Transformation in the CF
Concepts Toward a Theory of Human Network-Enabled Operations

John Verdon
D Strat HR 2-2

D Strat HR TM 02-2005
July 2005

Directorate of Strategic Human Resources
Assistant Deputy Minister (Human Resources – Military)
Transformation in the CF

Concepts Toward a Theory of Human Network-Enabled Operations

John Verdon
D Strat HR 2-2

The contents are the responsibility of the issuing authority and publication by the author does not necessarily reflect the official position of the Department of National Defence

Directorate of Strategic Human Resources

Research Note
02-2005
July 2005
Abstract

The paper aims to make the concept of networks clearer, and in particular to make a case that group-forming networks are the key to enhancing military capability within network enabled operations. The complexity of networks is underlined by the fact the network science remains in its infancy – despite the rapid growth of a literature and the increasing salience of research devoted to this area. It is also clear that there is considerable knowledge of many types of networks that can provide powerful cross-fertilization for developing a theory of human networks. The concepts integrated within this paper include:

- A tentative network typology and topology;
- Group-forming networks, customized response, and heterarchy;
- Contexts and boundaries appropriate for different networks;
- Fundamental organizational metaphors shaping understanding; and
- Networked individualism, glocalization; and peer production.

Résumé

L’objectif de cet article est de clarifier le concept de réseaux et, plus particulièrement, de démontrer que les réseaux formateurs de groupes constituent un élément clé pour améliorer les capacités militaires à l’égard des opérations réseau centriques. La complexité des réseaux est mise en évidence par le fait que la science des réseaux reste au stade embryonnaire, malgré la croissance rapide de la littérature qui s’y rapporte et l’importance croissante accordée à la recherche consacrée à ce domaine. Il est aussi évident qu’il y a une connaissance considérable d’un grand nombre de type de réseaux qui peuvent permettre un important enrichissement mutuel pour l’élaboration d’une théorie des réseaux humains. Les concepts abordés par cet article comprennent notamment les éléments suivants :

- Typologie et topologie provisoires de réseaux;
- Réseaux formateurs de groupes, réponse personnalisée et hétéarchie;
- Contextes et limites appropriés aux différents réseaux;
- Principales méta-phares organisationnelles qui façonnent la compréhension;
- Individualisme réseauauté, glocalisation et production en réseau.
Table of contents

Abstract.................................................................................................................................i

Table of contents.................................................................................................................. iii

List of figures.............................................................................................................................. v

Acknowledgements.................................................................................................................. vii

1. Introduction.......................................................................................................................... 1

2. Networks – What are they?................................................................................................... 4
   2.1 Type 1 ............................................................................................................................ 4
   2.2 Type 2 ............................................................................................................................ 5
   2.3 Type 3 ............................................................................................................................ 5
   2.4 Typology of Networks.................................................................................................... 5
   2.5 Heuristic Valuation......................................................................................................... 6
   2.6 Network Topologies........................................................................................................ 6
   2.7 Purposeful Response........................................................................................................ 7

3. The Emergence of Group-Forming Networks .................................................................... 10

4. Contexts for Networks......................................................................................................... 14
   4.1 Ordered domain: Known causes and effects................................................................. 15
   4.2 Ordered domain: Knowable causes and effects ............................................................. 15
   4.3 Unordered domain: Complex Relationships ................................................................. 16
   4.4 Unordered domain: Chaos ............................................................................................ 16
   4.5 Disordered domain......................................................................................................... 16
   4.6 Five Domains – Three Ontological States – Boundaries ............................................... 17
   4.7 Known-Chaos Boundary – Collapse/Imposition ............................................................. 18
   4.8 Known-Knowable Boundary – Incremental Improvement ............................................... 19
   4.9 Knowable-Complex Boundary – Exploration/Exploitation ............................................ 19
   4.10 Complex-Chaotic Boundary – Divergence/Convergence – Swarming............................ 19
   4.11 Organizational Metaphors............................................................................................. 20
4.12 Networked individualism .................................................. 26
4.13 Glocalization and Networked Individualism ....................... 27
4.14 Place-to-Place and Person-to-Person ................................... 28

5. Network Decisioning – The Emergence of Peer-Production .......... 29

6. Conclusion ........................................................................ 31

Bibliography........................................................................... 33
List of figures

Figure 1. Typology of Networks ................................................................. 5
Figure 2. Five Cynefin Domains ................................................................. 15
Figure 3. Border Dynamics ................................................................. 18

List of tables

Table 1. Response TypeNetworks ................................................................. 8
Table 2. Comparing Organizational Forms and Modalities of Organizing ............... 12
Table 3. Root Metaphors ........................................................................... 24
This page intentionally left blank.
Acknowledgements

I would like to thank D Strat HR for the support to pursue this line of thought. In particular I would thank LCol Jim Uchiyama for his belief, Brian McKee for his guidance, and Dr Sarah Hill, Sandra Schwartz, and Tracy Wait for feedback. I would also like to express gratitude to the Network Enabled Operations Symposium Working Group, notably: John Bovemkamp, Sandy Babcock, Maj A. Whitaker, LCol J.D. Graham, Terry Gongora, for including me in the important forum for grappling with the implications of networks. There are many theorists and others whose works I cite and have learned from – to these I am a humble follower. And to all, who have given support, encouragement, and feedback.
1. Introduction

More than a year after the Iraq war began soldiers are rotating home with a sense of unmet expectations. Consensus seems to be building among them that this conflict was fought brilliantly at the technological level but inadequately at the human level. The human element seems to underlie virtually all of the functional shortcomings chronicled in official reports and media stories: information operations, civil affairs, cultural awareness, soldier conduct...and most glaringly intelligence, from national to tactical. Technological failures are easy to identify and fix. Human failures are very hard. The human element in war is not a system built using the laws of empiricism but a collection and fusion of seemingly independent thoughts and actions that combine together to influence events on the battlefield. The American military is not accustomed to finding collective solutions to address human failures. But this war has shown that the development of such an approach is absolutely essential and long overdue.

Major General Robert Scales, 
Army Transformation: Implications for the Future, 
Testifying before the House Armed Services Committee - July 15, 2004

The advent of the networked society\(^1\) and economy heralds a paradigm change in our approaches to organizational structure and culture. This is no less a shift than that represented by the industrial revolution and the development of Fordist and Taylorist\(^2\) concepts. Without an appreciation for the nature of this paradigmatic change – that is, of the consequence of the disruptive nature of network technologies\(^3\), it is not possible to conceive the breadth and depth of the implications for organizations and more importantly on human resource systems.

The CF, along with most modern militaries, is currently marshalling tremendous efforts to meet the challenges of omni-transformation – the sense of having to advance evolutionary change\(^4\) on every front while simultaneously sustaining high operational tempos. Attempting to cope pragmatically with the initial concept of revolution in military affairs, “transformation” has come to be accepted as the larger operational environment. New technologies are coming hand-in-hand with new missions and mission domains – from battle-to-security space, from winning-the-war to winning-the-peace.

---

1 See Castells and Wellman
2 Scientific management or Taylorism refers to the approach to management and Industrial/Organizational Psychology initiated by Frederick Winslow Taylor in his 1911 work The Principles of Scientific Management. Taylorism is often mentioned along with Fordism, because both are closely associated with mass production methods. Taylor's relied upon time and motion studies to find the "one best method" to achieve a goal, i.e., one that was shorn of unnecessary movements. This sort of task-oriented optimization of work tasks is nearly ubiquitous today in most approaches to organizational design.
3 This includes Information and Communication Technologies (ICTs) and Computer Mediated Communications (CMC).
4 Whether it is only 'evolutionary' change remains controversial as there are many who see the nature of paradigmatic change as revolutionary. Those who must manage and fund change overwhelmingly prefer to understand transformation as a pragmatic and evolutionary process.
The recent development of new strategic concepts such as Network-Enabled Operations (NEOps), Effects-Based Operations (EBO) and Joint, Interagency, Multinational and Public (JIMP), (see Box 1), suggest a larger integrating framework of concepts for critically thinking about fundamental future capabilities within a more integrated military organization. Regardless of any particular approach to force structure, these concepts can also offer a foundation for understanding and aligning all stakeholders in a coherent development of CF capabilities. Success will enable stakeholders to achieve unprecedented synergy throughout a full spectrum of activities – from the determination of desired effects and the analysis of the complex target systems to the agile marshalling of resources to achieve a desired effect.

**Box 1**

While the nature of war is immutable, many changes in the character of conflict have taken place. These changes are stimulating the development of new strategic frameworks, concepts, theories, and missions. Innovations in Strategic Integrated Operating Concept and related enabling concepts strive to inform capability development by exploring the questions of Why, Who, What, Where, When and How.

*Why*: change in the dimensions and missions. The 20th century has seen many developments relevant to military organizations, including: the addition of the dimensions of air and space, the movement from battlefield/front to battlespace, from destruction and attrition of the enemy to the possibility of their disintegration, the blending of the strategic and tactical, the blending of the spectrum of conflict, the interdependence of domestic and international issues and the ascendant salience of security as the arena of concern. 20th century changes represent structural changes to the military leaving its organization essentially intact. The advent of the 21st century is introducing fundamental changes in the organization of the military evident in the emerging change in the key mission – winning the peace.

*Who*: With a broader range of participants and partners – Joint, Interagency, Multinational and Public coalition against traditional and asymmetric networked and individual actors.

*What*: Effects Based Approaches to operations – Operations designed to influence the long- or short-term state of a system through the achievement of desired physical or psychological effects. Operational objectives are sought to achieve directed policy aims using the integrated application of all applicable instruments of hard or soft power. Desired effects, and the actions required to achieve them, are concurrently and reactively planned, executed, assessed (and potentially adapted) within a complex *adaptive system*. (Robert Grossman-Vermaas, The Effects-Based Concept and Multinational Experiment 3: An Analysis of the Inter-Agency Role, Research Note 12/2004, (Ottawa: Operational Research Division, DND), p. 7)

*Where*: Anywhere and everywhere – the domestic/international battle/security-space arena.

*When*: proactive and reactive, responsive and pre-emptive, the tactical integrated with the strategic, Horizon 1 linked to Horizon 3.

*How*: with the development, implementation and exploitation of Network Enabled Operations. Agile, responsive and comprehensive collaboration, within and between traditional organizational boundaries will be a core competency for all stakeholders.

The central argument of this paper is that networks represent a dramatic change in the nature of organizational structure and processes. More profoundly, the emergence of a network society suggests a fundamental new avenue of human self-development and identity formation – networked individualism. The existence of human networks is as old as humanity. However, the exponential increase in the range and extent of human networks made possible by computer mediated information and communication technologies presents a quantitative change that makes possible a qualitative difference in capability – a "more is different" change. The struggle to understand and effectively
use emerging network capabilities represents the birthing of a post-industrial paradigm, influencing the individual, the organization, society and even the nation.

This paper is the first of three whose aim will be the exploration of the human implications of an emerging military organization embracing network enabled operations. This first paper will offer an ambitious contribution toward the development of a theory of human networks within a military context. To serve this end, it will present a brief typology of network structures, some notions of potential topological differences between networks, and a discussion of the possible contexts where different network approaches could provide the most utility. The final section will explore the emergence of ‘network individualism’ as a fundamentally new type of social solidarity and personal identity formation followed by some discussion of the paradigmatic change that the emergence of ubiquitous access to networks will require for their productive use.

The second paper will offer a relatively broad list of People and Human Resource implications related to a military transformation shaped by the concept of Network Enabled and Effects Based Approach. The final planned paper will propose some elements of an HR concept.
2. Networks — What are they?

The definition — in concrete terms of a network society is a society where the key social structures and activities are organized around electronically processed information networks. So it's not just about networks or social networks because social networks have been very old forms of social organization. It's about social networks which process and manage information and use micro-electronic based technologies.


What is the pattern of, and capacity for, information and communication flows within an organizational network? What technologies support them? How well do they suit the organizational design, as well as the narrative and doctrinal levels?


Networks, like hierarchies, have always been with us. The new organizational myth posits that the hierarchy is on its last legs and will soon be completely displaced by the network — that hierarchies and networks are antitheses of each other. The fact is, the traditional hierarchy can easily be considered as one type of network. To discuss the meaning of networks, we will begin by outlining a tentative typology of network structures with a heuristic formula of their value, and a topology of different network structures.

2.1 Type 1

Perhaps the simplest type of network is the “hub-and-spoke” type, which is easiest to illustrate with the idea of a broadcast system (in television and radio this is actually called a broadcast network). The idea is a single source (center) linked to many nodes in a simple one-way communication. (see Figure 1)

The traditional hierarchy and “chain-of-command” is a more complicated (depending on the number of levels in the hierarchy) version of this type of network. Formal links exist between levels of authority. The hierarchy becomes further complicated as two-way vertical communication and horizontal communication between nodes at similar levels is included in the structure (although the structure essentially remains the same). Here the formal links between levels of authority are augmented by informal links among nodes within a particular level of authority, so that one hears of vertical and horizontal communication links.
2.2 Type 2

This type of network is most easily illustrated by the telephone network where potentially every node is/can be connected to any/every other node. The geodesic structure is perhaps another way to visualize this. In the telephone network, communication is explicitly two-way, but is limited to a one-to-one, or at best few-to-few (as in a conference call) communication. While the reality of this type of network is highly complex, its functional capability is relatively simple.

2.3 Type 3

The Internet is a perfect illustration of this type of network. Structurally it is difficult to differentiate from type two. The power of this network lies in the increased functionality to connect – from one-to-one, to one-to-many, to many-to-many. The connectivity of this type of network is dynamic and thus defines its group-forming capability. The structural connectivity between every node with every other node is enhanced by a dynamically scalable connectivity and selection of members. Essentially, groups of any size (and location) can connect.

2.4 Typology of Networks

![Figure 1](image)

**Figure 1.** Typology of Networks
2.5 Heuristic Valuation

How do we assess these three different types of networks? Considerable debate has taken place in efforts to characterize the utility and therefore the value of each of these types of networks\(^5\). Precise measurement of value is not the object of this section. However, there is some utility in an effort to offer a heuristic aid in understanding value, or perhaps, in utility of potential connectivity, within orders of magnitude.

Broadcast networks provided a real business model upon which to assess the value of a network. It was literally related to the number of nodes it contained – the audience it could deliver to advertisers. Hence: \(\text{Value} = n \) (where \( n = \text{the number of nodes} \)).

It was likely that the feasibility of relatively accurate valuation possible with the broadcast network was the basis for what is often referred to as “Metcalf’s Law” – which has been characterized with the equation for the value of telephone type networks – \(\text{Value} = n^2\). However, while useful in conveying an order of magnitude increase in the utility of such networks, precise determination is really not possible, nor is it its intention. The important feature of Metcalf’s Law is the sense of the geometric increase in the possible connections (and therefore potential for useful interaction) that define these types of networks. It is, of course, equally possible to view the increase in potential interaction as contributing to negative situations that thus increase vulnerability.

The Internet and other group-forming networks were characterized by what has been called “Reed’s Law” the exponential extension of Metcalf’s Law with the power of Community Building.\(^6\) Here again, the important point is not the mathematically precise determination of value, rather it is the heuristic device to gain a sense of order of magnitude of increased potential. Reed’s Law, states that the value of group-forming networks is more appropriately understood as: \(\text{Value} = 2^n\).

2.6 Network Topologies

Social network analysis has roots in efforts to develop sociograms and directed graphs charting ties among different actors in particular contexts. Social network analysts, social psychologists and organizational sociologists studying what were then known as organization-sets, observed that networks could have several basic shapes (or topologies):

- \textit{chain} or line networks, members are linked in a row and communications must flow through an adjacent actor before getting to the next;

- \textit{hub-spoke}, star, or wheel networks, members are tied to a central node and must go through it to communicate with each other;

---

\(^5\) See Wellman for a similar outline regarding utility of various types of connectivity

\(^6\) www.reed.com/Papers/GFN/reedslaw.html
- *all-channel* or fully connected or full-matrix networks, where everyone is connected to and can communicate directly with everyone else – much like a telephone network;

- Other shapes identified include grids and lattices, center/periphery networks, and clique networks; as well as combinations and hybrids, such as sprawling networks with myriad nodes linked in various ways – ‘spider’s web’ networks; and

- Small world networks – the idea that unseen patterns are key to how networks exchange information, for example the idea of six degrees of separation between any two people in the world.

Moreover, any particular network may itself be embedded within surrounding networks. Yet, few social network analysts say much about such typologies\(^7\). Other important factors include the proportion of strong and weak links forming the network relationships, and the degree of reciprocity/mutuality in the network flows and exchanges. In addition to the presence of strong ties and weak ties in and of themselves, the possibility of the shift in the gradients / proportions of strong/weak ties can mitigate the nature of the network.

One further factor that is worthy of being described as a distinct topology but which adds further dimensionality (with significant implications for the people and groups forming the network) is the advent of increasingly wireless connectivity. Wireless connectivity accelerates the shift of network nodes from fixed place and group to wherever the individual person happens to be. In essence this adds enriched time/space dimensionalities to the modest range of network topologies we have noted. The issues of real-time and asynchronous communications are made more complex as we integrate with fixed and mobile nodes.

### 2.7 Purposeful Response

Like complexity theory, social network analysis views a network as a systemic whole that is greater than [the sum of] and different from its parts. In this way the ‘unit of analysis’ is not the individual as much as it is the network in which the individual is embedded. While it is important to show how the properties of the parts are defined by their networked interactions and relationships, the essential aim is understanding how a network itself functions to create opportunities or constraints for the individuals in it.

Depending on how an organization needs to respond, three other broad categories of networks can help augment and clarify the types of networks described in the heuristic valuation section. Different demands require appropriate response capabilities in order for organizations to be effective. Organizations can structure themselves to use networks to respond in routine, modular or customized ways to solve problems, deal with challenges or seize opportunities. The types of response an organization seeks to master tend to favour different types of networks.

\(^7\) Ronfeldt, David and Arquilla, John. *Networks, Netwars, and the Fight for the Future*  
The table below outlines three types of organizational responses, and suggests the type of network most suited to achieving a particular type of response and the corresponding values, issues and regimes.

**Table 1. Response Type Networks**

<table>
<thead>
<tr>
<th></th>
<th>ROUTINE RESPONSE</th>
<th>MODULAR RESPONSE</th>
<th>CUSTOMIZED RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Best for</strong></td>
<td>Solving familiar problems with known responses</td>
<td>Solving complex problems where components of the problems are known but the sequence of the solutions is not</td>
<td>Solving ambiguous problems that need innovative solutions</td>
</tr>
<tr>
<td><strong>Network Connections</strong></td>
<td>Focused on process flow; external connections are limited</td>
<td>Focused on roles through which different parties can rotate; external connections are targeted to inform aspects of response</td>
<td>Dense and redundant, both internally and externally</td>
</tr>
<tr>
<td><strong>Trust</strong></td>
<td>Is placed in process execution</td>
<td>Is placed in role occupant</td>
<td>Is placed in other's expertise</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td>Planning focuses on offerings; controls focus on efficiency and reliable delivery</td>
<td>Planning focuses on constellations of expertise; controls focus on integration at point of delivery</td>
<td>Planning focuses on general environments and expertise; controls focus on output, not coordination</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Work management systems &amp; artificial intelligence – IM</td>
<td>Role-based content systems and collaborative environments – KM</td>
<td>Expertise locators and Portals – Knowledge Management</td>
</tr>
<tr>
<td><strong>Culture &amp; Leadership</strong></td>
<td>Centralized decision making focused on standardization and task accountability</td>
<td>Shifting leadership, depending on domain; decision rights embedded in roles</td>
<td>Collaborative within and across organizational lines, norms of generalized reciprocity</td>
</tr>
</tbody>
</table>


It is probably safe to say that most organizations are familiar and comfortable with structures geared to routine response and have also adapted to structures enabling modular responses. Most military organizations have achieved considerable competence with modular type response structures.
However, the key to understanding the greater potential that networks can unleash lies in the third type of structure enabling customized response. Inherent in these types of network structures is the capacity of self-organization that emerges when networks are structured to allow for dynamic configuration to occur – \textit{group-forming behaviour}\textsuperscript{8}. A network that is self-organizing and group forming can extend beyond the geographic and temporal parameters combining static and dynamic dimensions. While many network structures carry significant implications for the traditions of hierarchical governance, the dynamic dimensions of networks that facilitate group-forming behaviour implies a greater improvisational character to governance.

\textsuperscript{8} Reed, David P. 1999. \textit{That Sneaky Exponential – Beyond Metcalfe’s Law to the Power of Community Building}. \url{www.reed.com/Papers/GFN/reedlaw.html}
3. The Emergence of Group-Forming Networks

What is keenly interesting is the need to assess required human capital (personal properties – owned by the individual) and the degree that organizational structures develop that human capital. However, most important is the social capital (interpersonal or relational – owned by no-one but used by all) that each type of structure needs and develops. Emergence is related to the concept of ‘wholeness’ – in that a system must be seen as an interacting whole not as an assembly of distinct and separate parts. When the whole is greater than the sum of its parts the disaggregation of its parts for analysis loses the very thing that underlies the whole’s distinctness. Emergence occurs in the transition from local rules or principles of interaction between parts or agents to where global principles encompassing the entire collection of parts/agents take hold.

"If we understand a network not as a type of formal organization, but as social capital, we will have much better insight into what a network’s economic function really is. By this view, a network is a moral relationship of trust: A network is a group of individual agents who share informal norms or values beyond those necessary for ordinary market transactions. The norms and values encompassed under this definition can extend from the simple norm of reciprocity shared between two friends to the complex value systems created by organized religions."  
(Fukuyama, 1999, p.199).

"Our exploration of emergent social structures across domains of human activity and experience leads to an overarching conclusion: as an historical trend, dominant functions and processes in the information age are increasingly organized around networks. Networks constitute the new social morphology of our societies... While the networking form of social organization has existed in other times and space, the new information technology paradigm provides the material basis for its pervasive expansion throughout the entire social structure."

(Castells, 1996, p. 469)

Understanding of the dynamic and fluid nature of group-forming self-organizing networks continues to develop. One attempt to describe such networks is captured in the acronym SPIN - "Segmented, Polycentric, Ideologically Integrated Network" (SPIN). Segmentary refers to a network’s cellular aspect – composed of many different groups; Polycentric refers to the nodal dimension of many different leaders or centers of direction; Networked refers to the connectivity of the segments and the leaders into Integrated, reticulated systems or networks through various structural, personal and Ideological ties. Such networks tend to be expanding toward inclusive and permeable shifting boundaries.

---

Another view of the power of group-forming networks (GFN) is to see them as Complex Evolving Systems (CES). Group-forming networks that function effectively as complex evolving systems rely on connectivity and interdependence. The interrelatedness of elements both within a system and between systems is inextricably bound up with interdependence. Most adaptive systems exist in a zone between too little and too much interconnection – the edge of chaos. Too little interconnectedness creates systems that are too static, while connectedness beyond a certain point tends to be inherently unstable such that too much interdependence between the elements in the system can permit minor perturbations stemming from the environment to proliferate too rapidly through the entire system. On the other hand, too little interconnection between elements allow the elements to be relatively isolated such that perturbation in a single element will be unable to be felt by other elements. This level of interconnectedness leads to a rigid stability, as the system remains constrained by one or very few patterns of behaviour.

The need for a customized approach/response mirrors the delicate balance between too much order and too much stability. The chief concern for customized response of complex adaptive systems is the relation between the exploration of new possibilities and the exploitation of old certainties.¹⁰

Exploration – search, variation, risk taking, experimentation, play, flexibility, discovery, innovation.

Exploitation – refinement, choice, production, efficiency, selection, implementation, execution.

Like the balance between too much and too little connectivity, an over-emphasis on exploration over exploitation can result in suffering the costs of experimentation without gaining many of its benefits – too many undeveloped ideas and too little distinctive competence. The converse of emphasis on exploitation, over exploration, is likely to result in suboptimal stable equilibria that are unable to adapt.

If the traditional organizing principle for stability is hierarchy (e.g. the firm), and the generally accepted countervailing organizing modality is based on autonomy (e.g. the market), what lies in the zone of emergence? The concept of ‘heterarchy’ is appropriate to the needs of group-forming networks to compare the quality of interactions and the various coordination processes central to other organizing modalities and forms.

What are heterarchies? They are nested hierarchies, but in this case hierarchy is not the structure of official channels or chains of command from the top down. Rather, heterarchies can be conceptualized as loosely coupled systems within a hierarchy of subsystems that can be differentiated into further subsystems. Each system is both a whole in its own right as well as being a part of the whole. A heterarchy is an

¹⁰ Iannacci, F.; Mitleton-Kelly, E. 2005. Beyond Markets and Firms: The Emergence of Open Source Networks. First Monday Vol 10, No.5 May 05
http://firstmonday.org/issues/issue10_5/iannacci/index.html
ensemble of systems loosely coupled where the interactions between systems are less direct and less frequent than those within the system.

Heterarchies provide for both exploration and exploitation, customized response and stability by being able to search the space of possibilities through localized adaptations while maintaining local stabilities and ignoring limited perturbations elsewhere. Heterarchies in comparison to hierarchies feature decentralized interactions with actors able to adapt to each other in a parametric fashion and are relatively more stable than the autonomy of markets.

Table 2. Comparing Organizational Forms and Modalities of Organizing

<table>
<thead>
<tr>
<th>ORGANIZATIONAL FORM</th>
<th>FIRM</th>
<th>NETWORK</th>
<th>MARKET</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODALITY OF ORGANIZING</td>
<td>Hierarchy</td>
<td>Heterarchy</td>
<td>Autonomy</td>
</tr>
<tr>
<td>QUALITY OF INTERACTIONS</td>
<td>Stable and Centralized</td>
<td>Relatively Stable &amp; Decentralized</td>
<td>Transient &amp; Decentralized</td>
</tr>
<tr>
<td>COORDINATION PROCESS</td>
<td>Coordination by Plan/Authority</td>
<td>Coordination by Parametric/Mutual Adjustment</td>
<td>Coordination by Standardization/Price Mechanism</td>
</tr>
</tbody>
</table>


While the general mechanism of coordination characterizing hierarchies (e.g. firms) is authority, and for markets are the price mechanism, how do networks coordinate? Heterarchic or customized response or group-forming networks are coordinated through the principle of the emergence of self-organization – as the by-product of decisions taken in the pursuit of local interests. “Networks feature a large number of interdependent decision makers where each decision maker adapts to prior decisions in a parametric fashion. Each decision maker considers prior decisions to which it is worth adapting if, and only if, by so doing, the decision maker is better off.”11 The self-serving of a decision-maker can easily be understood in the local furthering of common intent. The emphasis on local decisions rather than centralized coordinating decisions is the definition of self-synchronization – coordination as an emergent process of parametric adaptation whereby distributed decision makers adjust to prior decisions by undertaking actions in the pursuit of localized interests. Heterarchy is a naturally emergent structure of the social system fabric.

While it may be difficult for a military organization to see itself functioning in this manner, this network approach is perfectly suited to the complex operational environments of today and the future. Self-organization via parametric adaptation of heterarchic networks is a useful contrast to traditions emphasizing ‘overarching authority and governance’.

The very institutional environment where networks operate is fundamentally different from the institutional setting of alternative organizational forms, the former pivoting around the right to distribute, the latter around the right to exclude. What are the implications of different institutional settings? How does it change across various configurations of networks?

Hierarchies tend to be more learning-oriented than are hierarchies, suggesting that for a customized response approach, more rather than fewer decision makers can facilitate coordination. As the number of decision-makers grows, the possibilities for coordination are even greater. More – rather than fewer – actors bring more skills, interests, energies and intelligences to the issue of coordination and in this way generate solutions based on multiple viewpoints and are able to select the best emergent solutions. The whole ensemble of networks uses weak and strong coupling, and interdependence, different patterns of connectivity emerging as required. Both short-term adaptation to changes in the social and operational ecosystem, as well as longer term co-evolution, where mutual influence creates new behaviours and new capabilities, are enabled.
4. **Contexts for Networks**

It would simplify the problem of organization if clear operational contexts could be delineated for the implementation of network approaches. Unfortunately, this is not possible. Reality presents us with contexts that intertwine and interact. For instance, formal command structures and informal trust networks often support (and simultaneously compete with) each other. However, it can be useful to artificially separate ordered and un-ordered\(^{12}\) contexts to understand their corresponding dynamics.

One approach was developed at IBM's Cynefin Center and is correspondingly called the Cynefin framework\(^{13}\). Cynefin is a Welsh word conveying a sense of the place of our multiple affiliations, that individuals, societies and nations have many roots – cultural, religious, geographic, tribal. The intention of the name is to express that all human interactions are influenced and determined by multiple direct and indirect experiences. The framework was developed to help in clarifying formal and informal communities and interactions of both structured processes and uncertain conditions. The framework is first of all intended as a sense-making tool, and is depicted below.

---

\(^{12}\) Kurtz, C.F.; Snowden, D.J. 2003. *The New Dynamics of Strategy: Sense-making in a Complex and Complicated World*. IBM Systems Journal. Vol. 42. No. 3. Here the authors use the term 'un-order' to refer to the sense of *emergent order* and in not in the sense of a lack of order but in less common sense of conveying paradox, of difference yet of similarity. For example, the term undead – neither alive nor dead but similar to and different to both.

\(^{13}\) ibid
**Five Cynefin Domains**

**Complex**
- Cause & effect only coherent in retrospect, non repetitive
- Pattern management
- Perspective filters
- Complex-Adaptive Systems
- Probe-Sense-Respond

**Chaos**
- No cause & effect relationship perceivable
- Stability-focused intervention
- Enactment Tools
- Crisis Management
- Act-Sense-Respond

**Known (complicated)**
- Cause & effect separated over time and space
- Analytical/Reductionist
- Scenario Planning
- System Thinking
- Sense-Analyze-Respond

**Known**
- Cause & effect relations repeatable, perceivable & predictable
- Legitimate best practice
- Standard operating procedures
- Process reengineering
- Sense-Categorize-Respond

---

**Ordered domain: Known causes and effects**

This is the domain of linear relationships, predictive models and sound evidence based practice. Knowledge can be made explicit and captured within structured processes. Efficiency can be pursued consistently with effectiveness. Single-point forecasting, field manual and standard operating procedures are effective. The decision model is to sense and categorize incoming data in order to respond according to predetermined and mandatory practice and structured techniques.

**Ordered domain: Knowable causes and effects**

Cause and effect relationships are stable but generally not fully known, except perhaps to experts/specialists. Causal chains extend over time and space making them complicated and more difficult to understand. Systems in this domain can be moved to the known with appropriate time, space and resources and when those are not available reliance on experts is required. The key issue is the trust between the expert(s) and the

---

decision maker(s). Systems thinking, experiment, expert opinion and structured scenarios planning are standard approaches in this domain. The decision model is to sense and analyze data and respond in accordance with expert opinion/interpretation. However, entrained patterns can be dangerous. Basic errors in assumptions can lead to false conclusions.

4.3 Unordered domain: Complex Relationships

Complex relationships can be perceived but not predicted – a type of retrospective coherence where the whole is greater than the sum of parts. In this space, structured methods confront novelty for which they are ill prepared. Once perceived, patterns appear logical and can repeat, but since the underlying causes/sources of patterns are not open to observation (without affecting the pattern), long term stability cannot be known. In this context, expert opinion that is based on historical and stable patterns of meaning cannot sufficiently enable the recognition of- and re-action to, emergent-type patterns.

Decisioning in this space requires probes in order to sense what potential patterns are present and then responses are aimed at stabilizing desirable patterns and destabilizing unwanted or non-useful patterns. Complex situations/contexts can also be ‘seeded’ so that desired patterns are more likely to emerge. Multiple perspectives are essential. Attention is key in order to gain the insights needed, rather than reliance on entrained habits of past experience.

4.4 Unordered domain: Chaos

In this domain there are no perceivable causal relationships, systems are turbulent and response times are limited. Situations of chaos can be precipitated by the application of ‘best practices’. Although there may be the potential for order, few see it or have the courage to act. Tendencies of trying to ‘work the system’ found in the known domain cannot work here. Decisioning in this space requires decisive and rapid action to reduce turbulence, and further action-reaction response cycles. In some cases interventions may be authoritarian to control a shift to a known/knowable -type space. In other cases multiple interventions may attempt to shift the chaos toward the creations of patterns that can be stabilized such as in a complex domain. Innovation is appropriate in a context of chaos.

4.5 Disordered domain

This is the domain of human disagreement, where decision-makers differ on the context and the appropriate course of interventions. Here is where the preferences of individual leaders compete to impose interpretive frameworks with which they are most comfortable, or most empower them. The more leaders can collaborate to reduce

These would be similar to wargaming and the force structure scenarios as opposed to the Scenario Development Process type scenarios as practiced by such proponents as the Global Business Network.
4.7 Known-Chaos Boundary – Collapse/Imposition

This boundary is perhaps the most dangerous and is easily characterized as asymmetric collapse. Crossing this border, from the Known to Chaos, can instigate a desperate grasping for order that continues long after tenable. Properly handled however, openness to innovation can also be the consequence. Crossing from Chaos to Known can instigate a similar desperation for order that is felt as a draconian imposition of order. Revolutionaries with high ideals and intentions can develop stifling and rigid bureaucracies or tyrannies. Here again, the positive handling of this crossing can result when order serves real needs. The quality of individual leadership has great influence on the nature of response when an organization faces the transition between these two domains.

---

this space the more likely it is that coherence about appropriate response can be achieved.

4.6 Five Domains – Three Ontological States – Boundaries
(see figure 3)

The states of order, complexity and chaos are embedded in five domains. Understanding these states in relation to the domains is important for human sense-makers and the assessment of appropriate decisioning. The right and left hand domains could be roughly understood to distinguish between situations where rules can be applied to produce predictable results (right) versus domains where pattern recognition is necessary to determine the possibility of attempting stabilizing types of interventions. In the upper two domains, time is necessary whereas in the lower two domains, immediate action is generally more the case.

For sense-making, boundaries present the most significant challenge. Whether they are experienced as gradual transitions or gradients or sharp borders, knowing the context is what enables appropriate decisioning. Boundaries can be experienced as easily crossed at any point, crossable only at distinct ‘bridges’ or highly dangerous situations of radical and/or unperceivable change. Boundaries can have different forms depending on the direction of movement or even depending on the individual’s perceptions. The key factor for boundaries is the recognition that each domain requires different models of interpretation, understanding, leadership and organization. One could make the argument that the domain of disorder also includes issues of boundary recognition.
4.8 Known-Knowable Boundary – Incremental Improvement

The scientific method probably represents the typical approach used to cross this border. Transitions here tend to be fluid and are generally the method of choice for handling change. Most people prefer this view of transition. The professional, the manager, and the expert are typical roles for leadership on this border. Traditionally structured organizations are adequate until the pace of change demands an acceleration of knowledge generation – at which point individual, cross-discipline, and some dimension of group-forming networks are required.

4.9 Knowable-Complex Boundary – Exploration/Exploitation

This border often operates as an engine for new ideas. As a border it is less permeable due to the fact that the domains embody different levels/types of order with correspondingly different rules. Crossing from knowable to complex is generally an exploration (versus exploitation). For exploration to be fruitful, trust is essential, as central control must be loosened (at minimum), however, unobtrusive (yet vigilant) monitoring is also required. Exploitation represents the crossing from complex to knowable. Perceived patterns are selected in order to make them stable enough to become exploitable (at least by experts). Group-forming networks of all sorts are powerful both in the domain of complexity and in the transition across this border. Fluid situational leadership and matrix-type management approaches are natural here.

4.10 Complex-Chaotic Boundary – Divergence/Convergence – Swarming

Like the known-knowable boundary this is a fluid, difficult to delineate border. This is the engine of evolution, the melding of randomness and order to produce novelty. While the transition from chaos to order is almost impossible, the shift from chaos to complexity is more natural and more manageable. In this way one can argue that swarming is an embodiment of the shift from chaos-to-complexity-to-the-knowable. Swarming represents the emergence of patterned order from random action. The transition area requires different leadership styles and organizational structures/cultures in order to avoid the reactive desire for order that leads to imposition or collapse and to enable complex capabilities to emerge. The contrast of ‘swarming’ types of activities versus ‘imposition’ types of response can provide a new conceptual system for leaders. Here as well, group-forming networks are a natural structure for this border. Group-forming networks enable the convergence and divergence that represents the shift from complexity to chaos and back. Such networks are much more resilient when they are asked to undertake the radical disruption and transformation that is the consequence of rapid innovation.

Beyond the issue of crossing domain boundaries are the issues of the interaction between groups and organizations structured to operate in and/or to create domains/contexts.
4.11 Organizational Metaphors

It has been argued that human language (symbol processing systems and structures), rather than behaviour, is the essence of the human condition. And in fact, humans often achieve understanding through the use of metaphor and iteratively structure their experience through the same metaphors. With the discovery of clocks, the universe was perceived as a clock set in motion by the hand of God, and soon organizations were conceived as types of clockwork mechanisms. A clockwork mechanism is set in motion by an external force and runs in one direction performing a single function. Each part of the mechanism has only one specified task within a very circumscribed series of tasks. In the “clockwork organization” people were seen in much the same way – as singular mechanical parts meant to perform simple determined tasks.

Later the engine/motor replaced the clock as the pre-eminent metaphor. Unlike the clock, the engine could be applied to many different tasks, could change direction, slow down or speed up. However, the nature of the mechanical machine remains at the heart of the metaphor. We can hear this in such terms as: the military machine, driving

A command system, even one as simple as that of clockwork armies, needs not only well-drilled tactical bodies, but also a hierarchical chain of command incarnated in an officer corps. Historically, the amount of control a supreme commander surrenders to his officer corps has depended on many factors, some of them relating to the commander’s personal style, some to the degree of complexity of the tasks confronting him.

In the age of clockwork armies, no such diffusion of authority was possible because the officer corps was not composed of professionals, subject to the filtering process of meritocracy, but rather it was monopolized by the aristocratic classes. This state of affairs ran counter to the avowed intentions of the commanders to create a fully functional chain of command, but it was impossible to cross the aristocracy/meritocracy threshold without provoking turbulent social consequences. The same was true of other thresholds involving the social composition of the army, like the shift from an army of foreign mercenaries to a mass citizen army. The French bet their future on turbulence (revolutionary upheaval) and were therefore the first army in Europe to become “motorized,” tapping the effective reservoirs of the population.

Manuel De Landa’s “War in the Age of Intelligent Machines” 1998.

The increasingly complex organizations of the 20th century required control. This emerged in the form of the machine metaphor, in which everything was controlled: every resource, every machine part and every human movement was subject to the discipline of machine thinking. Managers became a new breed of decision-makers – and human labour was engineered to the specifications of the new managers.

The economies of scale created by the development of monopoly capitalism required systems for controlling the complexity of the industrial machine. This was aided by the adoption of military thinking and concepts. Management control and decision-making were characterized by the adoption of military principles (planning, co-ordination, controlling) and infused with appropriate language (chain of command, lines of communication, leadership, strategic management and strategic planning, authority, delegation, management by objectives, operations management and mission statements).

change, command and control, engines of industry, etc. The conception of the modern organization as a machine is the kernel of the industrial revolution and the foundation of the Taylorist and Fordist approach to organizational structure. The shadow of this approach is captured in the images of Metropolis, and the “company man”. The incorporation of Scientific Management within the Fordist work process, engendered consequences, including the separation of brainwork from manual work and the way in which the invisible system, once it is constructed by experts and managers, becomes a subtle form of command and control.

While technology is perhaps the most important influence for organizational change, the advent of the information age has also allowed new understandings to emerge. The science behind our understanding of chaos, complexity, biology and more, the accelerating pace of technological and scientific progress and the birth of the Internet, have begun to crystallize new metaphors that help shape our comprehension. The concepts and study of self-organizing and autonomous intelligent systems provide a new framework for organizational structure and the roots of new metaphors. These new concepts and the resulting information and communication technologies (ICTs) have created problems of disequilibrium due to a cultural lag between the technological system and the behavioural system.

These technologies allow the coordination of tasks, and management of complexity. This results in an unprecedented combination of flexibility and task performance, of coordinated decision-making and decentralized execution, of individualized expression and global, horizontal communication, which provide a superior organizational form for human action.

Manuel Castells, Castells, Manuel. 2001. The Internet Galaxy: Reflections on the Internet, Business, and Society

Organizations, adapting to a turbulent, rapidly changing and increasingly competitive environment have begun to understand they must be knowledge-based, learning organizations. A need to support life-long learning also shifts the focus toward “self-programmable labour,” in order to ease the time and financial burdens of re-training, and development (equivalent to reconfigurable manufacturing processes vs re-tooling rigid systems). The power of the new technology and their enabling concepts and

While a human historian might try to understand the way people assembled clockworks, motors and other physical contraptions, a robot historian would likely place the stronger emphasis on the way these machines affected human evolution. The robot would stress the fact that when clockworks once represented the dominant technology on the planet, people imagined the world around them as a similar system of cogs and wheels. The solar system was pictured right up until the nineteenth century as just such a clockwork mechanism – as a motorless system animated by God from the outside. Later when motors came along people began to realize that many natural systems behave more like motors: they run on an external reservoir of resources and exploit the labor performed by circulating flows of matter and energy.

Manuel De Landa’s “War in the Age of Intelligent Machines” 1998.

capabilities can only be leveraged with appropriate organizational structures and cultures. These structures and cultures must in turn be "comprehended" with new metaphors derived from the emerging fields of understanding.

It may be too early to fathom the nature of our new metaphors, one appropriate to Effects Based Operations (EBO) and Network Enabled Operations (NEOps). However, three different fields may offer some insight: the field of artificial intelligence,\textsuperscript{18} the swarming nature of some forms of social insects, and in the workings of the market. A very brief review of each of these fields will serve to outline the potential for a "cross-domain" mapping of knowledge/understanding from one domain onto the emerging world of increasingly networked societies and human organizations.

The last three decades of research in Artificial Intelligence suggests that, in order to create more human-like programs, the control of a given process must not reside in a master program. Instead, control must shift to the very data that programs work on. In this approach the "mind" of a robot is a database in which the external world is represented through "sensors" that reflect changes in the outside world. This shifts control from programs to data in a way that permits external events to trigger internal processes. This movement reflects a long history in the shift of control from \textit{hardware, from hardware to software, and from software to data} that is now the source of machine intelligence, and thus at the origin of autonomous weapons systems.

Software languages (called "object oriented") substitute a hierarchical system of control with a hierarchy of software objects. In this way there is no master program that contains the "essence of the task" to be achieved, and therefore there are no sequences of subprograms meant to perform components of the task. Instead the designer embodies the essence of the task in many separate programs each of which can pass messages to one another reporting on the progress of their work. This approach allows any work to be accomplished in a more flexible way since the work is not prescribed through a rigid central program but accomplished through the coordinated action of different modules working in different sequences according to different circumstances.

\begin{quote}
...the kind of software that could endow robots with mechanical intelligence needed to go beyond a program-directed, hierarchical flow of control. Otherwise, every routine would have to be programmed, every contingency planned for - its activities would remain, in a sense, clockwork, in that it could follow only a limited repertoire of orders. Such a master program would soon become too big and unmanageable and, indeed, would present an obstacle for the further evolution of robot intelligence. To avoid the combinatorial explosions that a hierarchical scheme of control would produce once a certain level of complexity is reached. AI researchers began in the 1960s to design software languages that allowed the data itself to act as the controlling agent.
\end{quote}

\begin{flushright}
 Manuel De Landa's "War in the Age of Intelligent Machines" 1998.
\end{flushright}

\textsuperscript{18} This digression is largely based on Manuel De Landa's "War in the Age of Intelligent Machines" 1998.
We can see that in this approach control is never passed from a higher authority to a lesser authority. There are no hierarchical levels. The heterarchy of software objects or agents capture control as they are invoked into action. This scheme allows the database (or patterns in it) to control the flow of activities. Thus if the patterns in the database reflect changes in the outside world, the agents are then able to allow the world itself to control processes. Ultimately this method of organizational structure is what allows a robot to respond to changes in the world. By dispersing control, machines and organizations can be structured so that they may be driven by conditions in the real world or by the nature of the problems that confront them. (see Table 3)

In addition, creating artificial or machine intelligence involves the design of software that moves from “sequential procedures” (recipes followed one step at a time) and towards “parallel procedures” (dealing with several aspects of a problem at once). Parallel processes are not only dramatically faster but facilitate the development of systems that are more “human-like” in that they can plan strategies by considering many factors simultaneously. When agents are allowed to communicate (barter, bid and/or compete) among themselves for resources, what emerges is a new structure resembling natural ecologies (like an insect colony) or even human ecologies (like a marketplace).

The key is to understand that the issue is not “technology versus people”. The successful and productive transformation enabled by technology is primarily dependent on people. Therefore, while it is “not about the technology” it is imperative to understand the nature of this emerging “technological framework” in order to fully appreciate the implications for people.

Hierarchies have certain virtues – efficiency and speed – as a way of executing decisions. But they’re outmoded as a way of making decisions, and they’re ill-suited to the complex strategic landscapes that most companies now inhabit. Firms need to aggregate the collective wisdom instead. Under the right conditions, groups are smarter than the smartest person within them. We often think of groups and crowds as stupid, feckless and dominated by the lowest common denominator. But take a look around. The crowd at a racing track does an uncannily good job of forecasting the outcome, better in fact than just about any single bettor can do. ...Groups will consistently make better decisions than an individual.


But just as the conoidal bullet forced armies to disperse on the battlefield, the new machines are forcing the military to disperse in the problem-solving field. In particular, the software control structure with the least amount of central control... is the only one that allows large computer networks to operate without traffic jams and bottlenecks. [This approach], like the conoidal bullet, is a technology that should be adopted by the military on purely pragmatic grounds. But, like rifled firearms, it will be resisted for a long time, for as long as it threatens centralized control and command. In that gap, the period of time between the emergence of a new [organizational] paradigm and its incorporation into a tactical doctrine, new opportunities arise for the experimentalists outside the war machine.

Manuel De Landa’s “War in the Age of Intelligent Machines” 1998.
In essence the above describes the paradigm change involved in a shift to network-centric approaches to organizational structure and culture. This is no less a shift than that represented by the industrial revolution and the development of Fordist and Taylorist concepts. The table below presents another way to see the major shifts in the root metaphors shaping our understanding of optimal organizational structure and as a prime shaper of culture.

**Table 3. Root Metaphors**

<table>
<thead>
<tr>
<th>FRAME</th>
<th>Functionalism</th>
<th>Behaviourism</th>
<th>Scientific Management</th>
<th>Self-Organization, Autonomous Intelligent Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>METAPHOR</td>
<td>Organism</td>
<td>Man-as-Machine</td>
<td>Homo Economicus Rational Actor</td>
<td>Networked Individual, Learning Organization</td>
</tr>
<tr>
<td>METHODOLOGICAL</td>
<td>Positivistic study</td>
<td>Positivistic/functional</td>
<td>Pseudo-science of effort and control</td>
<td>Science of Networks, Complexity and Chaos</td>
</tr>
<tr>
<td>ASSUMPTION</td>
<td>of Organizations</td>
<td>analysis of man</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

However much the social dimension of human networks is highlighted, even social network theorists can ‘mechanicalize’ the definition of networks, so that even a systems theory approach loses the dimension of human agency.

* A network is a relatively open system linking at least three relatively closed systems.*
  - A system is a set of interdependent units working together to adapt to a changing environment.
  - A closed systems consists of fixed (sub)units primarily interacting among themselves to reproduce the system as a whole in a (pre)determined way.
  - An open system consists of a changing collection of (sub)units primarily interacting with the environment to change the systems as a whole in a random way.

Therefore recent theorizing about Network-Centric Operations has posited that four domains are necessary to understand network implications— the physical,

---


informational, cognitive and social is a positive development. But given the ground
covered so far, it would be more useful to give more primacy to the human dimensions
by emphasizing that the design and performance of networks depend on what happens
across five levels of analysis (which are also levels of practice)\textsuperscript{21}:

- Technological level – including the physical and the information systems in use
  and the corresponding technical standards and protocols necessary for interaction;
- Organizational level – specific organizational design\(s\) that enables, inhibits and
  adapts networks;
- Doctrinal level – the collaborative concepts, strategies and tactics;
- Social level – the personal ties that assure loyalty and trust; and
- Narrative level – the story being told, through frames, narrative structure and value
  frameworks.

More to the point, anthropologists have written a great deal on the structures of
Tribalism, speaking of Kinship and Lineage networks. However, the concept of group-
forming networks would also have to include the dimensions of the Fictive-Emotive-
Affinitive-Ideational, as human drives for creating maintaining and adapting social and
organizational networks.

\begin{quote}
It is not enough to say something is a network. According to one model, a network may start out as a
set of scattered, barely connected clusters, then grow interconnections to form a single hub-and-
spoke design, then become more complex and disperse into a multi-hub "small world" network, finally
to grow so extensive, inclusive and sprawling as to become a complex core/periphery network. For a
while, the pressures put on the Al Qaeda network evidently decreased it from a hub-and-spoke back
to a scattered-cluster design. But now it is growing again, apparently into a multi-hub design. Which
design is it? Do the pieces consist of chain, hub (i.e., star), or all-channel subnets? And where are the
bridges and holes that may connect to outside actors? The answers matter, for each design has
different strengths, weaknesses, and implications. Some designs may be vulnerable to leadership
targeting, others not. As research proceeds on how best to disrupt, destabilize, and dismantle
networks, analysts are finding that in some cases it may be best to focus on key nodes and in other
cases on key links, in some cases on middling rather than central nodes or links, and in other cases on
 peripheral nodes or links. But this is tentative. And much less is known about how to analyze the
capacity of networks to recover and reassemble after a disruption, possibly by morphing into a
different design.

analysts and strategists have adopted a basic set of organizational views to work with. But they still
face a lack of knowledge about .... how they may combine and shift among network, franchise,
 hierarchical, and possibly other design elements. Thus, it is advisable not to get fixed on any one
view, but instead to work with "multiple models" whose content and probability may continue to vary.
 It is also advisable to keep looking for additional views that are not yet fully articulated.

David Ronfeldt “Al Qaeda and its affiliates: A global tribe waging segmental warfare?”
\end{quote}

\textsuperscript{21} see the rest of Ronfeldt’s article
If we are to understand networks from a human dimension, then ultimately the most basic unit of analysis, the foundational element, in a theory of human networks is the person, the individual. The paradox is that the individual human is a social being self-constructing within a social context with social tools including language, concepts, groups, structures, and many technologies. Individuals as they are, cannot be without societies as they are, people are the product of their social context. It is the same iterative cycle as when humans shape tools and then tools shape humans. This cyclic integration of individuality, society, and technology is captured in the term Networked Individualism—a term that embraces both figure and ground, being and context. Perhaps the most important role of the Internet and related information, communication, and computing technologies in the structuring of social relationships is through contributions to new patterns of sociability based on individualism.

The proliferation of the Internet is facilitating—and perhaps accelerating—social change that have been developing for decades in the ways that people contact, interact, and obtain resources with each other. It is a shift from tightly-bounded, densely-knit, solidary and often-local groups to more loosely-bounded, sparsely-knit, multiple and often far-flung social networks.


4.12 Networked individualism

Networked individualism harkens a shift from people who are socially and cognitively encapsulated by homogeneous, broadly embracing groups: groups in which individuals principally deal with other individuals within the few groups to which they already belong. In the place-based society, work has tended to be in discrete work groups and within single organizations; life centers on a household and in a neighborhood, people are members of one or two kinship groups. Social participation is in structured, voluntary, hierarchical, organizations—churches, bowling leagues, etc. Group boundaries are often for inclusion. Each interaction is in its place—one group at a time.

In networked societies, boundaries are more permeable, interactions are more fragmented, variegated, and personalized, with a greater variety of other people, linkages switch between multiple networks, and hierarchies are both flatter and more complexly structured. Autonomy, opportunity, and uncertainty predominate.

---

22 See Wellman as well as Castells, the substance of this discussion have been adapted from the work of these authors.
The emergence of networked individualism can be seen in at least three shifts:\(^{23}\):

- From grouped individuals – where individuals have many bonding ties (within a group) and few bridging ties (between groups) – to networked individuals, where individuals have relatively fewer bonding ties and relatively more bridging ties;

- Cultural rhythms – communication environments that blur boundaries between home, community and work. Work and people can be digitally available anywhere and at anytime; and

- Social networking practices – A change from place-to-place networking, to person-to-person networking. From a single front door, mail address and house phone number to multiple email addresses and mobile phones.

Personalized, wireless, portable, and ubiquitous connectivity facilitates the new sociability of networked individualism as a foundation of networked community. Connections are to people rather than to places, linking people anywhere. Communication is everywhere and situated nowhere as the person becomes the portal.

### 4.13 Glocalization and Networked Individualism

Glocal is the combination of Global plus Local. In the concept of glocalization, place, in the form of households, social sites and work units, remains important even if the more traditional sense of neighbourhood or village is less important than before. From local bases people reach out in-person and ethereally to engage with their networks. Social closeness does not mean physical closeness. However, unlike traditional public meetings in community centres or pubs, network relationships can be more selective. Networks tend to contain higher proportions of people who enjoy one another and a lower proportion of people who are forced to interact with each other because they are juxtaposed in the same neighbourhood, kinship group, organization, or workplace.

Glocalized connectivity enables fluid systems to create ramified networks in order to bring material cognitive and influential resources to the local place. Rather than be limited to an identity as a member of a single group, switching among multiple networks, people can use ties to one network to bring resources to another. Knowing how to network has become a measure of human capital, while creating or having a supportive network is a measure of social capital. The shift incurs a potential cost in the loss of a palpably present and visible local group to provide social identity and sense of belonging. Glocalization incurs a potential gain in greater diversity of opportunity and more scope for individual agency and freedom from the constrictive control of a single group.

---

\(^{23}\) Wellman. 2001.
4.14 Place-to-Place and Person-to-Person

The technology of place-to-place communication enabled the dispersal and fragmentation of organizations and community. In contrast, the technology of person-to-person enables the shift to a personalized, wireless world of networked individualism. People remain connected, but as individuals rather than through local bases. Each person individually uses their networks for information, collaboration, orders, support, sociability, and sense of belonging. Employees in networked organizations similarly have multiple and shifting work partners, and partial involvements within dispersed work relations that can often extend globally.

The use of asynchronous communication technologies can provide participants more control over the timing and content of interactions. These methods can facilitate specialized relationships developed from shared interests and also circumvent the possibility of undue interference by differences in social status. Relationships sustained by shared interests rather than similar characteristics can be especially empowering as they permit interaction beyond traditional socio-economic categorizations. Another example, the option to shift from face-to-face to email contact can be a way of achieving more autonomy. In brief, the proliferation of these types of network relations fostering a basis for interest-based structures can provide support, partial solidarity and mechanisms that aggregate and articulate common interests. Thus the Internet serves as a Tocquevillian substitute for traditionally organized community groups.

Weak ties can become a richer source of information, since people more reliant on strong ties are more likely to be socially similar, know the same people and are therefore more likely to possess similar information. New information is more likely to travel via weaker ties because of more connections with more diverse social circles. Owing to the fuzzy nature of network boundaries, individual autonomy and agency are more salient as each person is the responsible operator of their own personal networks.

The point to remember is that networked individualism is a social pattern, and not simply a collection of isolated individuals. It is a social pattern providing individuals with access to multiple networks, enabling each to develop unique "portfolios of sociability" and to differentially invest as they prefer. The low entry barriers and opportunity costs of networks engender extreme flexibility in how individuals express their sociability through various forms of social interaction. The continuing development of the wireless and ubiquitous Internet is likely to accelerate the rise of networked individualism.
5. Network Decisioning – The Emergence of Peer-Production

The recent military literature contains numerous references to concepts such as swarming, common-operating-picture and self-synchronization. While considerable effort has been devoted to understanding, developing and improving the technologies underlying the achievement of a common-operating-picture (COP), much less effort has been made to understand the magic mechanisms of self-synchronization. It could be that the idea of a COP is consistent with traditional approaches of control. Self-synchronization is less amenable to traditional concepts of command and leadership. In fact, the COP and self-synchronization sound very similar to Adam Smith’s ideas of perfect information and the invisible hand of the market. However, the thought of a transformation of traditional command and control to “control through market forces” is not a comforting one to the trained military mind. And yet the acceptance of the necessity of command concepts such ‘common intent’ is recognition of the limits of control as is the concept of self-synchronization. There is an affinity between Manuel de Landa’s understanding of object-oriented programming and self-synchronization, just as there is between self-synchronization and the notion of market principles. But how to best articulate this affinity?

James Surowiecki, in his book “The Wisdom of Crowds”, outlines the conditions that tend to make crowds smarter than the smartest person in the group. Essentially, three conditions are necessary. Members of the ‘crowd’, group or network, must be diverse, they must be independent and they must be decentralized with an additional condition of a capability to aggregate relevant information (similar to price mechanisms).

However, this type of wisdom is not applicable to every problem. Surowiecki defines three types of problems that lend themselves well to the application of crowd and network wisdom. These are problems of ‘cognition’, ‘coordination’ and ‘cooperation’.

Cognition problems are those that have definite solutions such as “Who will win the world cup?” “How long will it take for Health Canada to approve a new drug?” Other problems include questions in which some answers may be better than others, such as “Where is the likely location to find a sunken ship?”

Coordination problems are those that require members of the group to determine how to coordinate their behaviour with each other, when each member is trying to do just that. For example, how do pedestrians align their traffic pattern to let everyone flow?

Cooperation problems involve the challenge of having self-interested, distrustful people work together despite narrow self-interests which dictate that no one should do so.

---

The more profound implications of advancing information and computer-mediated communications technologies concern the transformation of human decisioning, not the least of which will be the challenges to the traditional cultural mythos of leader as heroic decision-maker. It could be argued that the 21st century is the last mile of the market, as market type principles penetrate the organization's 'managerial command system/economy' and morphs into a peer-production model similar to the massive collaborations of the open-source movement. New processes have been trialled using market approaches to determine corporate strategic decisions such as mergers, product innovations and introductions, regional expansions and even new CEOs. The power of new and emerging technologies can only be leveraged with new concepts of group, organization and decisioning. Within the fog and friction of conflict, in a turbulent, rapidly changing world, each action invites reaction, engendering a change in the situation away from initial conditions. Thus no plan survives 'first contact' with the enemy. The power of command intent is that the organization may not be in a position to plan how intent will be fulfilled. The process of parametric adaptation may in itself be unpredictable despite being a sound method of successful implementation. The need to leverage the power of group-forming networks through new decisioning concepts implicit in other concepts such as swarming, self-synchronization, and self-organization require market like approaches.

6. Conclusion

It has been the aim of this paper to make the concept of networks clearer, and in particular to make a case that group forming networks are the key to ultimately enhance military capability. The complexity of networks is underlined by the fact the network science remains in its infancy – despite the rapid growth of a literature and the increasing salience of research devoted to this area. It is also clear that there is considerable knowledge of many types of networks that can provide powerful cross-fertilization for developing a theory of human networks. Interdependent models and metaphors of networks include:

- Physical networks such as technical systems, roads, waterways, electronic;
- Organic networks such as nervous/neuronal, circulatory, lymphatic/hormonal systems, tissue systems and ecologies;
- Social networks such as families, tribes and affinitive lineages; and
- Media networks such as symbol systems, mental maps and information structures.

The concepts offered in this paper include:

- A tentative network typology and topology;
- Group-forming networks, customized response, and heterarchy;
- Contexts and boundaries appropriate for different networks;
- Fundamental organizational metaphors shaping understanding; and
- Networked individualism, glocalization; and peer production.

Other concepts integral to the effective functioning of human group forming networks will have to be elaborated. As the concepts outlined above indicate, a theory of human networks that provides a basis for the full exploitation of human networks within a social, organizational and technological context will require a ‘paradigm shift’. Other concepts that will likely have to be developed for our theory include:

- Transparency – where the ‘need-to-know orientation is displaced by a ‘need-to-share’ orientation, in order to make the information and knowledge accessible for timely knowledge generation and agility;
- Privacy – where anonymity is not the default position used to protect individual rights (and the right to not be unduly interfered with). Rather other mechanisms in keeping with transparency must be developed;
• New accounting regimes and resource management frameworks appropriate for the ‘intangibles’ of human and social capital and the allocation of resources/compensation that in fact enable network capability;

• Trust – how to develop and sustain trust between people and organizations; and

• Boundary – the understanding of how people come to be included and excluded from networks.

Considering the concepts thus far outlined, an alternative definition of Network Enabled Operations is suggested.

Network Enabled Operations leverages Human Capability, collaboration and virtuosity to enable intelligent adaptive improvisation and emergent innovation to achieve successful performance within a range of situations – from unpredictable complex conditions to stable predictable situations.

In summary, this paper has offered a number of important concepts that are key to the development of a theory of human networks that would be useful to the Canadian Forces. Further work now needs to focus on the Human Resource implications that follow from the ideas set forth in this paper and finally to outline a network-enabled and effects-based Human Resource concept. This work will be reported in subsequent papers.
Bibliography


Adams, Micheal. 1997. Sex In The Snow: Canadian Social Values at The End of The Millennium. Viking: Toronto


D Strat HR RN 02-2005 33


Lakoff, George; Johnson, Mark. 2003 *Metaphors We Live By*. University of Chicago Press.


Strategic Defense Review. 1998. UK publication. WWW.MOD.UK/ARCHIVE/SDR


**Transformation in the CF: Concepts Toward a Theory of Human Network-Enabled Operations**

**AUTHORS** (last name, first name, middle initial)
VERDON, John B.

**DATE OF PUBLICATION** (month Year of Publication of document)
July 2005

**DATE OF PUBLICATION** (the category of document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

**SPONSORING ACTIVITY** (the name of the department or laboratory sponsoring the research and development. Include the address)
N/A

**PROJECT OR GRANT NO.** (if appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)
N/A

**DOCUMENT AVAILABILITY** (any limitations on further dissemination of the document, other than those imposed by security classification.)
- (X) Unlimited distribution
  - Distribution limited to defence departments and defence contractors: further distribution only as approved
  - Distribution limited to defence departments and Canadian defence contractors; further distribution only as approved
  - Distribution limited to government departments and agencies; further distribution only as approved
  - Distribution limited to defence departments; further distribution only as approved
  - Other (please specify):
The paper aims to make the concept of networks clearer, and in particular to make a case that group-forming networks are the key to enhancing military capability within network enabled operations. The complexity of networks is underlined by the fact the network science remains in its infancy – despite the rapid growth of a literature and the increasing salience of research devoted to this area. It is also clear that there is considerable knowledge of many types of networks that can provide powerful cross-fertilization for developing a theory of human networks. The concepts integrated within this paper include:

1. A tentative network typology and topology;
2. Group-forming networks, customized response, and heterarchy;
3. Contexts and boundaries appropriate for different networks;
4. Fundamental organizational metaphors shaping understanding; and
5. Networked individualism, glocalization, and peer production.
Canada