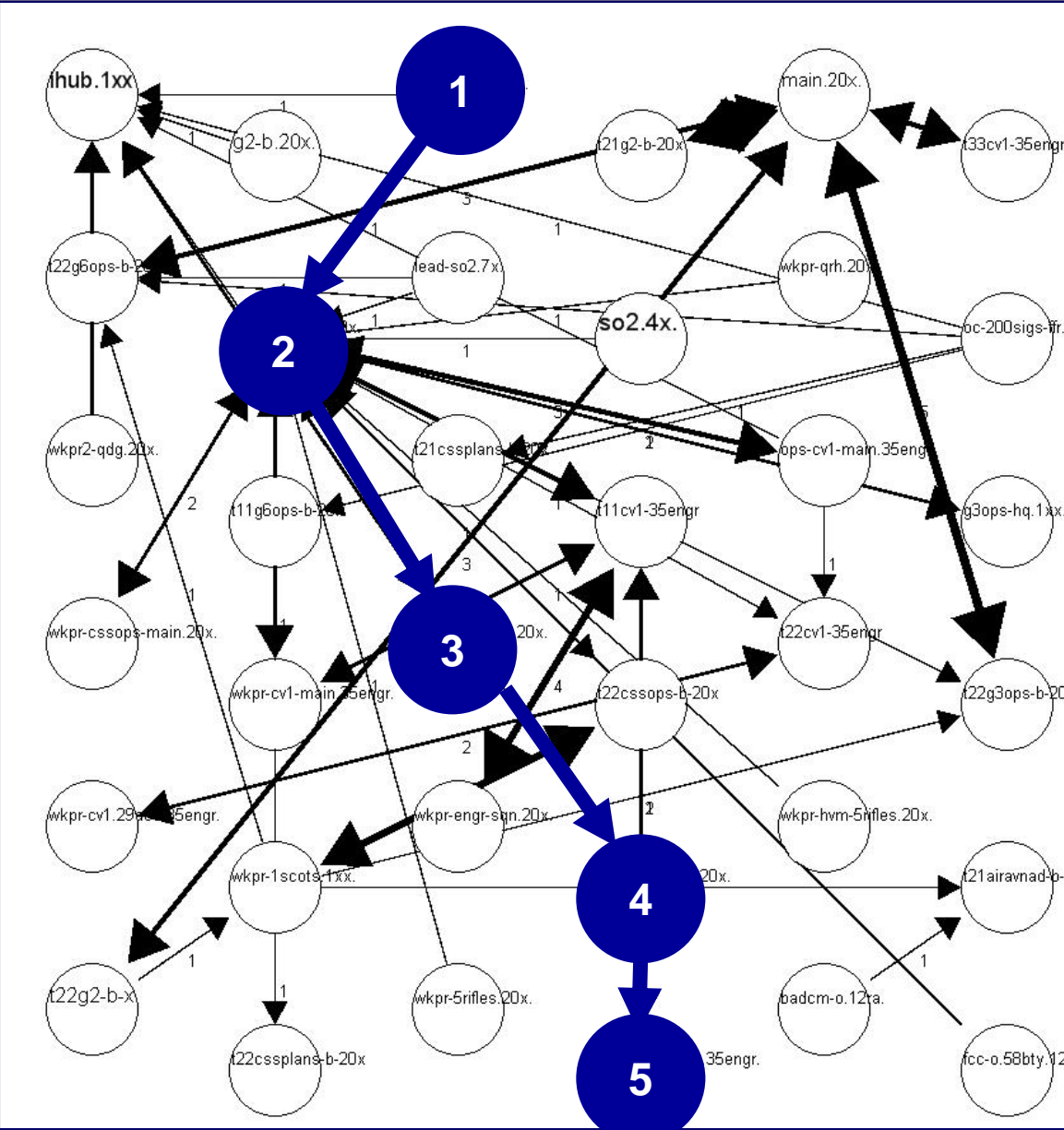




Approach Space



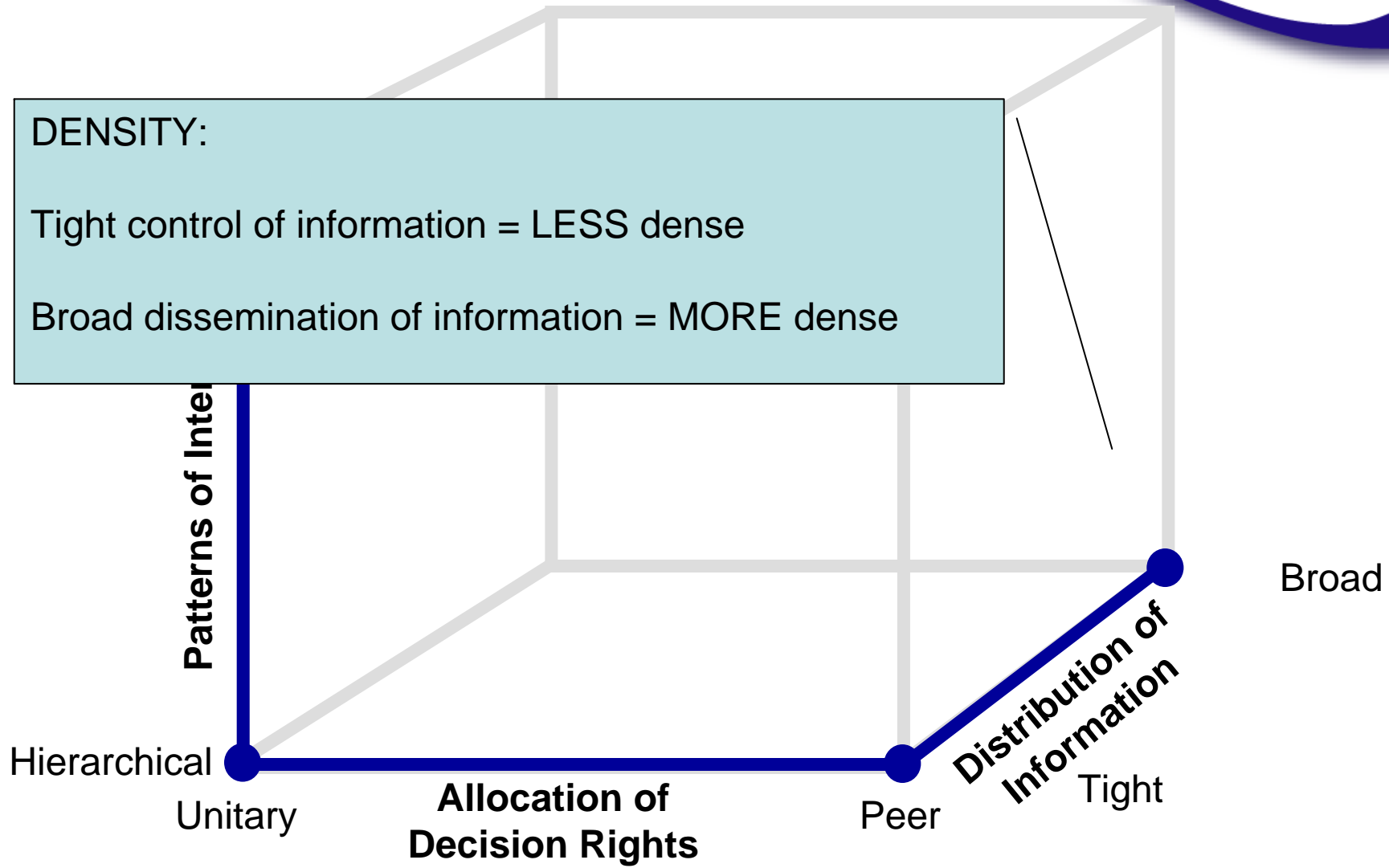
Diameter



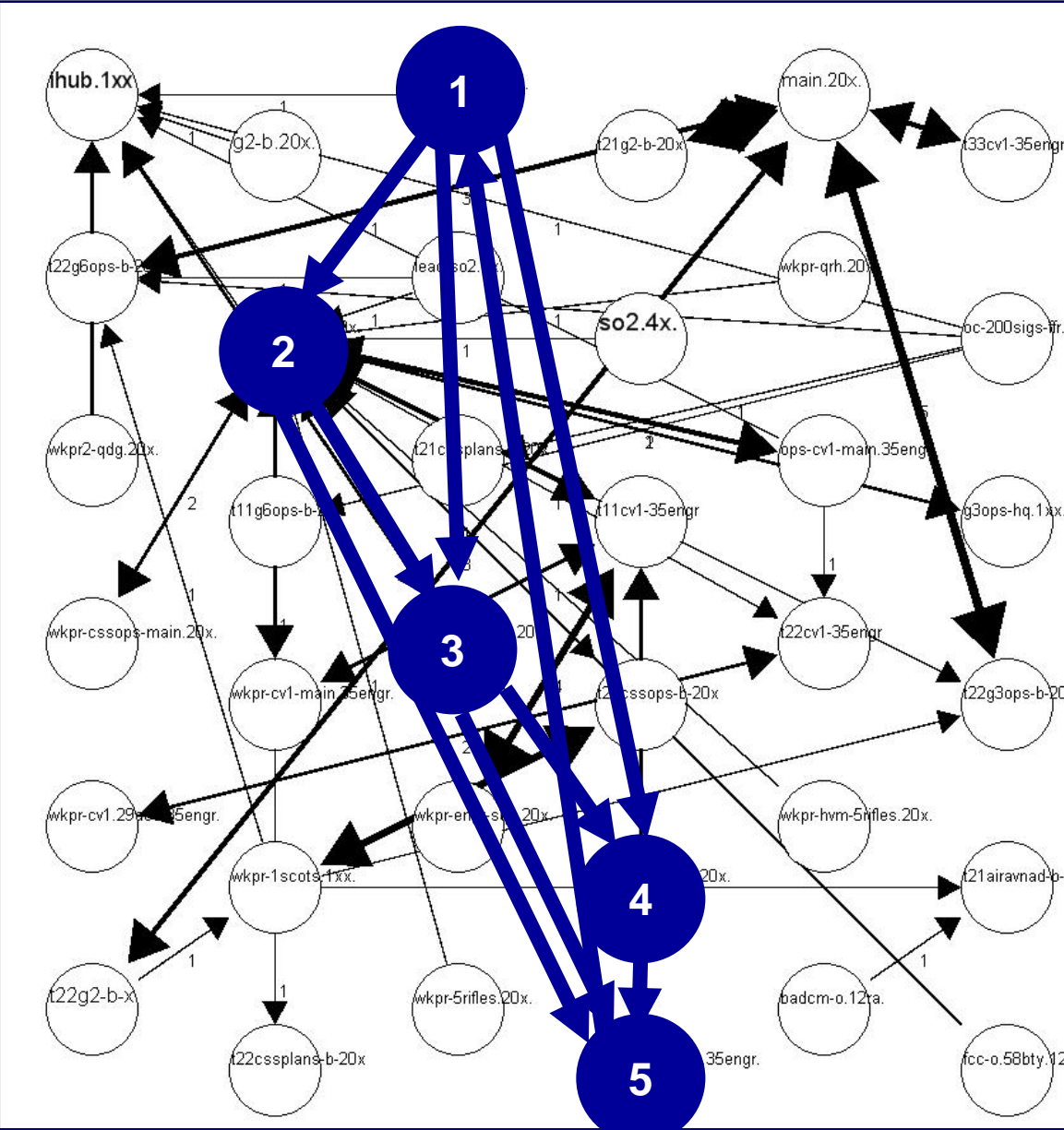


Approach Space

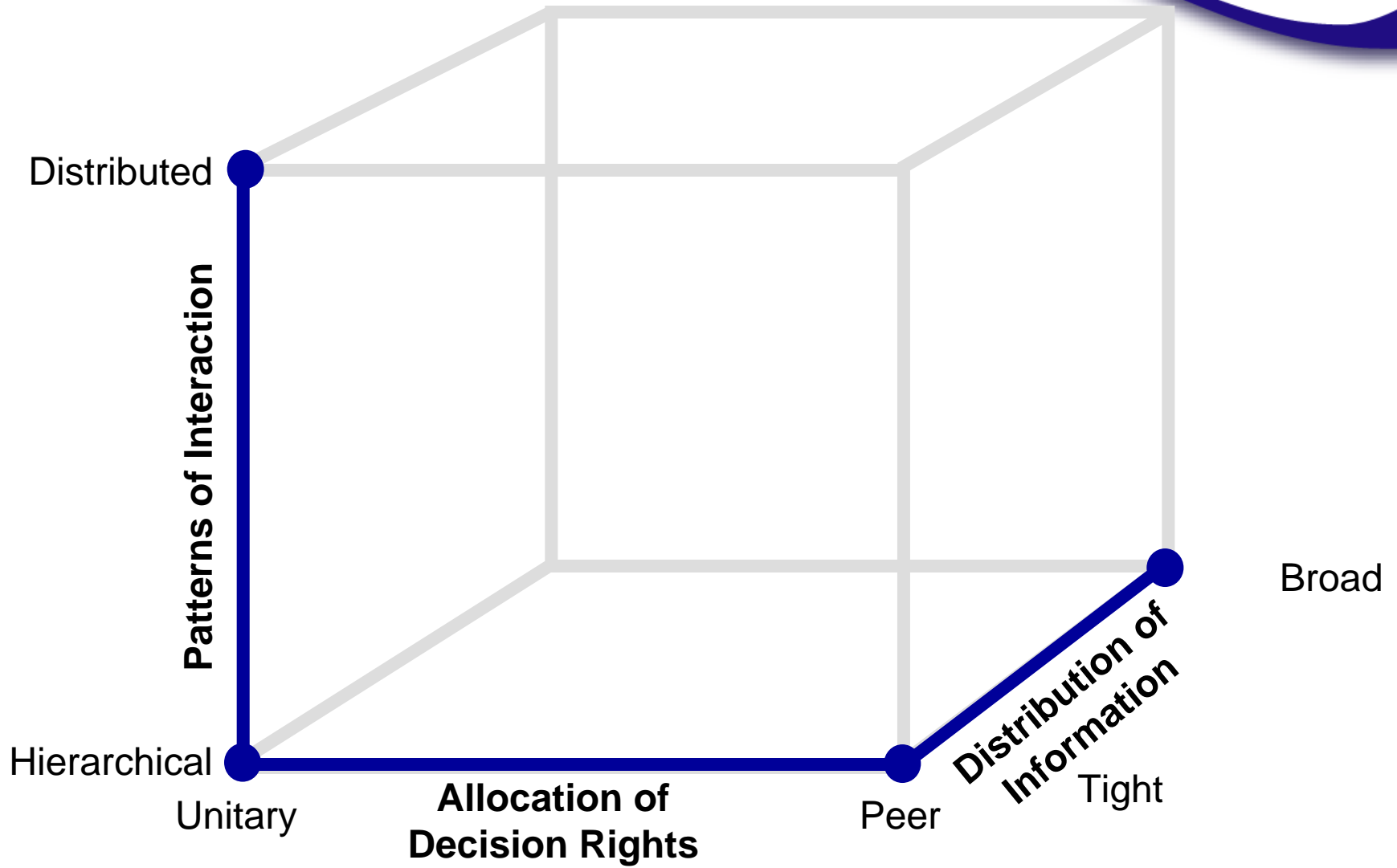
DENSITY:
Tight control of information = LESS dense
Broad dissemination of information = MORE dense



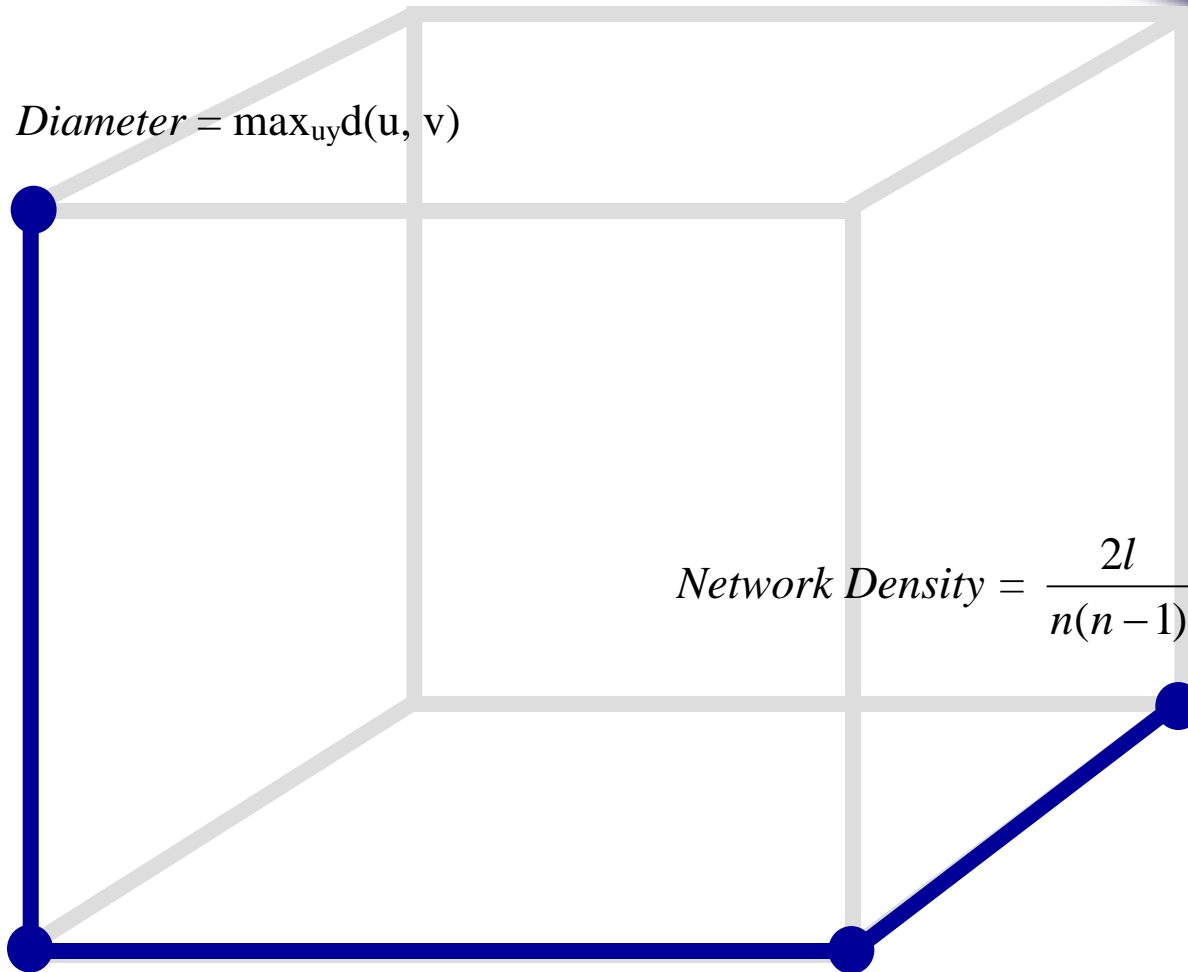
Density



Typology



Taxonomy



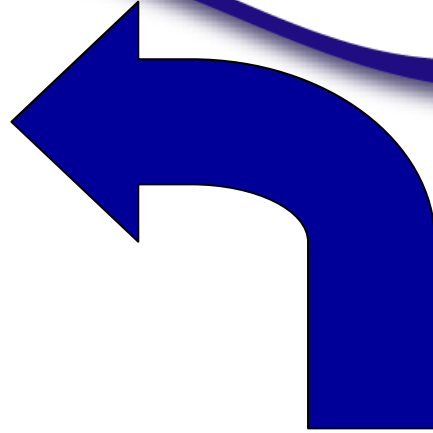
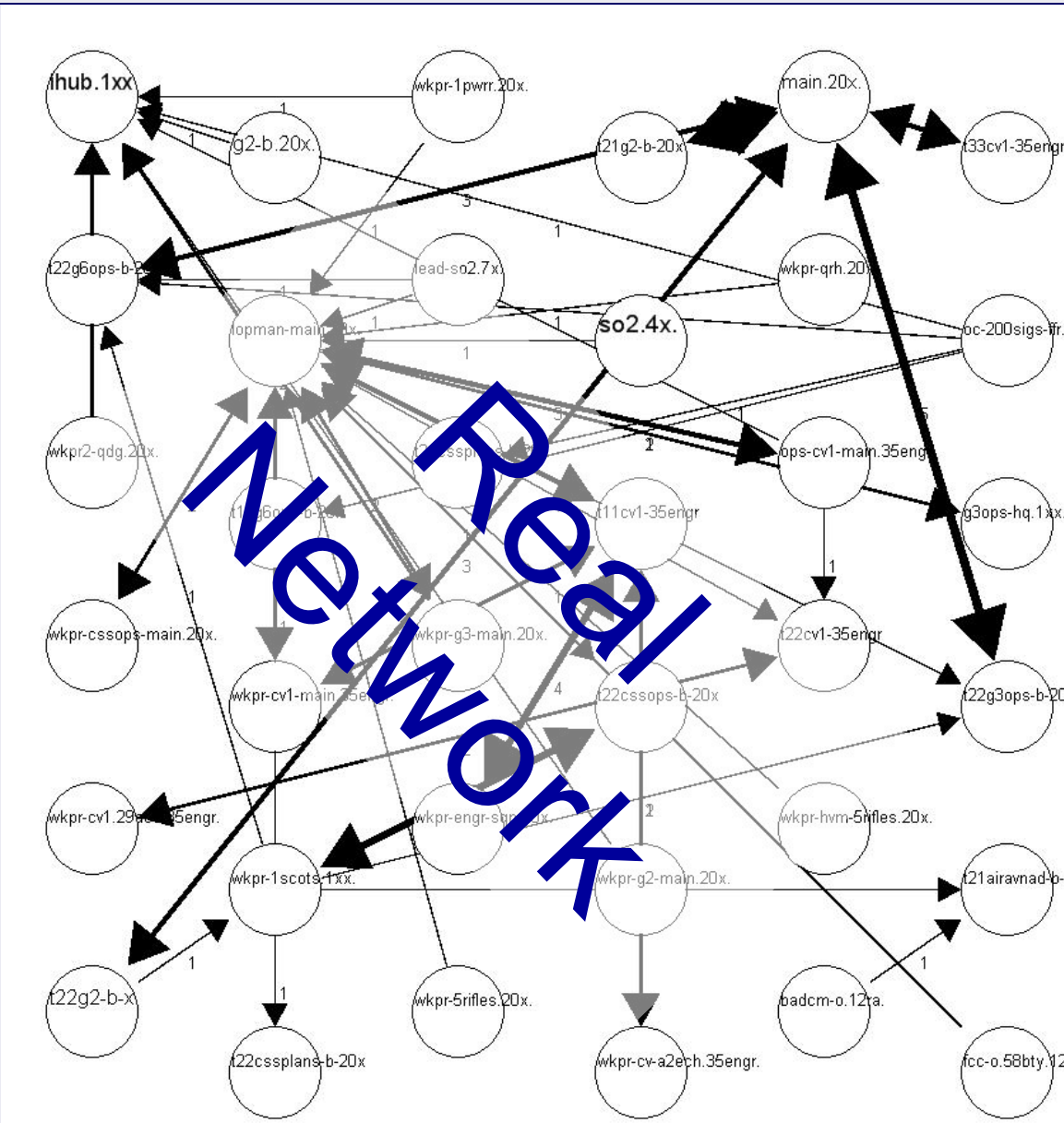
$$\text{Diameter} = \max_{u,v} d(u, v)$$

$$\text{Network Density} = \frac{2l}{n(n-1)}$$

$$\text{Sociometric status} = \frac{1}{g-1} \sum_{j=1}^g (\chi_{ji} + \chi_{ij})$$



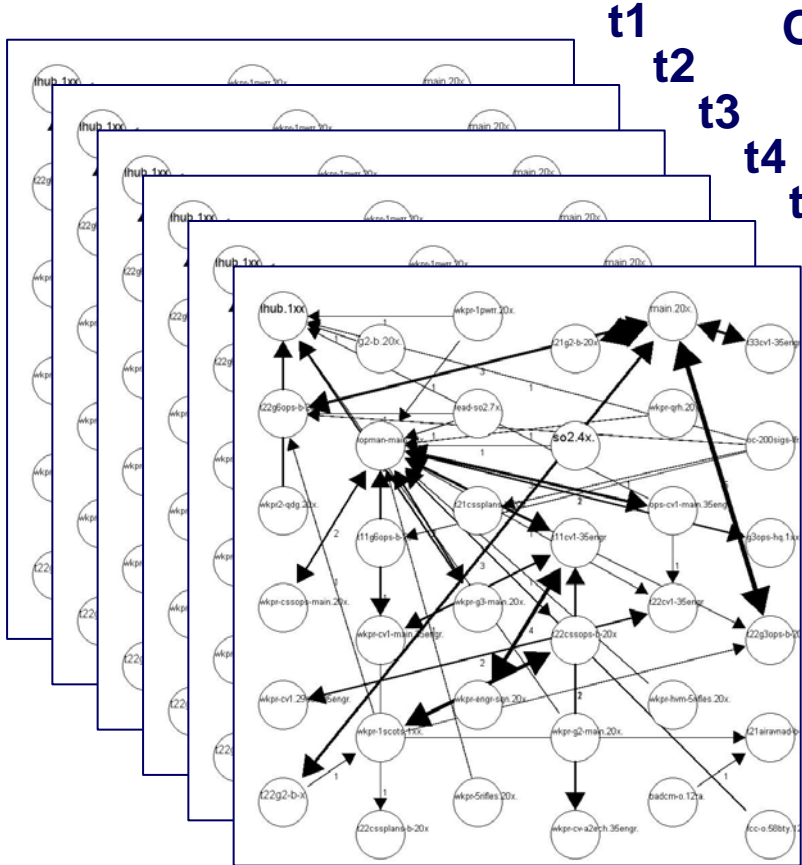
Actual Place of Region...



```
syslog20 - Notepad
File Edit Format View Help
112 11/19/07 10:21:00 CFPStack Received
FreeText from EXCON1.IXX. Seq# 154088499
113 11/19/07 10:21:00 Unable to create
Async Wrapper for Alarms and Alerts
IAAServiceApi interface. Using Sync
connection.
114 11/19/07 10:21:05 checking for entry
in database
115 11/19/07 10:21:24 PLGR Communication
is lost.
116 11/19/07 10:22:43 OC-200SIGs-FFR.20X.
can now be reached via CFPStack
117 11/19/07 10:22:43 CFPStack Received
SmPktOSPR from OC-200SIGs-FFR.20X. Seq#
154088643
118 11/19/07 10:22:43 Movement Outside of
View! [32U MC 83762
39417-OCSIGs-TEAM/DET-CGP-200-20-UtilityV
eh] just moved!
119 11/19/07 10:22:46 OSC131.IXX. can now
be reached via CFPStack
120 11/19/07 10:22:46 CFPStack Received
FreeText from OSC131.IXX. Seq# 154088656
121 11/19/07 10:22:46 Unable to create
Async Wrapper for Alarms and Alerts
```

Raw Data

Function and Time...



Observe
Block
Block
Turn
Destroy
Observe

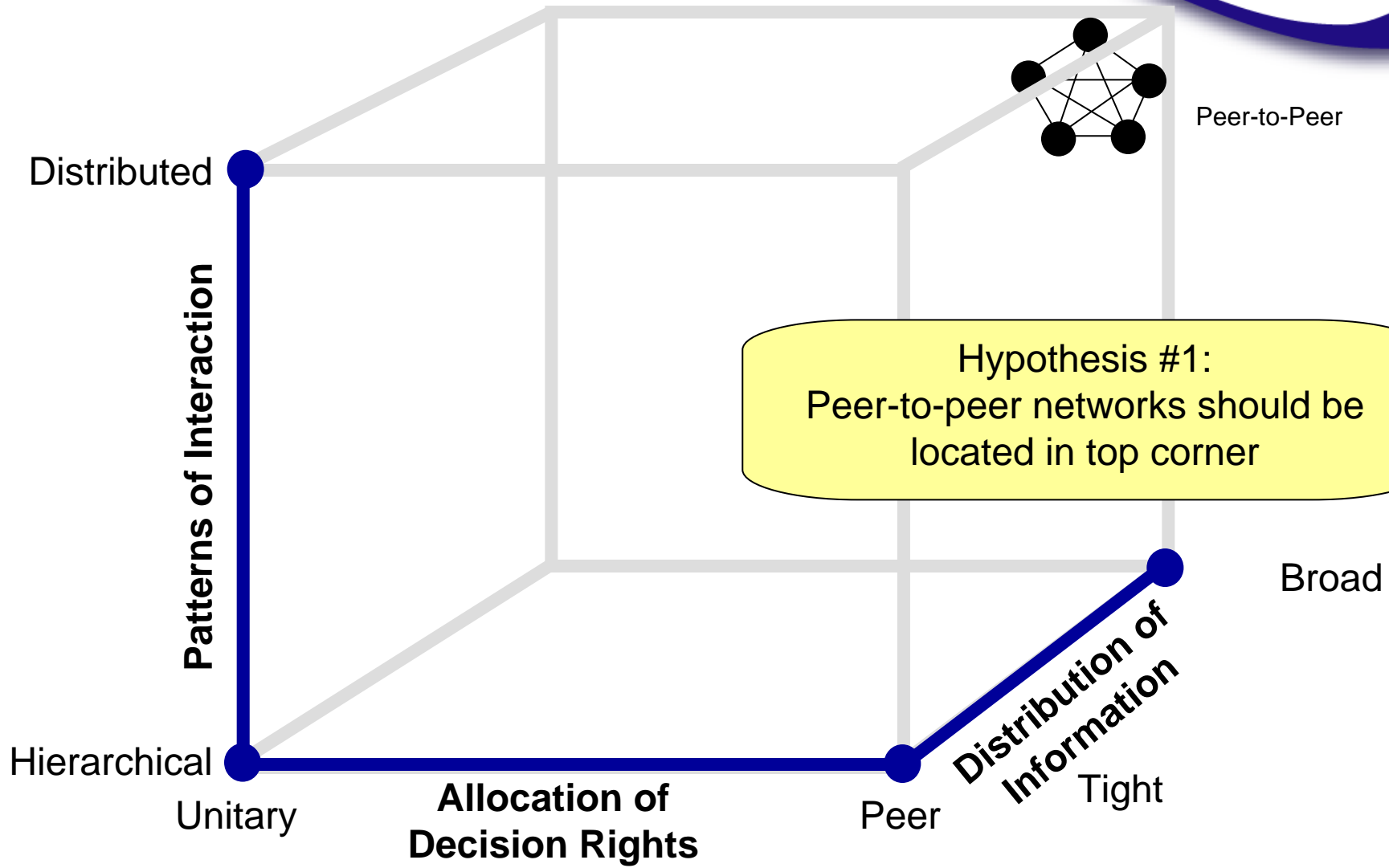
OFT3
Classic C2
Emergency Services
Air Traffic Control
Terror Organizations
Internet

- By time...
- By function...
- By organization...

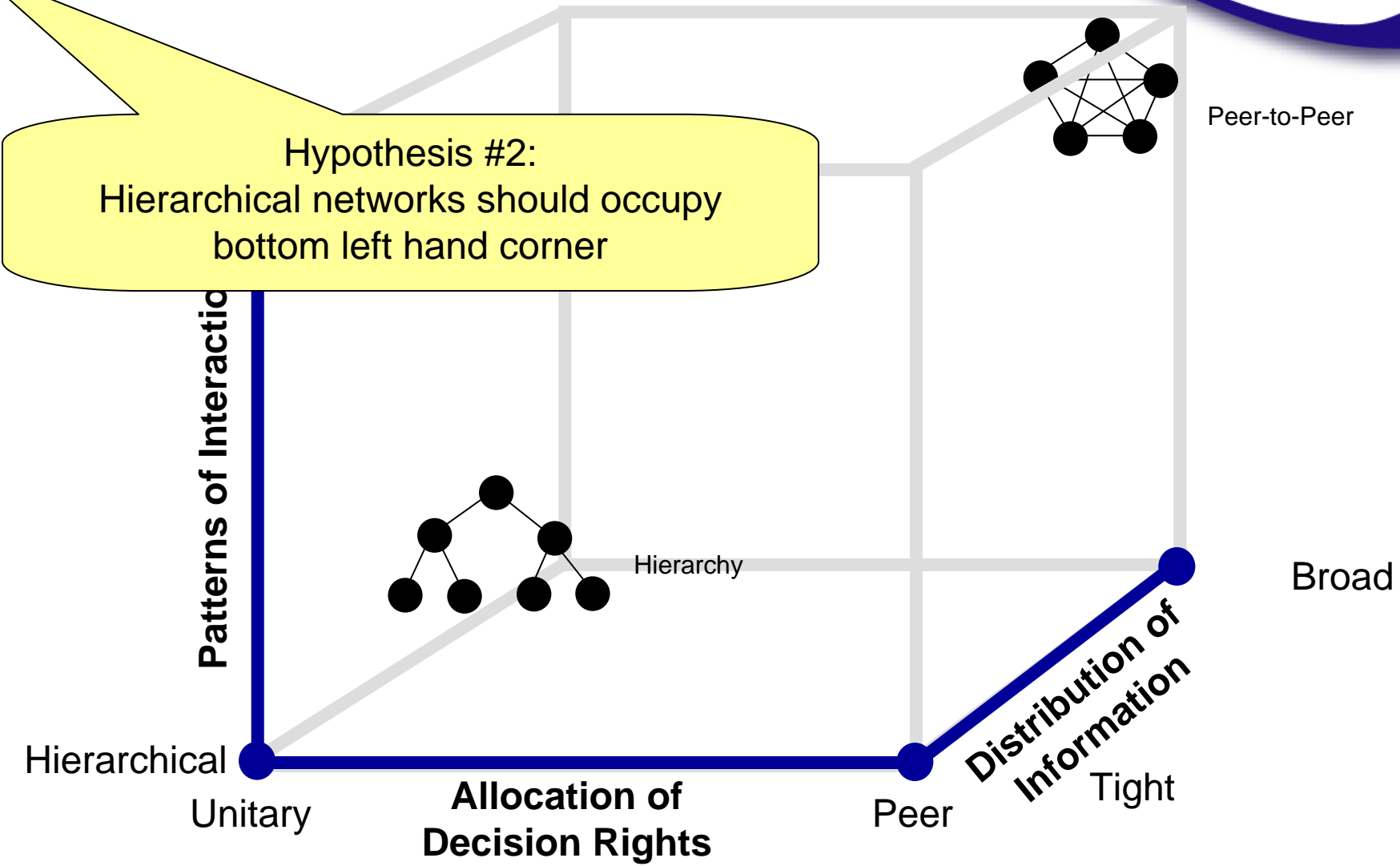


Testing with Network Archetypes

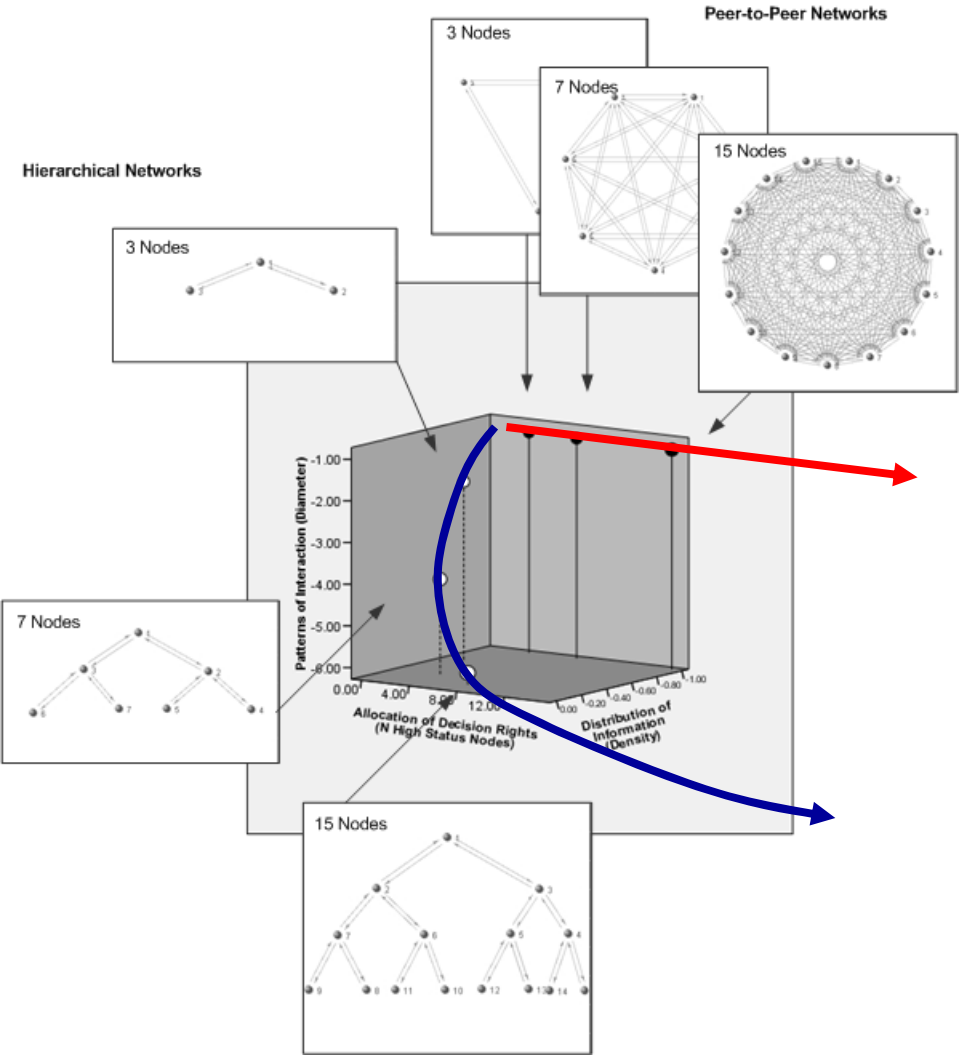
Network Archetypes



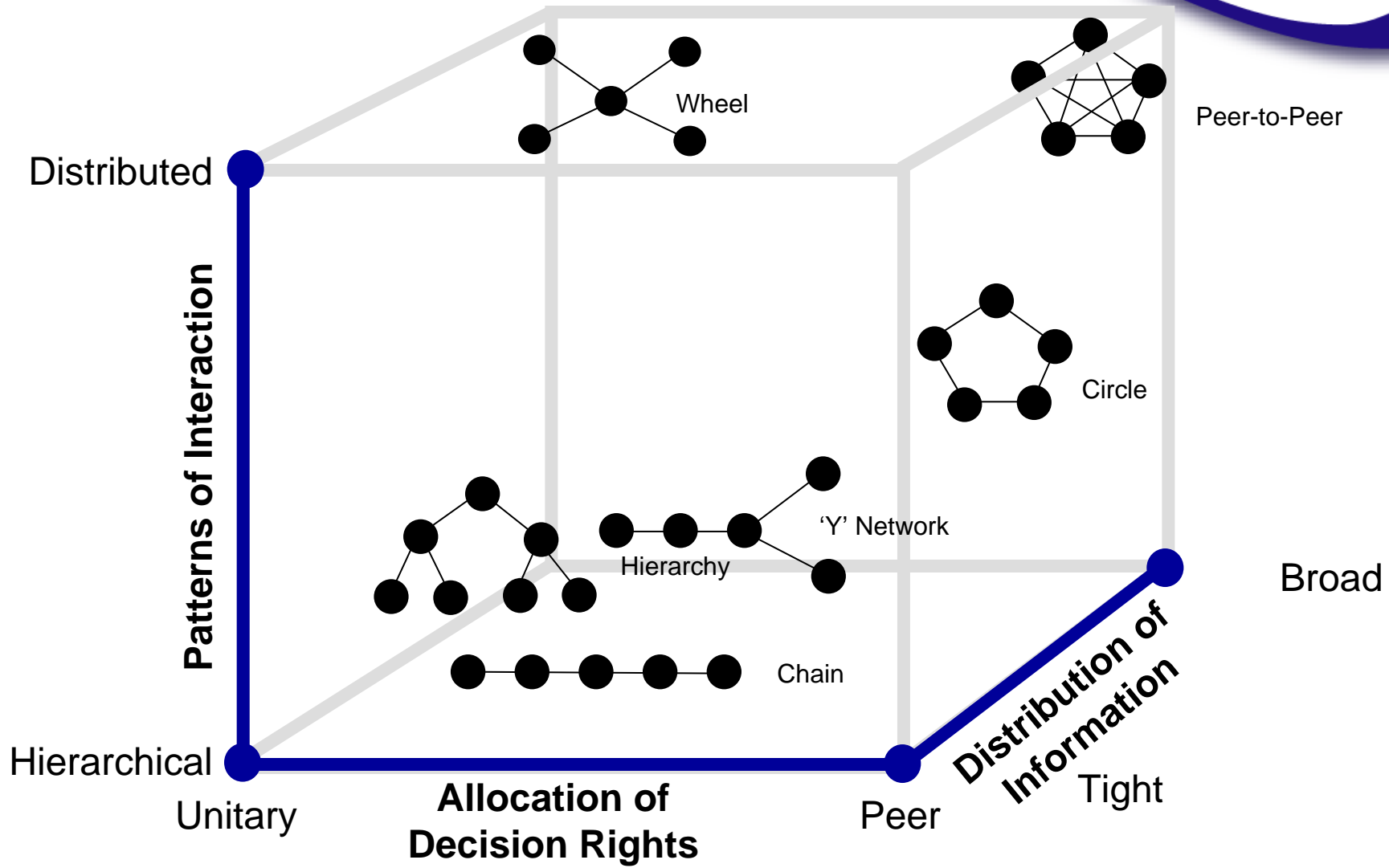
Network Archetypes



Effect of Scale



Network Archetypes





Testing with Live Data

Field Trial

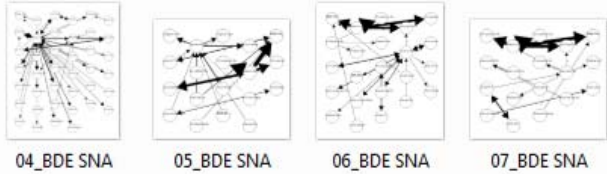


- Field trial involving Brigade and Battle groups
- 73 agents
- Digital comms. (2866 comms. events/34 social networks)
- Voice comms. (158 comms. events/32 social networks)

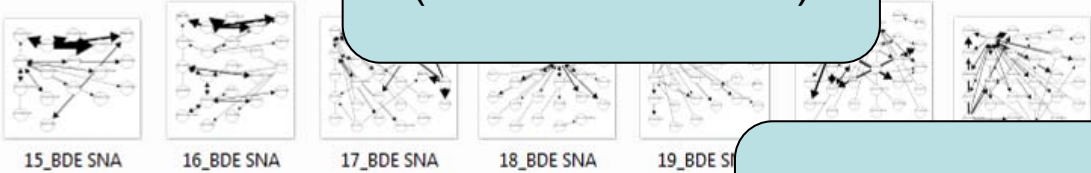
Field Trial



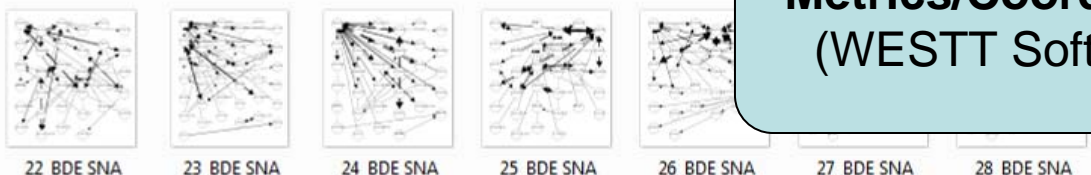
Raw Data
(Telemetry/Observation)



Social Networks
(WESTT Software)



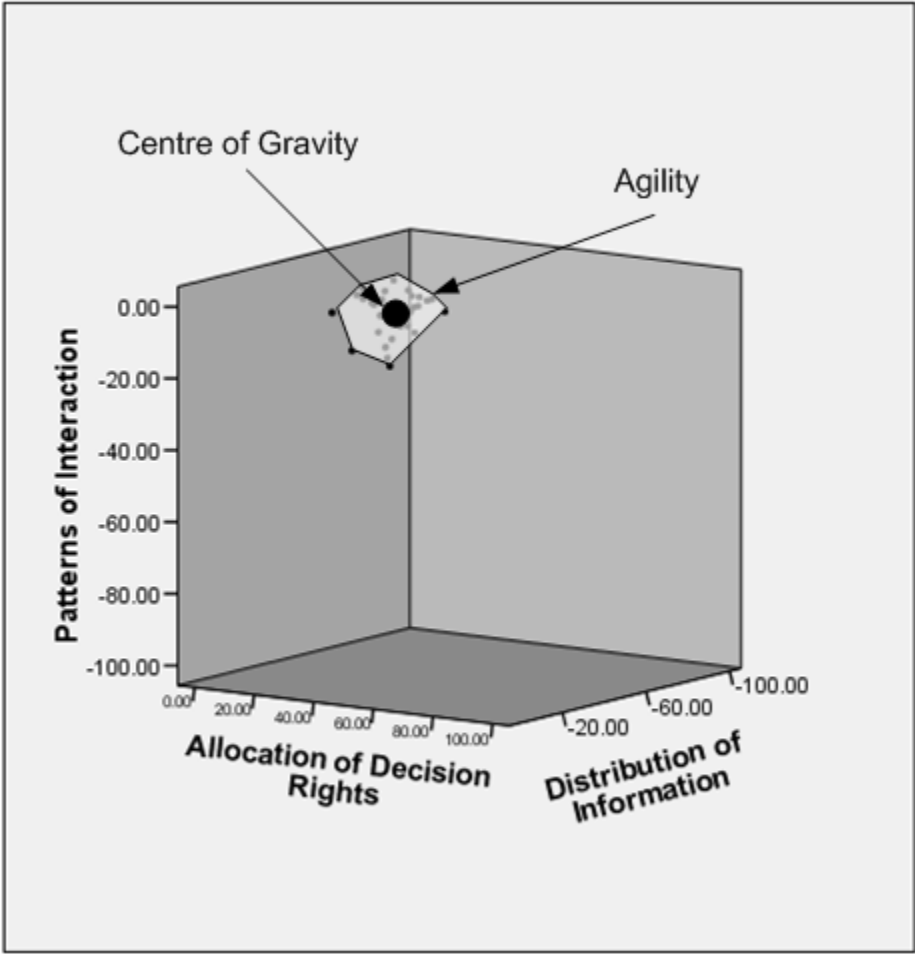
Metrics/Coordinates
(WESTT Software)



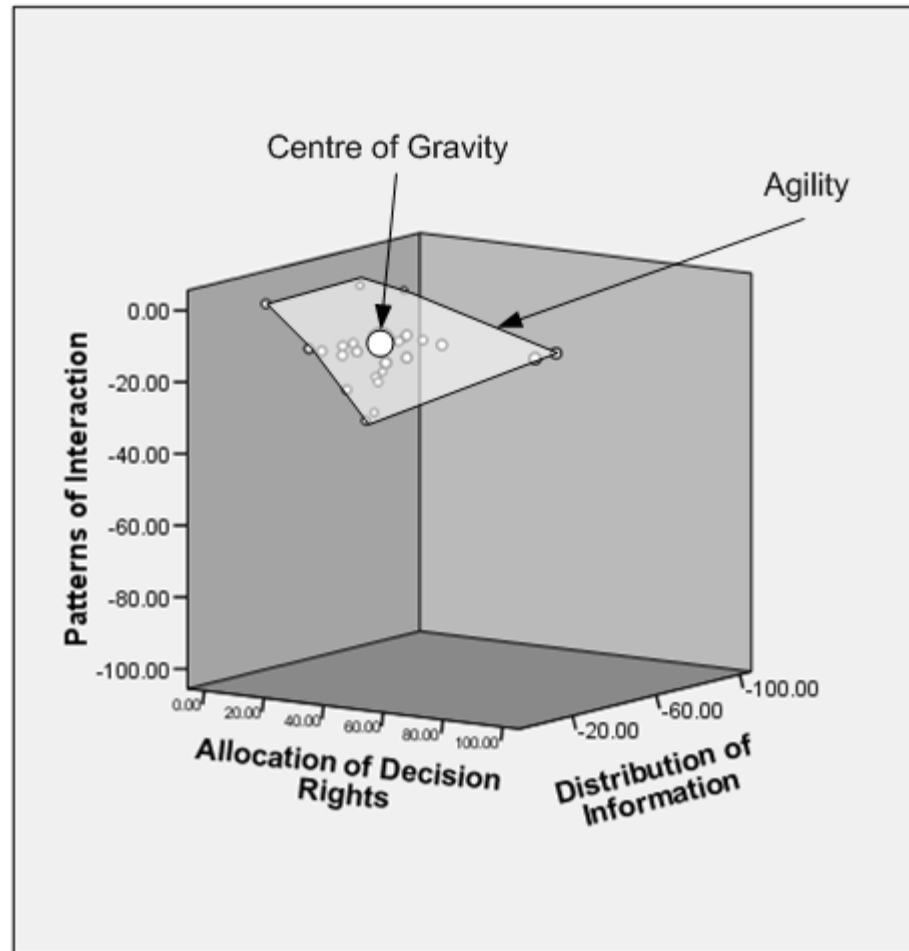
Approach Space



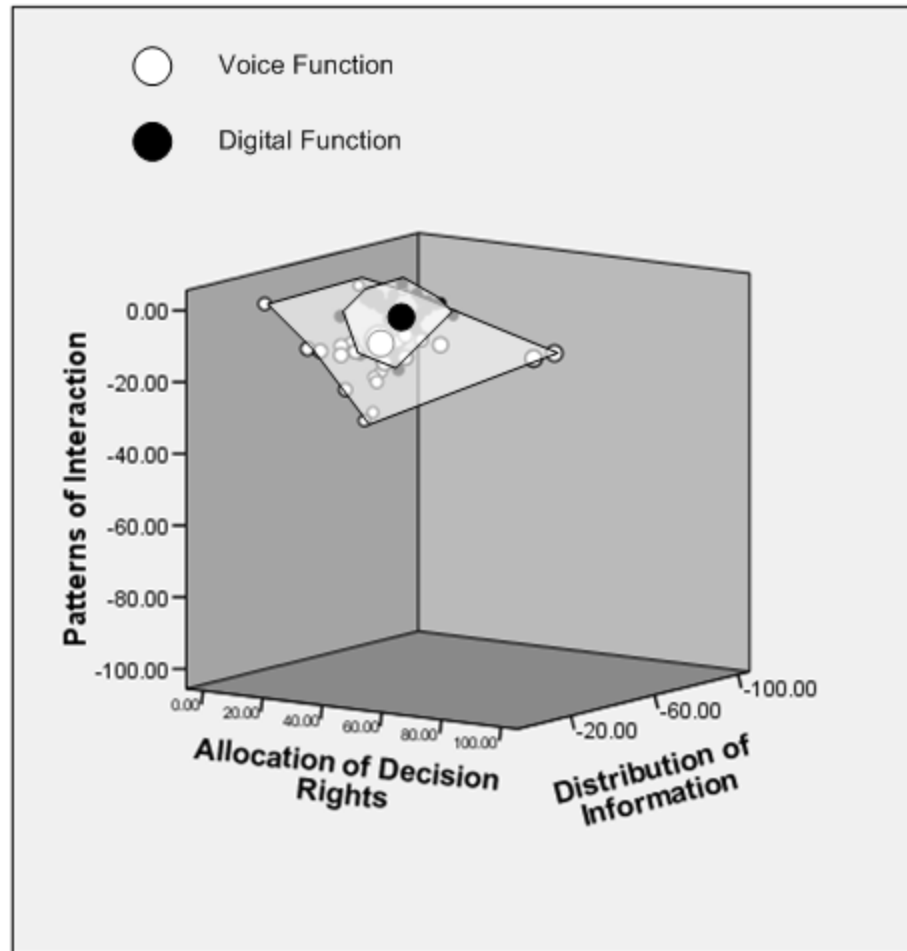
Digital Comms. Layer



Voice Comms. Layer



Agility





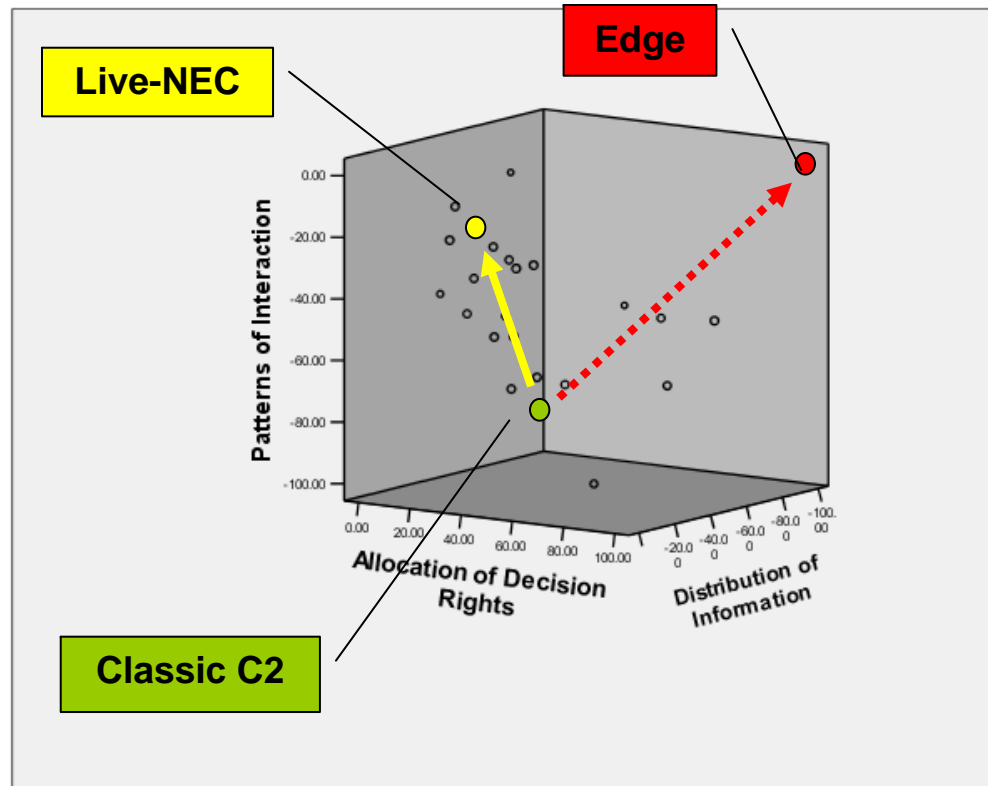
Conclusions

Conclusions

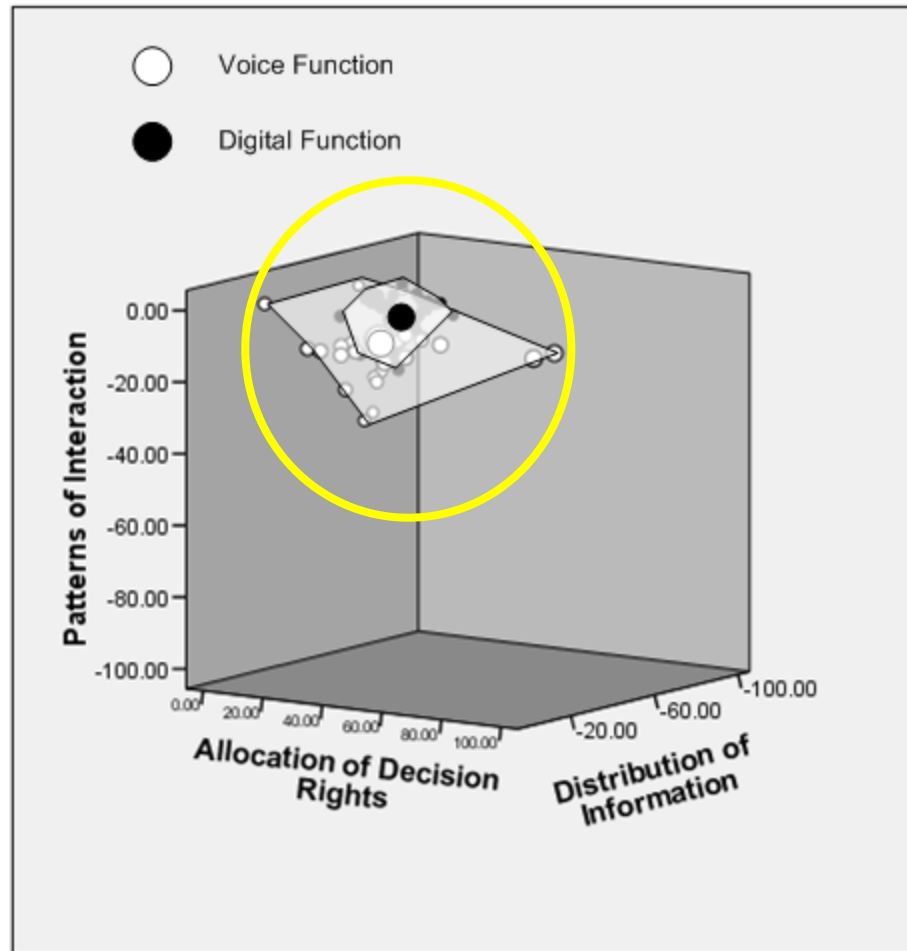


- Key innovation is turning NATO RTO SAS-050 approach space from a typology into a taxonomy
- Deriving something that can be expediently applied in live settings
- Meeting identified NATO research priorities...

Where C2 'actually is' ...



How C2 changes...



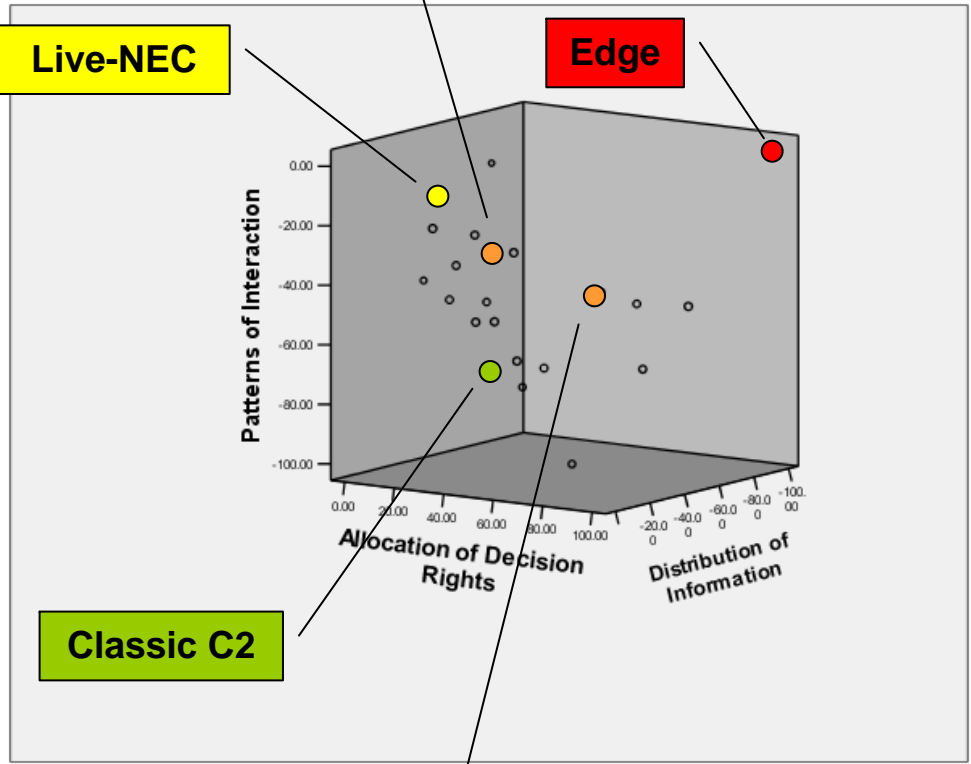


Matching areas in approach space to...

Indian Terror Organizations

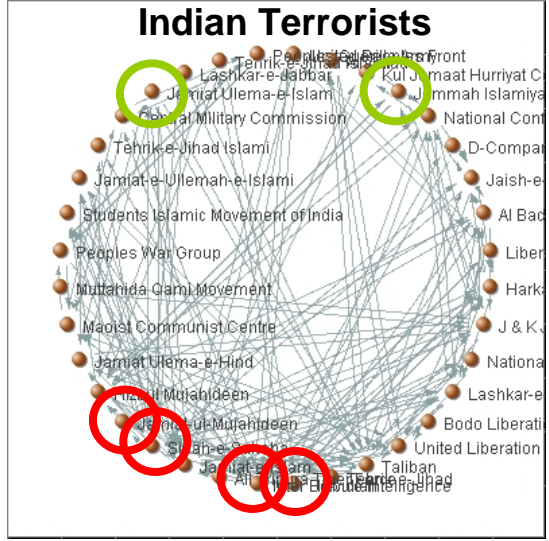
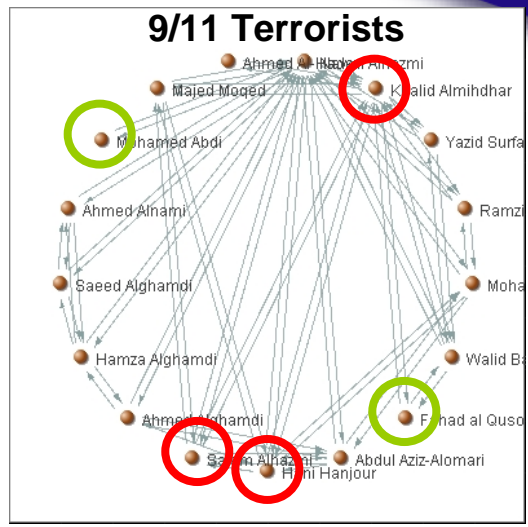
Live-NEC

Edge

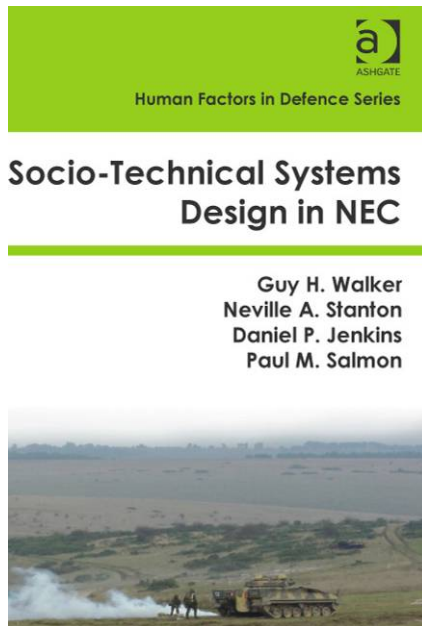


Classic C2

9/11 Terrorists



Walker et al. (Autumn 2009). Sociotechnical Theory and NEC System Design.
Ashgate: Aldershot.



“Technology is creating new opportunities for different types of command and control, and new types of command and control are creating new aspirations for technology. The question is how to manage this process, how to achieve a jointly optimised blend of socio and technical and create the kind of agility and self-synchronization that modern forms of command and control promise. One answer is to re-visit the considerable legacy of sociotechnical systems theory. In doing so the problems of 21st century command and control are approached from an alternative, multi-disciplinary, and above all human-centred perspective.”

“Time and again, what emerges is a realisation that the most agile, self-synchronising component of all in NEC is the human.”