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Helen M. Hasan
University of Wollongong, hasan@uow.edu.au

Kate Crawford
katecr@uow.edu.au

Publication Details

This paper was originally published as: Hasan, H & Crawford, K, The application of Go*Team to network-centric characteristics, Simulation Industry Association of Australia Conference (SimTecT 2006) ,Melbourne, 29 May–1 June 2006.

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Keywords
Simulation and gaming, team cooperative behaviour, newtwork-centric configurations

Disciplines
Business | Social and Behavioral Sciences

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This conference paper is available at Research Online: http://ro.uow.edu.au/commpapers/286

The Application of Go*Team to Network-Centric Characteristics

Helen Hasan; Kate Crawford
Information Systems, Faculty of Commerce, University of Wollongong
hasan@uow.edu.au

Abstract. Many organizations are adopting network-centric configurations in which workers leverage information and make operational decisions through the collaborative efforts of small agile and self directed teams. Go*Team is a computerised client-server team version of the ancient Chinese strategy game of Go that has been designed to simulate contexts requiring complex collaborative strategic activity by teams. The system has been developed and is already breaking new ground in the way it provides a medium for research and training in the area of network-centrism. In particular, the capability of Go*Team to simulate a network-centric environment, with appropriate constructs and protocols, can be constructively employed in Go*Team sessions to provide valuable research and learning opportunities. Although it originated through the interests of the military, the socio-technical Go*Team system has broad applications for business, government and community organisations. This paper discusses its potential for applications in practice, training and profiling, and both applied and theoretical research. This system is now at a turning point to bring these to fruition.

1. INTRODUCTION

The flatter forms of modern organisations call for decentralised decision-making; greater tolerance of ambiguity; permeable internal and external boundaries; empowerment of employees; self-organising units, and self-integrating coordination mechanisms [3]. As a consequence, many organisations are adopting a network-centric configuration in which workers leverage information through the collaborative efforts of small and agile self-directed teams [9]. The capability to do this emanates from rapid developments of information and communications technologies (ICT) which are driving and supporting the change from the industrial to the information age. The network-centric environment implies new ways of working, with consequences for the organisation's infrastructure, processes, people and culture. Managing organisational change towards a more network centric form is both difficult and complex. There is a need to better understand both the processes involved and the desirable personal characteristic of the people who can succeed in a network-centric organisation.

As described more fully elsewhere [4], Go*Team is designed to simulate situations in which people and groups coordinate, cooperate and share information, to achieve organisational goals in the anticipated future network-centric environment. Although Go*Team was created for the military, such situations may also exist in other government, business and community settings. This paper concerns ways whereby the playing of Go*Team can be applied in order to gain a better understanding of the collective processes and behaviour of the people in all network-centric configurations. Of particular interest are human or group related factors that may impede or even prevent the successful achievement of network-centric coordination, cooperation and information sharing despite the availability or presence of the technological capability to support it.

This paper emanates from a research and development project sponsored by a military organisation to create a system in the context of a study on network-centric warfare. It begins with a brief overview of some critical characteristic of network-centrism followed by an outline of Go*Team in order to explain how it is intended Go*Team be used to study network-centric characteristics. This is followed by an account of preliminary trials with Go*Team, resulting in an understanding of where, and how, it can be used for both research and practice. This leads to a description for intended purposes and protocols of use. The paper concludes with a discussion of intended areas of application and plans for future work.

2. NETWORK-CENTRISM

2.1 An Overview of Network-Centrism

In some of the early literature the term 'network-centric' only referred to the connectivity achieved thorough technological networks, in particular the Internet and Web enabled applications. However its connotation has expanded as ICT networks and applications are transforming the ways in which people gather, share, and process information and knowledge. This is having an impact in organisations; on their structures, their ways of working, on organisational learning, as well as on the ways people collaborate and form social networks. [9]

Large bureaucratic organisations, and the people who work in them, are facing rapid and substantial changes which require new understandings, skills and capability for the network-centric environment. Many organisations are now hybrids of a traditional hierarchy, with a limited command and control structure, allowing the emergence of self-directed groups in a network-

centric configuration. The domain of network-centrism now encompasses the organisational, social and cultural, as well as the technical, aspects of working in these changing, hybrid environments.

Where organisations are adopting network-centric practices within a hierarchical bureaucracy, they face the challenge of imposing culture change much more rapidly than it would normally occur. Managers are having to relinquish some of their traditional control to small self directed teams while workers must increase their situational awareness in order to take on more decision-making responsibilities within a small less formal group setting. This is a considerable change from the way they would have operated in the past and often of there is little training or even understanding of the skills and capability needed. Traditional business competition must be tempered with a more cooperative culture both within the organisation and across organisational boundaries. Ephemeral attributes such as sharing, trust and collective development are now valued along-side more tradition work skills. Through-out this unsettling state of constant change, the complexity of the workplace continues to increase to a level where rational scientific management practices are no longer appropriate and other more organic approaches may be more appropriate [8]. This is justification for the adoption of alternative more flexible management techniques which include the use of gaming systems such as Go*Team.

2.2 Characteristics of Network Centrism

The network-centric processes that lend themselves to enhancement through the use of Go*Team include team-building, local intelligence, multi-modal information sharing, autonomous decision-making and learning to operate flexibly in stressful environments of uncertainty, diversity and risk. Many of the individual and collective characteristics that epitomise and sustain this balance are revealed in the work of Warne et al [10]. These include:

- Empowerment of workers
- Trust and mutual respect
- Forgiveness of mistakes when risk-taking
- Cultural cohesiveness
- Mutual commitment
- Openness of decision-making
- Culture of information sharing

The research and development group responsible for the creation of Go*Team, considered the following issues in designing for its use as a simulation of the network-centric environment:

- Self-directed teams
- Situational Awareness
- Distributed leadership and power
- Conflict, Cooperation and Competition
- Shared Understanding in communication
- Trust, Collaboration and Information Sharing
- Performing under stress
- An uncertain and unpredictable environment
- Local strategic decision-making
- Tempo in Decision-Making
- The role of ICT

The group was also aware that such characteristics can not be understood or developed in isolation but that an integrated, balanced approach is more appropriate. In this context, the concept of co-opetition has received some attention of late in the work of Angehrn, & Loebbecke [1]. These authors describe the "inherent balancing act between cooperation and competition" as one which requires designing and implementing specific management practices. In describing his revolutionary plans for the Australian Taxation Office, Hind [5] used the Chinese concepts of yin and yang to explain how holistically sustainable and dynamic working communities involve a balance between collaboration and competition. Go*Team creates an environment where these characteristics can be studies in a dynamic integrated fashion.

3. GO*TEAM

3.1 An Overview of Go*Team

Go*Team is a computerised client-server team version of the ancient Chinese strategy game of Go[1]. The project to develop Go*Team has taken over a year from its original inception to its current state where the software application is operational and several trial games have been played. There are a variety of stakeholders involved in the project. The proposal came from a researcher who originally conceived of the idea and was given leave for much of the development time to work with others on the project. These included software and interface developers, other researchers and the sponsors of the project from the military.

Traditionally, Go is played with black and white stones on a 9x9 to 19x19 grid where individual players take turns to place their stones,. Unlike standard Go, teams playing Go*Team no longer have to take turns; a team's next turn can be taken after a "relaxation time", specified via the server, regardless of whether or not the opposing team has done anything in the interim. There is also no preset command structure built into the Go*Team game. As far as the game software is concerned all team members are peers; with no predetermined roles and there is no "team leader" with more power or capabilities than other team members. The client screens for each player show only a partial view of the board so that there is a need for team

[1] See Hart et al paper in this volume

members to communication their view of the board to others as well as to discuss strategies. Players on the same team make use of modern communication tools such as email, voice over IP, chat rooms and the like, to effect the cooperation and coordination they need to successfully play the game.

The Go*Team game has, therefore, been created to place its players in an environment exhibiting a number of the features outlined above in order to explore how they function in that environment, the techniques they prefer to use, the techniques that are more successful, and the barriers that may inhibit them from operating as effectively as they otherwise might.

There are a considerable number of variables and factors that can be determined, set and/or measured when playing Go*Team. These must be viewed in terms of network-centric attributes so that the playing of the game reflects those attributes. The challenge is to align the Go*Team conditions, factors and variables with those of network-centrism. For the purpose of research the course of the game must be recorded and the results analysed and interpreted.

These issues will be addressed in then following sections of the paper however some Go*team variable are mentioned here. The size of the board can be set from 9x9 to 19x19. The number of players on each team can be varied, as can the composition of each team from a group of heterogeneous players to a completely homogeneous one. Players can be grouped by personality, previous experience with Go, age, previous team experience and so on. The composition of Teams can thus be varied considerable as can the pre game training of individuals and teams. the relaxation time can be varied at any time during the game. This may for example increase stress levels if shortened or boredom if lengthened. Team members can be allocated different numbers of stones each making up the standard issue to each team. The mode of communication between team members can also be varied from verbal, to online chat, to video.

3.2 Experiences of playing Go*Team to date

The Go*Team client-server software is now developed to a stage of readiness for practical application. Technically the system is robust and functional. Trials have been made of small teams playing Go*Team, initially using the development team and researchers as players and, subsequently, with university students. These trials have involved small teams of 2 to 4 with team communications predominantly via Chat sessions although 2 involved one team where members could communicate orally. The initial Go*team game sessions, played with the developers and researchers taking part, provided hands on experience to inform the researchers through post-game debriefing and planning sessions. The sessions with students were recorded using a facility to capture, as video, the server screen and all oral and Chat communication (see Figure 1).

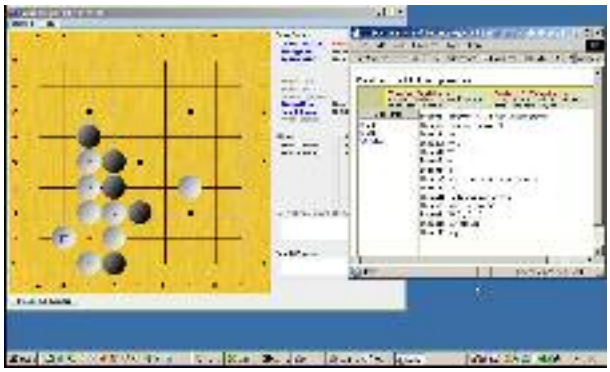

Figure 1: A still of the server screen captured showing the whole board and the Chat of the Black team during a game with students. The audio communication of the white team is also on the video recording.

As will be described in the following section of the paper protocols for running Go*Team sessions are being designed and tested based on feedback from the preliminary trials. These include possible game objectives, appropriate settings of systems parameters, such as timing, team composition and communications media to emulate actors in a network-centric environment. This is being done in conjunction with the identification and standardization of constructs to measure suitable attributes of the players as individuals and as teams aligned with network-centric characteristics.

4. ALIGNING ELEMENTS OF NETWORK-CENTRISM WITH GO*TEAM PARAMETERS

As will be elaborated in the following sections of the paper it is intended that Go*Team be used both for research into network-centrism and for practical training and profiling people working in a network-centric environment. For the research applications in particular, the group of developers and researchers are working to identify and prioritise objectives to give purpose to Go*Team sessions. However all Go*team applications, research and practice, require more quantitative and qualitative data collection and analysis than has been done to date. This has required identification of those network-centric elements that can be represented when playing Go*Team and then how they can be represented, then measured or otherwise evaluated.

4.1 Network-Centric Elements and Go*Team Parameters

The general characteristics of network-centrism of relevance to Go*Team simulations are listed in section 2.2 of this paper. From the brainstorming sessions of the research and development group, the elements listed

below have been adopt as the specific set network-centric elements to be investigated with Go*Team:

Possible issues to study as dependent variables:

- Emergent Leadership
- Communication Quality
- Cooperative behaviour
- Competitive Behaviour
- Situation awareness
- Information Sharing
- Effects of ICT used
- Group dynamics
- Trust
- Effective Decision-Making

Possible Independent variables are

- Stress
- Uncertainty of information
- Training
- Tempo
- Team structure and organisation
- Diversity
- Communication Mode

When running Go*Team simulation sessions it is possible to set the values, both quantitative and qualitative, of the following independent variables:

- Time of game
- Size of the board.
- Relaxation Time: Game or team based
- Size of team
- Composition of Team
- Characteristics of Individuals
- Motivation: individual and team
- Means of communication
- Previous experience with Go*Team
- Go*Team Training

Dependent variables include:

- Number of stones captured
- Learning
- Changes in individual behaviour
- Changes in group behaviour

The challenge is now to develop an alignment of network-centric elements with the independent and dependent variable in Go*Team. This is a complex issue, particularly where the variables are not inherently quantitative, where a combination of Go*Team variables may be involved in a given network-centric element or where the alignment needs further investigation.

4.2 Alignment, measurement and calibration

Although a full exposition of the alignment of network-centric elements with Go*Team session parameters is beyond the limits of this paper, an outline of is presented here with examples. These come from an inspection of the lists in the previous section of the paper.

Firstly, there are some obvious alignments between network-centric concepts and Go*Team variables such as training behaviour and team composition Other alignments can be implied, such as Go*Team timing can be used to induce tempo and stress, and stones captured can be an indication of effective decision-making. The latter are convenient quantitative measured but need calibration through the results of a number of Go*team sessions. Other constructs are inherently qualitative and need to be determined through perceptions and interpretation.

Collecting of qualitative data is done in two ways. One is through a comparison of pre and post session questionnaires, interviews and focus groups. This would be suitable for factors such as learning, co-opertition, trust and perceptions of team dynamics. It is also possible to collect perceptions from participants during the game. This is particularly useful for the issue of situation awareness. However this type of data collection is only in trial form as it is important that it not distract the players while the game is in progress.

4.3 Protocols for Go*Team simulation sessions

Lessons learnt from the observation and analysis of sessions with Go*Team have shown that the system provides a holistic and realistic experience in situations related to both research and practice, as will be described more fully in sections 5 and 6. There is a wide range of issues that can be incorporated into the objectives of a Go*team session. However to begin a series of session a more focused purpose must be determined. This can range from a practical purpose, such as training for team cooperation, to theoretical research into specific areas of network-centrism such as the influence of communication medium on group trust in heterogeneous teams.

Once the purpose of the session is determined, the sessions themselves can be planned and conducted to collect the required data. As shown in Figure 1, sessions can be recorded with video screen capture software which is able to capture the server screen, and chat sessions. This can be supplemented with microphones where there are more than one set of verbal communications.

However there is much more to a Go*Team session than the playing of the game. In planning a session consideration must be given to the independent variables listed in section 4.1, particularly the composition of the teams, the modes of communication,

the size of the board and the time settings. Pre-session briefing of participants can involve different sets of instructions, training and data collection. Post-session de-briefing sessions are also vital to providing much of the critical data on perceptions of group dynamics, behaviours and learning.

5. PRACTICAL APPLICATIONS OF GO*TEAM

5.1 Overview of Practical Applications

The researchers are confident about the prospects of using it to study a variety of issues related to the strategic decision-making behaviour of teams, in particular:

It is evident from exercises to date that, in addition to its use for research, Go*Team can be used for raising awareness, training and profiling. The system is designed to provide experiences in which people confront the notion that each member of the team has a different awareness of any situation and explore the strategic benefits of collaborating to use all the insight and information available and also the risks of non-collaboration and 'going it alone'. The game environment makes a shift to this fundamental network-centric orientation clearly beneficial and provides an opportunity for players, while embedded in a fun environment, to explore new strategic strategies associated with working in teams.. The game can also be used to identify people with, and train them to further develop, those attributes that will enable them to perform effectively in the network-centric environment. Go*Team has the capability to be used for training in strategic team-based decision making under various forms of stress, including time pressures and conditions where information is distributed among disparate team members. Through observation and measurement of individual performance in Go*Team sessions, it also has a potential use in profiling an individual's capacity to work as a team-player in a network-centric configuration.

5.2 Training

It is apparent that playing the game is a useful exercise in strategic team activities and decision making, balancing competition with cooperation, and, through competition, introducing stress which can be increased through changes to the timing. It is also clear that teams benefit from developing a strategy both to share information and to coordinate making sensible moves as soon as time allows. Thus playing Go*Team, followed by a facilitated de-briefing session, would be effective general training for the network-centric environment of working in self-directed teams under stress.

5.3 Profiling

Profiling of individual participants as well as the evaluations of the training outcomes could be achieved through measurements of success in a Go*Team game at both individual and team levels. This could be supplemented by cognitive assessments through coding of the communications between team members during the game. The content analysis software tool Leximancer could aid the coding process.

Structuring the de-briefing sessions following a game of Go*Team could enable assessment of the creativity, adaptability and cooperative nature of participants to determine their alignment with the culture of a network-centric environment. This would be a useful process for individual profiling.

Debriefing sessions for reflection on what took place during a game have been found to be an active learning process. It is suggested that some effort be made to design these post game sessions to identify and re-enforce the lessons from the game. This process could ideally be extended by scenario building sessions about the applications of the learning experiences in the field.

6. RESEARCH APPLICATIONS OF GO*TEAM

6.1 Applied Research

As indicated by the list of possible dependent variables in section 4.1, there are many research issues that could be studied with Go*Team. The research and development group have determined to begin with the following objectives as they are of particular interest to the project sponsors, the military.

- Team dynamics, conflict (with the other team or teams involved in the game), cooperation and coordination, but also competition (with and between the players in one's own team);
- Situational Awareness and information sharing (through the need to continually share information in order to synthesize and integrate, in a dynamic situation, multiple fragmentary and local perspectives into an overall situational picture);
- Communication and Trust (face to face and online, within and between groups)
- Timely and appropriate decision making (through the need to balance the time taken for adequate situational analysis and the pressure to avoid being overtaken by events).

It has been decided that the objective of next set of Go*team sessions to be conducted for the military will focus on issues of situational awareness. A facility is being incorporated into the software to prompt players, at regular intervals during a game, to record their perception of how well they understand their current situation. This data will be plotted for all players

against other variables measured The topic will also be a topic in the session de-briefing.

6.2 Theoretical Research

Network-centrism is as yet in an early stage as a concept and cannot yet be considered as a theory. This research therefore relies on other theoretical traditions for its foundation, in particular elements of socio-technical systems and complexity theory. The relevance of these theories is readily apparent from recent literature. Coakes [2] describes the goal of socio-technical design as to produce systems capable of self-modification, of adapting to change and of making the most of the creative capacity of the individual for the benefit of the organisation. Snowden [8] states that in complex situations it is not possible to predict or determine outcomes in advance, and cause and effect is only seen in hindsight. He describes how meaningful patterns of behaviour emerge that can be encouraged, but not mandated or controlled. According to Snowden, attractors and barriers can be used to enhance the likelihood of desirable outcomes, and indeed innovation and organisational learning.

Taking a socio-technical systemic view of Go*Team quickly reveals the complexity both of the system itself and the context of its use. There are many technical and human components involved with multiple relationships between them. From the theoretical perspective there is uncertainty among the developers, sponsors and the researchers as to the purpose of the system. The latter see Go*Team as a tool for research into aspects of network-centric organisations. They are in the process of designing protocols for conducting research with Go*Team, identifying constructs as dependent and independent variables as well as measures for them. The others stakeholders are less clear on this. The view of the system from its originator and principle developer of the project is that Go*Team is designed to "embed its players in an environment that involves conflict (with the other team or teams involved in the game), cooperation and coordination, but also competition (with and between the players in one's own team), uncertainty, complexity and information sharing (through the need to continually synthesize, in a dynamic situation, multiple fragmentary and local perspectives into an overall situational picture), timely and appropriate decision making (through the need to balance the time taken for adequate situational analysis and the pressure to avoid being overtaken by events)" [4]. The question now arises as to what outcomes can be achieved when this is done and for whom.

The research currently being conducted with Go*Team aims to add to our understanding of network-centrism relying on concepts from the theories of socio-technical systems and complexity.

7. DISCUSSION AND CONCLUSION

The particular aspect of the long-term study of network-centrism that led to the system described here is the investigation of how people and groups coordinate, cooperate and share information, especially in a military network-centric environment. Of particular interest are human or group related factors that may impede or even prevent the successful achievement of such coordination, cooperation and information sharing despite the availability or presence of the technological capability to support it [4].

Go*Team is already breaking new ground in the way it provides a medium for research and training in the area of network-centrism. Although it originated through the interests of the military it will have broad applications for business, government and community organisations. Its potential for applications in practice, training and profiling, and both applied and theoretical research have been demonstrated. Go*Team is now at a turning point to bring these to fruition.

This paper has outlined the capability of Go*Team to simulate a network-centric environment and provided detail of the constructs and protocols that can be constructively employed in Go*Team sessions. The paper has also given examples of the broad spectrum of application areas for which the system is now being used and how significant these may be.

REFERENCES

1. Angehrn, A.A. and C. Loebbecke (2003) "Open Source Communities Reflecting Co-opetitive Learning and Knowledge Exchange Networks", *Proceedings of DSS 2004*, Prato, Italy

2. Coakes E (2002) "Knowledge Management: A Sociotechnical Perspective", in E. Coakes, D Willis and S. Clarke eds, *Knowledge Management in the SocioTechnical World*, Springer- Verlag London, 4-14.

3. Daft, R. L. and A. Y. Lewin. (1993). "Where are the theories for the "new" organizational forms? An editorial essay." *Organization Science* 4(i-vi)

4. Hart D., Eronen M., Jagiello J., and Warne L. (2005) "Go*Team: A Team Version of Go for Investigating Cooperation, Coordination and Information Sharing in Network-Centric Warfare Environments", *Proceedings of SimTect2006*, Melbourne

5. Hasan H. and Crawford. K (2003) "Socio-Technical Systems for Knowledge Mobilisation in Communities", Proceedings of *ACIS2003*, Perth

6. Hind, Philip (2005) *Keynote address at the ActKM Conference*, Canberra October 2005

7. Huysman M. and Wolf V. (2004) *Social Capital and Information Technology*, MIT Press, Cambridge MA

8. Snowden D. (2002) "Complex acts of knowing: paradox and descriptive self-awareness", *Journal of Knowledge Management*, 6/2 100-111.

9. Warne L. Ali I. and Hasan H. (2005) "The Network Centric Environment viewed through the Lens of Activity Theory", in G. Whymark and H. Hasan (eds) *Activity as the Focus of Information Systems Research*, Knowledge Creation Press, UCQ, 117-140.

10. Warne L. Ali I. Linger H. Pascoe. (2003) "Socio-technical Foundations for Knowledge Management", in eds H. Hasan & M. Handzic, Australian Studies in Knowledge Management, UoW Press, 277-321.