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"Adding Culture to Command Decisions"

Modeling and Simulation, Cognitive and Social Issues, Multinational Endeavors

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Adding Culture to Command Decisions

Abstract

It is well understood that local culture can drastically affect the types of responses to various military actions in foreign countries. However, attempting to predict culturally-influenced reactions is extremely difficult or narrow in scope (based off specific previous experiences). This work proposes a dynamic game-theoretic framework with culturally-defined probabilistic payoff matrices to predict inter-cultural threat responses.

It will be shown that initial payoff matrices can be constructed from the World Values Survey (WVS) data. WVS provides standardized data collected from some 80 countries over the 6 occupied continents. Specific political action questions in the WVS are used to create culturally-specific probabilistic response tendencies for non-force, non-lethal force, or lethal force responses. These responses are combined to provide the initial game-theoretic payoff matrices which are then used in simulations. The results of various dynamic cultural interactions are discussed in relation to potential command decisions based on the potential for indicated types of responses.

Keywords: culture, game theory, payoff matrix, dynamic gaming, probabilistic approach, psychological warfare

Introduction

Recent military engagements have highlighted the need for maintaining a good rapport with local non-combatants. Maintaining cultural awareness in some instances can mean the difference between life and death for both soldiers as well as civilians. While work has been done on maintaining positive interactions between differing cultures (VCom3D 2008, Christian 2007), predicting outcomes of multi-cultural interactions has received little attention outside of Red Teaming (TRADOC 2005).

Game theory is often used for analyzing situations with multiple participants, such as in analysis of power markets (Singh 1999, Ferrero, Shahidehpour, and Ramesh 1997) or wireless networking (Srivastava, et al. 2005). Game theoretic concepts are used here to form a probabilistic-based framework to calculate threat responses from multi-cultural interactions. As a baseline, initial probabilistic parameters are obtained from components of the World Value Survey (WVS) data. WVS data provides culturally-specific data from multiple countries. However, the framework is intended to be applied to any size groups (not necessarily country) if appropriate cultural response information is available.

The goal for this work is a characterization of the likelihood of non-violent, violent, or lethal responses to an action. A great deal of interest has been expressed for this capability by the Department of Defense for use in crowd control and psychological operations. Being able to have some prediction of operation effects provides crucial decision support to the warfighter. The framework will be helpful for answering

questions such as "If a violent action is performed by group A on group B, will group B respond with a retaliatory violent (or even lethal) action?" There is no specific scenario to limit or define the types of group interaction other than the classification of response to the actions shown in Table 1**.**

Table 1. Classification of possible threat response actions.

Label	Threat Response
NA	Non-violent Action
VA	Violent (non-lethal) Action
LA	Lethal Action

Game Theory

Game theory is a formalism for interactions, stemming from the field of applied mathematics. Game theory's roots are in the context of economics and monetary payoffs, but game theory holds broad application potential. Aspects of game theory even translate into popular culture such as film (the classic 1983 "WarGames" or more modern 2001 "A Beautiful Mind") and television (the game show "Friend or Foe?" is a variant of the classic Prisoner's Dilemma game theoretic problem (Poundstone 1992)).

Simultaneous and Sequential Games

Various game configurations exist within game theory, corresponding to the types of scenarios the game is meant to reproduce. If a game's players make moves at the same time without knowledge of the other players' moves, the game is said to be simultaneous. If moves alternate among players (with each player taking a turn) the game is said to be sequential.

For examining multi-cultural reactions, a simultaneous game does not make much sense. The actions of interest do not occur simultaneously, but are in response to some initiating (or potentially retaliatory) action which has already occurred. The iterative responses to non-violent, violent, and lethal actions lend themselves to a sequential game representation.

Game Representation

There are two typical representations of games, corresponding to the two types of games mentioned above. Simultaneous games are typically represented by a payoff matrix for a normal, or strategic, form game as shown in Figure 1. In this example, Player 1 calls heads or tails while Player 2 flips an unbiased coin. If Player 1 calls the coin correctly, there is a payoff. If Player 1's call does not match the landed coin face, Player 2 gets a payoff. While the idea is to call the flip correctly, Player 1 has little more than random

chance to guess if the coin will land with heads or tails facing up. Note that if this was not a simultaneous game, Player 1 would have a much better opportunity to obtain a high payoff (if the coin lands before heads or tails is called). Likewise, if Player 2 was an experienced coin flipper (assuming Player 2 could determine how the coin would land), a simultaneous game could also benefit Player 2 if Player 1 was forced to make the call before the flip.

Player 1	Player 2	
	Flips Heads	Flips Tails
Calls Heads	1,-1	-1,1
Calls Tails	-1,1	1,-1

Figure 1. Sample payoff matrix for two players; one flipping a coin with one calling heads/tails.

Sequential games are represented in extensive form, as shown in Figure 2. The characteristic tree structure shows the iterative selection process where each player has an opportunity to make their selection in turn. Figure 2 shows sequential selections by Player 1 and then Player 2 of a non-violent action (NA), violent action (VA), or lethal action (LA). Following the sequence of moves are the payoff values for the players illustrated as (a,b) and (c,d) in Figure 2.

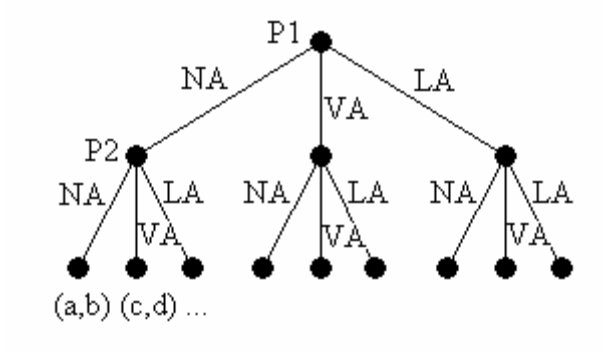

Figure 2. Sample sequential game shown in extensive form with payoffs (a,b) (c,d) … for (Player 1, Player 2).

Zero-Sum Games and Payoff

A zero-sum game is a game in which the gain of one player is done so at the expense of the other. Figure 1 illustrates such a game as the payoff for each possible outcome sums to zero (meaning for Player 1 to gain, Player 2 must lose). This type of game can represent situations with a finite resource that is distributed among the players based on their play (such as a game of poker where each player is allowed one buy-in). In actuality, the casinos operate non-zero-sum games. In a non-zero-sum game, the net payoff is not necessarily equal to zero. For example, with respect to a table of poker players, each hand will result in a net loss of money when the house takes their cut. In this way, what one player loses is not what the other player wins (as there is a small

amount retained by the house). To identify if the cultural interaction can be represented as a zero-sum game the payoff must first be determined.

Achieving a payoff for non-violent, violent, or lethal action is non-trivial. There is generally no monetary benefit from a multi-cultural confrontation so the typical gain/loss for payoffs must correspond to something other than money. The loss of life would be an important metric. However, life is only lost through the lethal action (LA) response. Weighting a payoff based on a loss of life would yield an ambiguous payoff in that non-violent and violent payoffs would be identical (no loss of life). Incorporating a measure of violence would also be ambiguous or unfairly weight the payoff, introducing philosophical questions such as "How much violence or damage is equivalent to (or should be weighted the same as) one human life?"

To eliminate the confusion with payoff, the culture-aware response framework is constructed with payoffs corresponding to the probability of each response. This is essentially a Bayesian network built in the game theoretic domain. The probabilistic-based payoff is independent of the ambiguous quantifying problems of lethality or death and provides an easy method to determine the likelihood of obtaining a specific response in the face of a multi-cultural confrontation.

World Values Survey

Originally constructed as the European Values Survey (EVS) group in 1981, World Values Survey (WVS) provides standardized data collected from some 80 countries over the 6 occupied continents using local researchers native to the studied areas (WVS 2008). The WVS is a world-wide investigative work into the social, cultural, political, and religious underpinnings of these countries obtained through one-on-one questionnaires exploring hundreds of related aspects. Throughout WVS's existence, four waves of questionnaires were administered, providing opportunities for historical analysis in addition to cross-cultural analyses.

Although it does not appear WVS data has been analyzed with respect to violence or lethality, certain data might be used to provide a baseline for the desired probabilistic-based action responses. It is important to note this usage is only meant as a baseline and method for easily obtaining initial action-response probabilities. There is no direct analysis on the correlation of WVS data to the propensity of the action responses, nor claim thereto. However, without additional subject-matter experts providing analysis or operatives providing experience and insight from within the organizations of interest, the preliminary WVS data will provide a method to concisely provide country-wide culturally specific analysis across identical measures. Specific WVS question usage and calculations are provided in the following section.

Culture-Aware Response Framework

The Culture-Aware Response (CAR) framework facilitates the analysis of multi-cultural interactions through the probabilistic-based game theoretic methods outlined above. More

generally, the CAR framework is designed to handle group interactions of two groups where each group's action responses are classified to the probabilistic occurrence of non-violent, violent, and lethal action responses. For the discussion here, the groups of interest are representations from two arbitrary countries with corresponding WVS data. These requirements will provide a method for quickly obtaining the required probabilistic "payoff matrix" associated with countries to be used in the action analysis. For additional versatility, the probabilities would be continually adjusted based on intelligence in the field for the cultural entities involved. In this way, the modeling would be dynamic, incorporating the most up-to-date data. Additionally, external modeling factors could be brought in such as the sectarian response tendencies noted in Garner (2008).

The CAR framework is built upon individual threat-response action matrices as shown in Figure 3 and Figure 4. These sample matrices are assigned arbitrary data for the purposes of understanding the framework. Player 1 (Figure 3) shows a group which is likely to respond with at least as much force as was initially dealt. Player 2 (Figure 4) shows a group which is largely non-violent.

Player 1	Retaliatory Force		
Initiating Force	NA	VA	LA
NA	85%	13%	2%
VA	20%	75%	5%
LA	5%	10%	85%

Figure 3. Payoff matrix indicating probabilities of action responses for a "Player 1" group which mostly responds in kind to initiating action.

Player 2	Retaliatory Force		
Initiating Force	NA	VA	LA
NA	94%	5%	1%
VA	75%	22%	3%
LA	45%	47%	8%

Figure 4. Payoff matrix indicating probabilities of action responses for a "Player 2" group which is largely non-violent.

Formulating these players into an extensive form game provides visualization of the potential outcomes. It is natural to assume upon first beginning the game no action has transpired. (However, if prior action has transpired, the probabilistic payoffs can be adjusted accordingly.) With no prior action, the initial probabilistic payoff is associated with non-violent action probabilities. As either player could initiate the actions, the game is shown as two potential plays, one for each initiator with one subsequent response from the opposite player. These two game moves are shown in extensive form through the tree-like spreadsheet as Figure 5 and Figure 6, as opposed to the more natural tree structure of Figure 2.

P1		P2		Overall
NA	85.0%	NA	94.0%	79.9%
		VA	5.0%	4.3%
		LA	1.0%	0.9%
VA	13.0%	NA	75.0%	9.8%
		VA	22.0%	2.9%
		LA	3.0%	0.4%
LA	2.0%	NA	45.0%	0.9%
		VA	47.0%	0.9%
		LA	8.0%	0.2%

P2	Overall
NA	90.6%
VA	8.1%
LA	1.4%

Figure 5. Two-move game with two players (Player 1 makes the initiating move) with probabilistic payoffs of each response action. Probability of overall response is shown at the right as a summation of Player 2's individual action responses.

P2		P1		Overall
NA	94.0%	NA	85.0%	79.9%
		VA	13.0%	12.2%
		LA	2.0%	1.9%
VA	5.0%	NA	20.0%	1.0%
		VA	75.0%	3.8%
		LA	5.0%	0.3%
LA	1.0%	NA	5.0%	0.1%
		VA	10.0%	0.1%
		LA	85.0%	0.9%

P1	Overall
NA	81.0%
VA	16.1%
LA	3.0%

Figure 6. Two-move game with two players (Player 2 makes the initiating move) with probabilistic payoffs of each response action. Probability of overall response is shown at the right as a summation of Player 1's individual action responses.

Figure 5 and Figure 6 show that the initiator of the initial action is pivotal in determining the likelihood of a violent or lethal response. Likewise, if the initiating action is known, additional insight can be gained. For example, if Player 1 senses some type of confrontation is eminent, he may choose to initiate a non-violent action knowing that the probability of lethal action resulting is less than if Player 2 was allowed to initiate the action.

Clearly, many conflicts would not consist of a single pair of an initiating action followed by one response. The CAR framework can handle multiple moves by incorporating potential payoff matrix manipulation between moves. Manipulating the probabilistic payoff matrix reflects a shift in the player's beliefs or attitudes. Incorporating experts' external analyses, a player may substantially shift action response types in response to various actions. For example, a player subjected to frequent violent actions might be increasingly likely to resort to lethal responsive action. Alternatively, targeted lethal action against the leaders of the opposing group might diminish their tendencies to retaliate with subsequent lethal action.

Incorporating these complex contingencies into a single model is intractable. However, incorporating a mechanism to allow expert input is as simple as allowing for alteration of the payoff matrices from Figure 3 and Figure 4. Adjusting the matrices during multiple moves allows for a more representative analysis dynamically through outside analysis and expertise.

Utilizing WVS Data

As mentioned previously, there has not been any correlative analysis with regard to WVS data and violence. However, certain questions will be used to provide an initial set point to form a baseline payoff matrix. Each WVS wave had slightly different question sets. The questions used here are referenced from the question set used in the 2000 wave (WVS 2008). The WVS questions used for calculations include the following:

> "I'm going to read out some different forms of political action that people can take, and I'd like you to tell me, for each one, whether you have actually done any of these things, whether you might do it, or would never, under any circumstances, do it.

V134	Signing a petition	Have Done	Might Do	Never Do
V135	Joining in Boycotts	Have Done	Might Do	Never Do
V136	Attending lawful demonstrations	Have Done	Might Do	Never Do
V137	Joining unofficial strikes	Have Done	Might Do	Never Do
V138	Occupying buildings or factories	Have Done	Might Do	Never Do

V140 On this card are three basic kinds of attitudes concerning the society we live in. Please choose the one which best describes your own opinion.
(1) The entire way our society is organized must be radically changed by revolutionary action
(2) Our society must be gradually improved by reforms
(3) Our present society must be valiantly defended against all subversive forces

V126 Of course, we all hope that there will not be another war, but if it were to come to that, would you be willing to fight for your country? (1) YES (2) NO

The payoff matrix will be constructed iteratively beginning with action responses to NA. The payoff matrix is expected to take the form similar to a diagonal matrix in that the most often seen response is similar to the initiating action (as in "an eye for an eye" mentality). The baseline probabilistic LA response is calculated with Equation 1.

$$LA = 25\% \times \frac{\sum_{V140} answer \subset \{(1),(3)\} + \sum_{V126} answer = YES}{\sum_{V140} answer \neq \{\} + \sum_{V126} answer \neq \{\}}$$

Equation 1

Equation 1 calculates the LA tendencies to NA actions through a weighted average over the responses to the lethal-related questions V140 and V126. Those respondents willing to fight for their country and those selecting answers (1) or (3) for V140 (which promote violent and lethal action) are averaged over all (non null) responses and weighted to reflect the fact that this LA action is in response to a nonviolent action.

The baseline probabilistic VA response is calculated with Equation 2. This calculation computes the baseline probability for a violent action response using the WVS answers to V134 – V138. VA computes the average of all responses with all "Have Done" answers counting as 1, "Might Do" answers counting as ½, and "Never Do" answers as 0. As with the LA response, the resulting VA average is weighted to reflect that the response is to a nonviolent initiating action. With LA and VA calculated, NA is the remainder or $NA = 100\% - VA - LA$, presented as for completeness.

$$VA = 50\% \times \frac{\sum_{V134}^{V138} answer = HaveDone + \frac{1}{2}\sum_{V134}^{V138} answer = MightDo}{\sum_{V134}^{V138} answer \neq \{\}}$$

Equation 2

$$NA = 100\% - VA - LA$$

Equation 3

With the first row of the probabilistic response matrix complete, the second row is calculated; the responses to violent initiating actions. These calculations rely on the previously computed NA threat responses, adjusting the weights to reflect the increasingly violent initiating response. The VA threat responses are calculated with the following equations with LA_{NA} denoting the lethal action response to a nonviolent action (as calculated in Equation 1).

$$LA_{VA} = LA_{NA} + LA_{NA}\% \times VA_{NA}$$

$$VA_{VA} = VA_{NA} + VA_{NA}\% \times NA_{NA}$$

$$NA_{VA} = 100\% - LA_{VA} + VA_{VA}$$

Equation 4

Equation 4 shifts the weight of each of the LA and VA responses proportionate to the existing response and lesser response of the NV response actions. Conceptually, this predicts that additional participants of the group will respond in kind to the increasingly violent initiating actions in roughly the same proportions. The calculations of the LA responses are similar, as shown in Equation 5.

$$LA_{LA} = LA_{VA} + VA_{VA}\% \times NA_{NA}$$

$$VA_{LA} = VA_{VA} + VA_{VA}\% \times NA_{VA}$$

$$NA_{LA} = 100\% - LA_{LA} + VA_{LA}$$

Equation 5

Again, the response calculations for LA actions parallel existing weighting calculations with the LA response more heavily favored. Notice that the calculations for NA_{VA} and NA_{LA} require that $LA_{VA} + VA_{VA}$ and $LA_{LA} + VA_{LA}$ sum to less than 100% for Equation 4 and Equation 5 respectively. Equation 4 prevents $LA_{VA} + VA_{VA} > 100\%$ through the weighting mechanism. However, $LA_{LA} + VA_{LA}$ does not have the same bounds, allowing $LA_{LA} + VA_{LA} > 100\%$ in some instances. If $LA_{LA} + VA_{LA} > 100\%$ would be calculated through Equation 5, those calculations are replaced with Equation 6. Calculations in Equation 6 give full weight to the LA response to LA actions and limit the VA response to the remainder to maintain a probabilistic sum equivalent to 100%.

$$LA_{LA} = LA_{VA} + VA_{VA}\% \times NA_{NA}$$

$$VA_{LA} = 100\% - LA_{LA}$$

$$NA_{LA} = 0$$

Equation 6

Summarizing the previous equations, each country's payoff matrix can be calculated from the WVS data as shown in Figure 7. This payoff matrix provides a baseline aggregate for generalized cultural interactions of various countries based on the average responses from specific WVS questions.

	NA	VA	LA
NA	Equation 3	Equation 2	Equation 1
VA	Equation 4		
LA	Equation 5/Equation 6		

Figure 7. Payoff matrix calculations from WVS data.

A summary of WVS answer data is provided in Figure 8 for responses from the USA, Canada, and Mexico. These responses are used to calculate payoff matrices for each respective country, shown as Figure 9.

	USA		Canada		Mexico	
	Average	St Dev	Average	St Dev	Average	St Dev
V140	0.25	0.43	0.25	0.43	0.39	0.49
V126	0.71	0.45	0.66	0.47	0.75	0.44
V134	0.89	0.24	0.83	0.31	0.39	0.37
V135	0.51	0.35	0.4	0.37	0.12	0.24
V136	0.48	0.34	0.4	0.37	0.1	0.25
V137	0.25	0.3	0.21	0.31	0.09	0.22
V138	0.16	0.28	0.12	0.24	0.06	0.19
Size	1200		1931		1535	

Figure 8. WVS Responses used to calculate probabilistic payoff matrices for USA, Canada, and Mexico.

USA	NA	VA	LA
NA	65.3%	23.0%	11.8%
VA	47.5%	38.0%	14.5%
LA	4.7%	56.1%	39.3%

Canada	NA	VA	LA
NA	69.3%	19.5%	11.3%
VA	53.6%	33.0%	13.4%
LA	13.0%	50.7%	36.3%

Mexico	NA	VA	LA
NA	78.0%	7.5%	14.5%
VA	71.1%	13.4%	15.6%
LA	51.2%	22.8%	26.0%

Figure 9. Payoff matrices for USA, Canada, and Mexico calculated from WVS responses summarized in Figure 8.

As before, these matrices can be used to create a simple 2-move game shown in extensive form as Figure 10 and Figure 11.

USA		Mexico		Overall
NA	65.2%	NA	78.0%	50.9%
		VA	7.5%	4.9%
		LA	14.5%	9.5%
VA	23.0%	NA	71.0%	16.3%
		VA	13.4%	3.1%
		LA	15.6%	3.6%
LA	11.8%	NA	51.2%	6.0%
		VA	22.8%	2.7%
		LA	26.0%	3.1%

Mexico	Overall
NA	73.2%
VA	10.7%
LA	16.1%

Figure 10. Two-move game with USA initiating action.

Mexico		USA		Overall
NA	78.0%	NA	65.2%	50.9%
		VA	23.0%	17.9%
		LA	11.8%	9.2%
VA	7.5%	NA	47.5%	3.6%
		VA	38.0%	2.9%
		LA	14.5%	1.1%
LA	14.5%	NA	4.6%	0.7%
		VA	56.1%	8.1%
		LA	39.3%	5.7%

USA	Overall
NA	55.1%
VA	28.9%
LA	16.0%

Figure 11. Two-move game with Mexico initiating action.

The extrapolation of multi-move games and the knowledge of the culturally-aware responses allow better understanding of retaliatory action and can help determine the best Rules of Engagement (RoE) based on the anticipated (or avoidable) responses.

The framework is designed to allow generalized analysis based on groups. Although a mechanism is provided to analyze countries via publically available WVS data, the intention is to obtain a more detailed cultural analysis dynamically using payoff matrices based on current intelligence. The CAR framework could easily be tuned toward much smaller groups such as a police force anticipating the level of violence between protest groups or gangs. With these dynamic implementations, existing experiences and subject domain data would be used to create the initial probabilistic payoff matrices while allowing for dynamic modifications based on input from informants, undercover officers, or observed activities.

Limitations

As with any predictive mechanism, limitations exist with CAR. The WVS-based data is generalized to entire countries, leaving sub-cultural interactions unknown. This is extremely difficult for largely segregated countries such as Iraq, where a locally based culture will be vastly different from the culture elsewhere in the country. While this limitation exists, the framework allows for more detailed analysis by specifying each cultural entity as a separate group. Thus, Sunni and Shia Muslims could be the interacting groups, each with an associated payoff matrix. However, we provide no automated mechanism for populating matrices with a more detailed view. This task is left to individual implementations, but can utilize external data sources such as police reports and subject matter experts. Future work is planned to assist in identifying key characterizers that influence the payoff matrix. Socio-economic tendencies may be observable from interactions (i.e., not entirely dependent upon survey data) which will give direction in how to populate the matrix.

Game theory is largely based on the assumption that each player will make their optimal move (no one wants to lose). The CAR framework circumvents this assumption by providing a probabilistic payoff. Probabilistic payoffs remove the necessity for “fair play” requirements, but do not provide a single outcome selection. In other words, a traditional game would result with one clear choice of the “best” payoff for players based

on the available moves. With a probabilistic approach, there is no clear "best" payoff as the payoff is not representative of tangible values (as previously discussed), rather only of the chance that a particular action is initiated. This allows greater flexibility in situations where knowledge is limited than a traditional game-theoretic approach. Furthermore, this framework is designed to work under both static and dynamic game situations. The probability-based payoff is able to cover a much wider range than the "best" choice-based payoff and thereby allows the game to undergo some mutation without the matrix becoming invalid.

Conclusion

A culturally-aware response framework was presented to provide analysis of interactions between culturally diverse groups. While the most value can be obtained from utilizing dynamic culturally-specific data, WVS data was used to automatically provide a baseline probabilistic payoff matrix for each culturally defined group (in this case a country). An extensive-form game from multiple payoff matrices provides insight into the likelihood of nonviolent, violent, and lethal response actions based on the culturally group tendencies. Multiple moves can simulate the multiple retaliatory actions with the ability for payoff matrices to shift dynamically (for example, having already performed a violent or lethal action may more heavily weight future responses toward increasingly violent or lethal action).

The result of this framework is a tool which will help provide tangible, quantitative values as to the probabilities of each type of outcome from an interaction between two groups. This outcome prediction is generated dynamically from both players' payoff matrices. However, each matrix is maintained separately and updated dynamically based on available data. Thus, the entire framework becomes dynamic in that the payoff matrices are not constrained to a single set of *a priori* values. This framework provides a strong mechanism to reason about potential conflicts, but also requires operator maintenance of the payoff matrix to obtain the maximum benefit.

References

Christian. 2007. IPOD translator is music to my ears. DefenseTech. Accessed 1 January 2008. http://www.defensetech.org/archives/003767.html

Ferrero, R., S. Shahidehpour, and V. Ramesh. 1997. Transaction analysis in deregulated power systems using game theory. In *IEEE Transactions on Power Systems* 12(3): 1340–1347.

Garner, Ray. 2008. UAHuntsville researchers developing computer models to provide military with better intelligence. Accessed 13 February 2008. http://www.uah.edu/News/newsread.php?newsID=1035

Poundstone, W. 1992. *Prisoner's Dilemma*. New York: Doubleday.

Singh, H. 1999. Introduction to game theory and its application in electric power markets. In *IEEE Computer Applications in Power* 12(4): 18–22.

Srivastava, V., J. Neel, A. Mackenzie, R. Menon, L. Dasilva, J. Hicks, J. Reed, and R. Gilles. 2005. Using game theory to analyze wireless ad hoc networks. In *IEEE Communications Surveys & Tutorials* 7(4): 46–56.

TRADOC News Service. 2005. Army approves plan to create school for Red Teaming. http://www.tradoc.army.mil/pao/tnsarchives/July05/070205.htm

Vcom3D VCommunicator Mobile. Accessed 1 January 2008. http://www.vcom3d.com/VcomMobile/nate/vcommobile_information.pdf

WVS. World Values Survey. Accessed 1 January 2008. http://www.worldvaluessurvey.org/