Preferences, Structure and Influence:

The Engineering of Consent

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ABSTRACT

I present a decision process framework that informs the design and implementation of influence strategy. This process combines insights from agent-based dynamic utility and agent-based dynamic network processes as well as an existing decision framework for stakeholder influence strategies that lacks these micro-foundations. I subject the resulting decision process to simulation analysis that reveals the environmental and strategic determinants of the efficacy of various influence strategies. Simulation analysis highlights import effects from embedding actors within a policymaking network as compared to treating them as wholly autonomous agents. Subsequent analysis will allow for endogenous variation not only in preferences but also issue salience, beliefs, tie strength and tie affect.

Any person or organization depends ultimately on public approval, and is therefore faced with the problem of engineering the public's consent to a program or goal…When the public is convinced of the soundness of an idea, it will proceed to action.

What do [the people] know? What are their present attitudes? …What group leaders or opinion molders effectively influence the thought process of what followers? What is the flow of ideas-from whom to whom? To what extent do authority, factual evidence, precision, reason, tradition, and emotion play a part in the acceptance of these ideas? …If the engineer of consent is to plan effectively, he must also know the group formations with which he is to deal... (Bernays, 1947: : pp. 114, 120)

Introduction

Influence strategies involve strategic behavior by actors embedded in a network of economic, political and social relationships who seek to alter the preferences, beliefs or network structure in which they are embedded to secure a favorable policy outcome, collective decision or shift in group opinion. Such strategies are ubiquitous elements of the interaction of individuals, groups, organizations, coalitions, and societies. They are used by individuals seeking to influence team decision-making and organizational politics as well as by individuals and organizations in lobbying, marketing, sales, political campaigns and corporate, national or multilateral projections of soft power. Elements of such strategies have been subject to analysis but the process as a whole remains more art than science. In this paper, I draw from political economy and social network analysis to offer an interdisciplinary decision process framework that informs the design and implementation of influence strategy. I analyze the environmental and strategic determinants of the efficacy of various influence strategies using agent-based simulation.

The foundation of the decision process framework is the dynamic expected utility decision process developed by Bruce Bueno de Mesquita (De Mesquita, 1980, 1981, 1983, 1984, 1985, 1992, De Mesquita & Lalman, 1986, 1987, 1988) which allows for strategic interaction by utility maximizing autonomous actors over time to minimize their loss functions in a unidimensional policy space. Actors make choices recognizing that their peers are also behaving strategically albeit under constraints of bounded rationality (i.e., behavior that is intendedly rational but only limitedly so), that utility is derived when the policy outcome is proximate to an actors' ideal point and when an actor is on the winning team, and that beliefs regarding certain actor attributes may diverge from reality. The key attributes are each actor's ideal point in the policy space, actor power, issue salience and beliefs regarding the issue salience of other actors which together determine an actor's choice of whether to seek to influence others, accede in whole or in part to the influence of others by altering their policy position or stand firm in anticipation of an eventual "vote" or "competition" based upon a forward looking analysis of the expected utility of such a "play".

To this foundation I add insight from social network analysis (Wasserman & Faust, 1997) to better represent actors as embedded in a network structure than both enables and constrains their behavior. Specifically, I allow the parameters of actor power, utility, issue salience and the beliefs regarding peers' issue salience to vary according to the position of an actor in the policy network. In this manner, I capture the influence of peers and position on a focal actor's behavior privileging those peers whose position in the overall policy network affords them prominence. As a result, both the nature of the ties between any one actor and his or her peers and the overall structure of the network influence the preferences and beliefs of the focal actor.

I subject this augmented decision process of preferences, structure and influence to analysis using agent-based simulation which allows me to validate that the framework conforms with theoretical predictions in the political economy and social network theoretical literatures on which it is built. This is the first simulation based assessment of the overall Bueno de Mesquita framework or, in fact, that the full equation set for that framework has been published in a single article. The resulting simulation analysis highlights that the framework does generate results which conform to the underlying theories but also calls attention to the importance of incorporating social networks and social preferences within that basic framework. I close by describing further extensions which would allow for the evaluation of the efficacy of influence strategies as well as a prescriptive system for their design and even a predictive system for anticipating the best moves of competing players.

Relationship to Existing Theory and Tools

At the core of the decision process is the dynamic expected utility process of Bruce Bueno de Mesquita which

> is concerned with explaining how policy positions of competing players evolve over time and shape policy outcomes. Therefore, it leads to predictions about policy outcomes and identifies strategic opportunities for altering them. As such it can be used to explain and predict political decisions at any level of analysis, including, of course, foreign policy and international relations. It can also be used by policy makers to anticipate outcomes and to reshape them to be more in line with their own interests. (De Mesquita, 1992: : p. 51)

This decision process developed over two decades in dozens of academic publications offers a rigorous game theoretic assessment of the political strategies of utility maximizing actors defined by a level of power, an ideal point, a degree of issue salience and a set of beliefs regarding the issue salience of their peers. The decision process was originally developed to forecast interstate[1] or intrastate[2] negotiations that could lead to conflict but over time expanded in its application to consider a broader array of policy outcomes including privatization and regulation.[3] It was originally commercialized by Decision Insights Incorporated[4] and has been extensively validated and used by the United States Government (Feder, 2002) as well as The McKinsey Group (Allas & Georgiades, 2001) and the World Bank (Green, Barma, Abdollahian, Nunberg, & Perlman, 2010).

Like other agent-based models used in political economy (Acemoglu & Robinson, 2006, Grossman & Helpman, 2001, Persson & Tabellini, 2002), the dynamic expected utility decision process assumes rational behavior by a set of utility maximizing actors with either perfect information about the

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[1] Examples include Kosovo, China and Hong Kong, the South China Sea, Arab-Israeli disputes, French participation in the Strategic Defense Initiative, Philippine policy towards U.S. military bases, Pakistan's position on Soviet occupation of Afghanistan, relations between Mozambique and the United States, Chinese reaction to Taiwanese accession to Asian Development Bank and South Yemeni support for North Yemeni insurgents.

[2] Examples include the stability of the Soviet Union, Russia, China, Saudi Arabia, India, Iraq, Korea, Brazil, Italy, Yugoslavia and Northern Ireland.

[3] Examples include EU civil aviation as well as national policies in Poland, Czechoslovakia and Italy; legislative reform of health care in the United States; corruption reform in Mexico; liberalization of trade in the United States and Japan or investment in Sri Lanka; earmarking and other funding authorizations within the US, EU and China; standards regarding radioactivity in food and auto emissions among EU nations; regulatory rulings on rates of return in the US and EU; government approvals of mergers in the US and EU; and multiple policy decisions associated with the advent of the Euro including the French referendum on acceding to the Maastricht Treaty

[4] See http://www.diiusa.com/experience.html

nature of their interaction or imperfect information of a type that can be formally specified or parameterized. It makes two further key assumptions for the sake of analytic tractability: "(1) that issues are unidimensional, so that preferences can be represented on a line segment; and (2) that preferences (and associated utilities) for potential outcomes diminish steadily the farther in Euclidean distance a possible settlement is from one's preferred outcome." (De Mesquita, 1992: : p. 51). Actors then make decisions regarding efforts to influence others into shifting their position and responding to such entreaties from others with the aim of maximizing their individual utility assuming other actors are behaving similarly. The game continues until policy converges (i.e., the expected change in policy from one round to the next declines below some threshold).

Following a growing body of literature in social science (Freeman, White, & Romney, 1989, Knoke & Yang, 2008, Wasserman & Faust, 1997), I seek to acknowledge and model the importance of the network ties between various actors in this policymaking space. I wish to augment the dynamic expected utility decision process's assumption of independently determined actor characteristics and allow for structural relations between actors to rival or even exceed the importance of actor attributes in shaping beliefs and influencing actions (Knoke & Yang, 2008). Social network analysis has expanded far beyond its origins in the study of classroom interactions and work groups expanding to improve our understanding of such diverse phenomena as kinship, urbanization, "social mobility, class structure, perceptions of class, corporate power, international trade exchanges, contacts with deviant groups, welfare support, science citation, migration patterns and reactions to disasters" (Scott, 1988: : p. 116). The focus of recent research has further expanded to include social media, blogging, epidemiology, national security, innovation and alliances. Like the dynamic expected utility decision process of Bueno de Mesquita, social network analysis is also used by government (Borgatti, 2006) and business (Cross, Borgatti, & Parker, 2002) to improve strategic decisionmaking[5] although applications to political influence strategies remain descriptive (Barley, 2007, Knoke, 1990a, 1990b, 1996, Laumann & Knoke, 1987). I seek to build tractable analytics onto these descriptive foundations by incorporating well-

[5] See also http://www.orgnet.com

established positional metrics of the similarity between actors in structural position (i.e., structural equivalence) (Wasserman & Faust, 1997: : Ch. 9) and of power (i.e., centrality) (Bonacich, 1987a) into dynamic expected utility decision processes much as has occurred in other domains where network analysis has long been applied (see, for example in the context of innovation, Owen-Smith & Powell (2004) and Powell et. al. (2005).

As opposed to the focal question in most studies using social network analysis, I am interested not in the best manner to explain, promote or retard diffusion of a practice but how an actor can best alter the collective preferences regarding a practice within a policy network with the aim of altering the policy outcome of that network. Each actor is both influenced by their peers in the policy network but also seeks to influence them so as to maximize their utility. In this regard, my decision process shares many features with the dynamic network processess of Tom Snijders and his collaborators (Burk, Steglich, & Snijders, 2007, Mercken, Snijders, Candel, Steglich, & De Vries, 2005, Snijders, Steglich, & van de Bunt, 2008, Steglich, Snijders, & Pearson, 2007). As in these systems, I explicitly allow for various forms of endogenous network formation and restructuring. Dynamic network processes that either allow for actors with similar behavior to form ties or for actors with preexisting ties to adopt similar behavior (or both) have been powerful tools for the analysis of outcomes such as the transmission of sexually transmitted diseases or greater interdisciplinary collaboration among academics. By better identifying the nature of the causal relationship between network position and behavior such analysis allows for the identification of policy innovations that can “nudge” or “tip” equilibria onto more desirable and self-enforcing paths. My decision process shares with these efforts a balance between agent-based and network-based determinants of actor behavior. My depiction of the agent-based decisionmaking process is, however, substantially richer drawing upon the dynamic expected utility decision processes described above.

Formally, I define an actor’s preferences as a linear combination of the autonomously determined utility formulation based upon the distance from an actor’s ideal point and the autonomously determined utility of other actor’s in the network. I construct measures that allow for other actor’s to have greater weight on the focal actor if those peers have higher status (i.e., possess greater ties to alters with greater ties)[6] or share a similar structural position in the network (i.e., are structurally equivalent).

I also allow network structure to alter each actor's power. Here, in contrast to the communication or diffusion processes of social networks, ties to (powerful) actors that have fewer outside options (i.e., possess fewer ties) convey greater power. This insight regarding the importance of brokerage positions providing privileged connections across structural holes (Burt, 1992, Burt, 1997, Burt, 1987) has been validated in studies of entrepreneurship, innovation, organizational learning and performance (Burt, 2004). Total power is thus a weighted function of autonomously determined power and the power derived by connections to (powerful) peer actors with few other ties.[7]

The Dynamic Expected Utility Network Decision Process

Each of the n actors in the game begins positioned at their ideal points. In each round, each player broadcasts their current position (i.e., makes a proposal) to every other player. Based on these received proposals, each player i assesses, the credibility of the received proposals (i.e., would they expect each received proposal to beat the status quo policy in a vote); their expected utility from challenging the proposal (i.e., (the expected probability that the received proposal would defeat i's proposal * i's utility if the received proposal wins) + (1 – the expected probability that the received proposal would defeat i's proposal * i's if i's proposal wins); and their expected utility from not challenging the proposal (i.e., i's expected utility at the status quo – i's expected utility if all other players play their best strategy). Actor i chooses the credible proposal whose net expected utility for i < 0 < net expected utility for j that minimizes their loss in utility. Calculating the expected utilities and the expected probability of one proposal beating another requires the computation of the following antecedent calculations.

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[6] Formally, as described in more detail below, I adopt the Bonacich Bonacich, P. 1987b. Power and Centrality: A Family of Measures. *American Journal of Sociology*, 92: 1170-82. measure of centrality with β = 0.5.

[7] Formally, as described in more detail below, I adopt the Bonacich Bonacich, P. 1987b. Power and Centrality: A Family of Measures. *American Journal of Sociology*, 92: 1170-82. measure of centrality with β = -0.5.

Each actor *i* is characterized by

(1) an ideal point (ip_i) in a unidimensional continuous policy space [0,1]

$$0 \leq ip_i \leq 1 \tag{1.1}$$

(2) an autonomously determined amount of power (aw_i)

$$aw_i \geq 0 \tag{2.1}$$

normalized such that the sum of all actors power = 1

$$\overline{aw_i} = \frac{aw_i}{\left(\sum_{j=1}^{n} aw_j\right)} \tag{2.2}$$

(3) an autonomously determined strength of preferences (as_i) or issue salience (i.e., the degree to which they are willing to deploy their power – time and financial resources – on this issue as opposed to others on which they may have preferences)

$$0 \leq as_i \leq 1 \tag{3.1}$$

(4) a set of beliefs (b_{ij}) regarding the strength of preferences or issue salience of other actors

$$0 \leq b_{ij} \leq 1 \tag{4.1}$$ [8]

(5) a set of ties to other actors which vary in strength (ts_{ij}) and in affect (ta_{ij})

$$0 \leq ts_{ij} \leq 1 \tag{5.1}$$

$$-1 \leq ta_{ij} \leq 1 \tag{5.2}$$

Based upon these parameters, it is possible to calculate each actor's

(6) Utility at each point in the policy space ($u_i(m)$) which is a weighted function of the focal actor's autonomously determined utility ($au_i(m)$), the autonomously determined utility of actors with whom the focal actor is directly tied ($tu_i(m)$) and the autonomously determined

[8] Beliefs can be chosen as a random parameter, set equal to the true strength of preferences or, most realistically, drawn from a distribution whose mean is equal to the true strength of preferences but whose variance is proportional to the multidimensional scaled distance between actor *i* and actor *j* and whose kurtosis is inversely proportional to that distance (i.e., distance from an actor increases the likelihood of error whereas proximity to an actor reduces that likelihood although the potential for large errors increases relative to small errors so as to capture the possibility of proximity bias). I choose this last process for the purposes of the simulation.

utility of actors with whom the focal actor is structurally equivalent ($seu_i(m)$). This utility is not linear in distance but rather incorporates a risk parameter (ri(m)) that allows actors whose preferences are further from that of the mean voter to be more tolerant of risk whereas those closest to the mean voter are willing to tradeoff a greater deviation from their ideal point for the security provided by being on the winning side. This risk tolerance is incorporated within the utility function by having the actor's autonomous utility increase as they approach their ideal point in a non-linear manner with the shape of this function dependent upon the expected probability that taking a given position will allow the actor to be on the winning team.

$$u_i(m) = (1 - \delta - \theta)au_i(m) + \delta\, tu_i(m) + \theta\, seu_i(m) \tag{6.1}$$

$$au(m) = \left(1 - |ip_i - m|^{r_i(m)}\right) \tag{6.2}$$

$$r_i(m) = \frac{1-\left(\frac{R_i(m)}{3}\right)}{1+\left(\frac{R_i(m)}{3}\right)} \tag{6.3}$$

$$R_i(m) = \frac{2\left(\sum_{j\neq 1}^{n-1} \overline{w_i}\, b_{ij}(1-|ip_i - m|)\right) - \left(\sum_{j\neq 1}^{n-1} \overline{w_i}\, b_{ij}\left(1-\left|ip_i - m_{j:max}\right|\right)\right) + \left(\sum_{j\neq 1}^{n-1} \overline{w_i}\, b_{ij}\left(1-\left|ip_i - m_{j:min}\right|\right)\right)}{\left(\sum_{j\neq 1}^{n-1} \overline{w_i}\, b_{ij}\left(1-\left|ip_i - m_{j:max}\right|\right)\right) + \left(\sum_{j\neq 1}^{n-1} \overline{w_i}\, b_{ij}\left(1-\left|ip_i - m_{j:min}\right|\right)\right)} \tag{6.4}$$

$$m_{j:max} = m{:}\,max\left\{\sum_{i=1}^{n-1}\left(\overline{w_i} b_{ij}(1-|ip_i - m|)\right)\right\} \tag{6.5}$$

$$m_{j:min} = m{:}\,min\left\{\sum_{i=1}^{n-1}\left(\overline{w_i} b_{ij}(1-|ip_i - m|)\right)\right\} \tag{6.6}$$

The utility of tied actors ($tu_i(m)$) is a weighted function of the autonomous utility of each actor with whom the focal actors has ties weighted more strongly if the tied actor has strong ties with the focal actor (i.e., ts_{ij} is high), strong affinity for the focal actor (i.e., ta_{ij} is high), and is central in the network structure (i.e., cc_j is high).

$$tu_i(m) = \frac{\sum_{j\neq i}^{n-1}\left(cc_j x_{ij}\left(1-\left|ip_j - m\right|^{r_j(m)}\right)\right)}{\sum_{j\neq i}^{n-1} x_{ij}} \tag{6.7}$$

$$x_{ij} = ts_{ij} * (ta_{ij} + 1)/2 \tag{6.8}$$

The centrality measure used captures the extent to which an actor in a network is strongly connected to other powerful actors who are themselves central. The intuition is that such connections facilitate the transmission or diffusion of preferences.

$$cc_i(\alpha,\beta) = \sum_{j \neq i}^{n-1} \left(\alpha + \beta cc_j\right) ts_{ij} \qquad (6.9)$$

In matrix notation

$$cc(\alpha,\beta) = \alpha\left(I - \beta ts_{ij}\right)^{-1} ts_{ij} 1 \qquad (6.10)$$

where "1" is a column vector of ones, I is the identity matrix, β = 0.5 and α is selected so that

$$\sum_{i=1}^{n} \left(cc_i(\alpha,\beta)\right)^2 = n^2 \qquad (6.11)$$

As the overall level of tie strength (ts_{ij}) and tie affect (ta_{ij}) between the focal actor and tied actors increase, the weight that tied utility (tu_i) has in utility (u_i) increases as well.

$$0 \leq \delta \leq 1, by\ default\ \delta\ set\ to = \frac{\sum_{j \neq i}^{n-1} x_{ij}}{2(n-1)} \qquad (6.12)$$

The utility of structurally equivalent actors is a weighted function of peer utility with the weights proportional to their degree of structural equivalence. Structurally equivalent actors are those who though that may not be connected to the focal actor have a comparable set of external ties such that they are inhabiting equivalent positions in the actor network. I calculate this measure using the standard formula drawn from the social network literature.

$$seu_i(m) = \frac{\sum_{j \neq i}^{n-1} \left(se_{ij} \left(1 - \left|ip_j - m\right|^{r_j(m)}\right)\right)}{\sum_{j \neq i}^{n-1} se_{ij}} \qquad (6.13)$$

$$se_{ij} = \frac{\left[1 + \frac{\sum_{k \neq i,j}^{n-2} (x_{ki} - \overline{x_{\cdot i}})(x_{kj} - \overline{x_{\cdot j}}) + \sum_{k \neq i,j}^{n-2} (x_{ik} - \overline{x_{i\cdot}})(x_{jk} - \overline{x_{j\cdot}})}{\sqrt{\sum_{k \neq i,j}^{n-1} (x_{ki} - \overline{x_{\cdot i}})^2 + \sum_{k \neq i,j}^{n-1} (x_{ik} - \overline{x_{i\cdot}})^2} \sqrt{\sum_{k \neq i.j}^{n-1} (x_{kj} - \overline{x_{\cdot j}})^2 + \sum_{k \neq i,j}^{n-2} (x_{jk} - \overline{x_{j\cdot}})^2}}\right]}{2} \qquad (6.14)$$

$$\overline{x_{\cdot i}} = \frac{\sum_{j \neq i}^{n-1} x_{ji}}{n-1} \qquad (6.15)$$

$$\overline{x_{i\cdot}} = \frac{\sum_{j \neq i}^{n-1} x_{ij}}{n-1} \qquad (6.16)$$

As more actors become more structurally equivalent to the focal actor (i.e., se_{ij} increases for a large number of actors), the weight that structurally equivalent utility (seu_i) has in utility (u_i) increases as well.

$$0 \leq \theta \leq 1, by\ default\ \theta\ set\ to\ = \frac{\sum_{j\neq i}^{n-1} ts_{ij}}{2(n-1)} \quad (6.17)$$

(7) Issue salience (s_i) which is a weighted function of the focal actor's autonomously determined issue salience (as_i) , the autonomously determined issue salience of actors with whom the focal actor is directly tied (tss_i) and the autonomously determined issue salience of actors with whom the focal actor is structurally equivalent (ses_i) following the same intuition and process as with utility.

$$s_i = (1 - \delta - \theta)as_i + \delta\ tss_i + \theta\ ses_i \quad (7.1)$$

$$tss_i = \frac{\sum_{j\neq i}^{n-1}(cc_j x_{ij} AS_j)}{\sum_{j\neq i}^{n-1} x_{ij}} \quad (7.2)$$

$$ses_i = \frac{\sum_{j\neq i}^{n-1}(se_{ij} AS_j)}{\sum_{j\neq i}^{n-1} se_{ij}} \quad (7.3)$$

(8) Power (w_i) which is a weighted function of normalized autonomously determined power ($\overline{aw_i}$) and centrality (cp_i).

$$w_i = (1 - \gamma)\overline{aw_i} + \gamma cp_i \quad (8.1)$$

normalized such that the sum of all actors power = 1

$$\overline{w_i} = \frac{w_i}{\left(\sum_{j=1}^{n} w_j\right)} \quad (8.2)$$

The weight placed on centrality as opposed to autonomously determined power is the sum of the earlier weights for tied and structurally equivalent utility.

$$0 \leq \gamma \leq 1, by\ default\ \gamma\ set\ to\ (\delta + \theta) \quad (8.3)$$

A slight variant in the centrality measure used here (cp_i) captures the extent to which an actor in a network is strongly connected to other powerful actors who are themselves not central. The intuition is that having strong ties to powerful but isolated actors allows an actor to harness or channel the strength of these peers.

$$cp_i(\alpha,\beta) = \sum_{j\neq i}^{n-1}\left(\alpha + \beta cp_j\right)ts_{ij} \tag{8.4}$$

In matrix notation

$$cp(\alpha,\beta) = \alpha\left(I - \beta ts_{ij}\right)^{-1} ts_{ij}1 \tag{8.4}$$

where “1” is a column vector of ones, I is the identity matrix, β = -0.5 and α is selected so that

$$\sum_{i=1}^{n}\left(cp_i(\alpha,\beta)\right)^2 = n^2 \tag{8.5}$$

At this point, each actor makes a decision whether to seek to influence the preferences of another actor, adapt their preferences in response to a peers’ influence or do nothing. The joint decisions by *n* actors lead to a series of proposals, counter-proposals and concessions. The result of these deliberations is an updating of each actor’s position – not their ideal point, but the point that they are either advocating for or willing to accept in a given round of play. The strategic interaction of actors and coalitions of actors continues until actors no longer have an incentive to challenge each other. Mathematically,

(9) Preferences evolve in a series of *t* rounds via a series of pairwise comparisons between the expected utility to each actor from the proposal of another actor. Each actor begins at their ideal point.

$$p_{i,0} = ip_i \tag{9.1}$$

For each pair of actors i and j, player *i*’s expected utility from player *j*’s proposal ($Q_i(j)$) is the difference between the expected utility to player *i* from challenging player *j*’s proposal ($E_i(j)$) and the expected utility to player i from not challenging player *j*’s proposal ($F_i(j)$).

$$Q_i(j) = E_i(j) - F_i(j) \tag{9.2}$$

The expected utility to player i of challenging player *j*’s proposal ($E_i(j)$) is equal to the utility for player i at their position ($U_i(p_i)$) multiplied by their expected probability of winning if they challenge j plus the utility for player i at the position of player j ($U_i(p_j)$) multiplied by their expected probability of losing if they challenge j. The two probabilities incorporate information on the focal actor's beliefs regarding all other actors strength of preferences (b_{ij}) as well as the normalized power and relative preferences of all other actors. The resulting calculations simplifies down to the following expression.

$$E_i(j) = \left[U_i(p_i) - U_i(p_j)\right]\left[1 + 2b_{ij}(V_i(j) - 1)\right] \tag{9.3}$$

$$V_i(j) = \frac{\overline{w_i}s_i + \sum_{k\neq i,j}^{n-2} \overline{w_k} b_{ik} H_{ijk}}{\overline{w_i}s_i + \overline{w_j}b_{ij} + \sum_{k\neq i,j}^{n-2} \overline{w_k} b_{ik}} \tag{9.4}$$

$$H_{ijk} = \begin{cases} 1 \ if \ \left[U_k(p_i) - U_k(p_j)\right] > 0 \\ 0 \ else \end{cases} \tag{9.5}$$

The expected utility to player i of not challenging player j's proposal ($F_i(j)$) is equal to the difference between the utility for player i at the status quo and the utility for player i at the position of the likely policy outcome if they do not challenge j.

$$F_i(j) = U_i(p_{sq}) - \frac{1}{2n}\sum_n U_i(p_{i:max}(j)) \tag{9.6}$$

$$p_{i:max}(j) = p_i : max\left\{\sum_{k=1}^{n} \overline{w_k} b_{ik}\left[U_k(p_i) - U_k(p_j)\right]\right\} \tag{9.7}$$

The relationships between $Q_i(j)$ and $Q_j(i)$ determines the evolution of p_i and p_j in a given round of play. Where $Q_i(j) < 0$ and $Qj(i) < 0$, both parties perceive the expected utility to challenging each other's proposal to be less than the expected utility of not challenging and as a result do not offer such a challenge. Analogously, where $Q_i(j) > 0$ and $Qj(i) > 0$, both parties perceive the expected utility to challenging each other's proposal to be greater than the expected utility of not challenging and as a result hold firm to their positions in the hope of succeeding in achieving their policy objective through a "vote" over the policy outcome, a collective decision or a group preference. Where $Q_i(j) < 0$ but $Qj(i) > 0$, actor i perceives the expected utility to challenging actor j to be less than the expected utility of not challenging that actor but actor j perceives the utility of a challenge of actor i to exceed that of not challenging actor i. In such circumstances, actor i's position will unilaterally move towards that of actor j. If $Qj(i) < ABS(Q_i(j))$, the net expected losses to actor i are greater than the net expected gains to actor j. To avoid these potential losses, actor i concedes to actor j (i.e., shifts p_i to p_j). By contrast, if $Qj(i) > ABS(Q_i(j))$, the net expected gains to actor j exceed the net expected losses to actor i leading actor i to compromise and shift their preferences towards actor j. Specifically, in this instance actor i chooses the first point in between their preferred point and that of actor j that actor j can credibly threaten to obtain via confrontation. Formally, this point p_c must satisfy the credibility constraint.

$$CR(p_c) = \frac{\sum_{k=1}^{n} \overline{w_k} b_{ik} H_k(p_c)}{\sum_{k=1}^{n} \overline{w_k} b_{ik}} > 0.5 \tag{9.8}$$

$$H_k(p_c) = \begin{cases} 1 \; if \; \left[U_k(p_c) - U_k(p_{sq})\right] > 0 \\ 0 \; else \end{cases} \tag{9.9}$$

$$b_{ik} = s_i \forall i = k \tag{9.10}$$

Note that the case of $Q_i(j) > 0$ but $Qj(i) < 0$ is merely a transformation of the case where $Q_i(j) < 0$ but $Qj(i) > 0$ with actor j altering their preferences instead of actor i. Figure 1 summarizes these potential outcomes. The game continues until there are no actor pairs i, j where $Q_i(j) < 0$ but $Qj(i) > 0$ at this point the policy outcome, collective decision or group preference is $\frac{\sum_{i=1}^{n} \overline{w_i} s_i p_i}{\sum_{i=1}^{n} \overline{w_i} s_i}$.

Simulation Analysis

At this point it is possible to examine the impact of various assumptions or parameter changes in the decision process on the likelihood of concession, compromise or holding ground. Specifically, I construct 2513 distinct 9-player games which vary systematically in the distribution of preferences, power, issue salience, beliefs of other actor's issue salience, tie strength and tie affect. The strategies chosen by each of the nine actors in each game towards each of their eight peers (a total of 72 pairwise cases for each round of each game or 303,264[9] in total) are subject to categorical regression analysis[10] in which I examine the impact of specific changes in the processes parameters on the incidence of concession or compromise and a tobit analysis in which I examing the impact on the distance an actor's position moves from their ideal point. The variables that I include in this analysis (See Table 1 for Summary Statistics and a Correlation Matrix) are:

1) The absolute value of the distance between the ideal point of actor i or j in a given round and that of the median voter;
2) The effective power (the true power multiplied by the issue salience) of actor i, j and of actors perceived to be allied or opposed to I;
3) The accuracy of the beliefs of actor i regarding the issue salience of actor j, the allies of i and the opponents of i;
4) The strength of ties between actor i and actor j
5) The level of affect between actor i and actor j

My goal is to confirm that the well-established patterns in closed form political economy models manifest themselves in this decision process framework. The results of this analysis (see Column 1 of Table 2) indeed show that the likelihood of compromise or concession by actor i towards actor j in the full sample is

- Increasing in the absolute value of the distance between the preferred policy of actor i and that of the median voter;
- Decreasing in the absolute value of the distance between the preferred policy of actor j and that of the median voter;
- Decreasing in the effective power of opponents of actor i;

[9] In 16 cases, a summation caused a divide by zero or other error in the equation set so the total number of cases examined in the empirical analysis is 303,248.
[10] The basic results reported below using a probit estimator with clustering of errors by game are robust to the use of a logit or ordinal probit estimator.

- Increasing in the error in actor i's beliefs regarding the issue salience of actor j and the opponents of actor i but decreasing in the error in actor i's beliefs regarding the issue salience of the allies of actor i;
- Decreasing in the strength of ties between actor i and actor j;
- Decreasing in the tie affect between actor i and actor j;

However, these aggregate results mask important structural differences based upon the relative preference ordering of actor i, j and the position of the median voter. Such structural differences have long been noted within the positive political theory literature (see Krehbiel, 1999 and Holburn & Vanden Bergh, 2004). Once we allow for structural differences in the coefficient estimates according to whether actor I and j are on the same side of the median voter (i.e., allies or opponents) and whether, in each of these two cases, actor i or actor j is closer to the median voter. Columns 2-7 of Table 2 present an analysis of the differences in the coefficient estimates between these four regime types. This analysis reveals some new relationships hidden when these separate regimes are combined into a pooled sample.

- The effective power of the allies of i enhance the likelihood of a compromise or concession to an ally but reduce it for an opponent;
- The effective power of the opponents of i enhance the likelihood of a compromise or concession to an opponent whose preferred point is closer to the median voter than is actor i but reduces the likelihood for more extreme opponents;
- The error by i in estimating the effective power of j enhances the likelihood of a compromise or a concession for j's that are opponents but reduces that likelihood where j is an ally;
- The error by i in estimating the effective power of his or her allies increases the likelihood of a compromise or concession to an ally but reduces it for opponents that are closer to the median voter than is actor i;
- The negative effect of tie strength on the incidence of compromise or concession is entirely through the case of opponents;

- Tie affect has a positive effect on the incidence of compromise or concession for opponents;
- The centrality of actor i reduces the likelihood of a compromise or concession to an ally but increases the likelihood for an opponent that is closer to the median voter than is actor i;
- The centrality of actor j increases the likelihood of a compromise or concession if actor i and j are allies but reduces that likelihood for opponents.

Table 3 goes one step further and compares the results in each of these regimes for cases in which I allow for the presence of network effects and cases where I do not. The comparison of these cases offers support for the additional computational complexity of the networked or embedded actor process. In each case, prior theoretical or empirical research or our own intuition on political processes conforms more closely to the networked actor process than its autonomous actor counterpart. For example, in the autonomous actor process compromise or concessions are more likely with allies whose preferences are close to the focal actor and opponents whose preferences are as far from the median voter as the focal actor. By contrast, in the network process, compromise is more likely with both allies and opponents that are closer to the median voter. The notion of the median voter being privileged in multiparty negotiations is a longstanding one that need not always hold true but would certainly be expected to manifest itself as a mean tendency. The autonomous actor process predicts that compromise or concession is most likely with relatively weak allies and strong opponents whereas the network process suggests it is more likely with weak opponents. Turning to errors in beliefs, the autonomous actor predicts that compromise or concession is more likely with actors whose effective power is overestimated regardless of whether these actors are allies or opponents. The network process, by contrast, leads to a greater incidence of concession or compromise, with allies whose power is underestimated and opponents whose power is overestimated. In the networked process, the strength of the allied coalition is positively associated with the incidence of concession or compromise to an ally and negatively associated with the incidence of concession or compromise to an opponent. Similarly, the strength of the opposing coalition is negatively associated with the incidence of concession or compromise to an opponent. The networked process also captures the tendency to compromise with or concede to opponents with whom you have weak ties; allies or opponents with whom you have strong affect; opponents if you are more central and the opponent is less central; and allies if you are less central and the opponent is more central.

Table 4 presents the results of the tobit analysis for the distance a player moves from their ideal point. Here, the distance of their ideal point from the median voter, the true strength of their opponents as well as overestimations of that strength are associated with greater movement and their own effective power is associated with less movement. In the networked process, centrality and overestimations of one's allies effective power reduces the likelihood of movement and the true effective power of one's allies increases that movement.

Conclusion

While the dynamic expected utility process of network influence outlined encompasses network positional influences on utility, issue salience and power and forward-looking strategic behavior by utility-maximizing agents, it still necessarily abstracts from the complexities and subtleties of reality for the purpose of analytical tractability. It requires a unidimensional policy space, shared knowledge over the structure of the process and, for the most part, a common information set. It established arbitrary functional forms governing certain key relationships, arbitrary parameter values within those functions and arbitrary probabilities of success and failure for individual plays. It assumes actors can look ahead no more than one period in playing a repeated game. It abstracts away from history, culture, personality types and, most importantly of all, plays motivated by objectives other that utility maximization. Extensions to this process that loosen these or generalize these assumptions would be welcome but will likely strain the tractability of an already complex decision process.

One straightforward and less onerous extension of the process would recognize that influence games are often sequenced or multi-stage with the identity of the actors and the structure of the policy network varying from one stage to the next. Consider the process of legislation which involves a diffuse network seeking to influence a legislator to introduce a bill, followed by committee deliberation of that bill which includes the committee members and their constituents, followed by legislative deliberation in one or multiple chambers and may require Presidential approval subject to veto, followed by monitoring and implementation including regulatory and judicial oversight. This multi-stage game could be analyzed as a series of inter-connected influence games in which players from each look ahead to the implications of their actions not just on the multi-round game in which they are currently playing but also to the final outcome of the multi-stage process.

While, for the most part, the plays described were constituted and run by one actor on another allowing for each actor to run a play on each other actor, extensions of the process could require each actor to prioritize their play calling and to be able to call a number of plays proportional to their power.

The ultimate virtue of the process is its susceptibility to empirical analysis. While this may seem a surprising claim given the data hurdles involved in populating the social network and parameter values for dozens of relevant actors, just as information technology has allowed for agent-based simulation over this extremely complex process, so too has technology enabled a new form of data collection to test the process. Specifically, information extraction software at the intersection of computer science and linguistics is on the frontier of being able to read unstructured text (e.g., news feeds, press releases, speech transcripts and blogs), consistently identify subject-verb-object triples and code them with respect to affect. For example, if the policy in question is the munificence of the policy environment for a gold mine, a search for all relevant news articles on the mine and on mining in the focal country could be executed on line. The resulting tens of thousands (or more) of news articles could be parsed so as to identify thousands of subject-verb-object triples. The subjects and objects are normalized and clustered. The parser then returns a series of n X n matrixes including the number of press mentions of each actor (i.e., autonomously determined power), the ratio of the frequency of discussion of this mine by each actor relative to other mines or other policy issues (i.e., issue salience), the number of press mentions between each dyad (i.e., tie strength), the average affect embedded in the intervening verbs (i.e., tie affect) and the average affect embedded in each verb when the object is the mine in question (i.e., autonomously determined preferences). Until such information extraction technology enters the commercial market, human coders can replicate the above process albeit with a substantial loss of speed and increase in marginal cost leading to a substantive decline in time to influence.

While some may object to the formalization of strategies used to sway the opinion of others and label such efforts propaganda, the genie is out of the bottle. Our increased ability to model agents, networks and behavior and hone such processes using heretofore unimaginable quantities of data has created the risk and opportunity of a new era of the engineering of consent. When Edward Bernays popularized the term in the early part of the century, he spoke of the need for practitioners of public relations "to push only those ideas he can respect, and not to promote causes or accept assignments for clients he considers antisocial." (Bernays, 1947: : p. 116) The challenge on practitioners today could be even greater. Fortunately, whereas the primary tools employed by Bernays were new forms of mass communication to which large corporations had privileged access due to their deep financial resources, the rapidly collapsing cost of computational power and information today open the door to a more balanced adoption of these techniques. Large corporations will do battle not only with each other but with sophisticated NGOs, social movements and community activists. The implications are on the one hand, a more even playing field, but, on the other hand, a playing field with less coordination and greater potential for abuse. Corporations, politicians and activists will exploit the fear and hope of the public for their own ends as well as for mutual gain. The new technologies enabling the engineering of consent will thus promote the democratization of propaganda for good and for ill.

Table 1: Summary Statistics

N=303,264	Compromise or concede	Preference distance_i_mv	Preference distance_j_mv	Effective Power_i	Effective Power_j	Effective Power_allies of i	Effective Power_opponents of i	Error_by I in effective power of j	Error_by I in effective power of allies	Error_by I in effective power of opponents	Tie strength_ij	Tie affect_ij	Centrality_i	Centrality_j
Mean	0.02	0.18	0.18	0.03	0.03	0.09	0.11	0.00	0.00	0.00	0.14	0.40	0.29	0.29
Std. Dev	0.14	0.12	0.12	0.03	0.03	0.08	0.10	0.02	0.04	0.08	0.13	0.43	0.11	0.11
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.16	-0.38	-0.44	0.00	-0.96	0.00	0.00
Maximum	1.00	0.96	0.96	0.18	0.18	0.43	0.51	0.32	0.25	0.50	0.33	1.00	0.56	0.56
Preference distance_i_mv	0.34													
Preference distance_j_mv	-0.05	0.00												
Effective Power_i	-0.06	-0.15	0.07											
Effective Power_j	0.00	0.07	-0.15	0.61										
Effective Power_allies of i	-0.01	-0.03	0.09	0.74	0.65									
Effective Power_opponents of i	-0.02	0.16	0.06	0.60	0.67	0.57								
Error_by I in effective power of j	0.01	-0.12	0.09	0.29	-0.19	0.14	-0.05							
Error_by I in effective power of allies	-0.02	-0.10	0.00	0.28	0.05	-0.01	0.06	0.36						
Error_by I in effective power of opponents	0.00	-0.17	0.00	0.38	0.03	0.20	-0.19	0.54	0.32					
Tie strength_ij	-0.04	-0.06	-0.06	0.02	0.02	-0.04	0.02	-0.01	-0.02	-0.01				
Tie affect_ij	-0.07	-0.07	-0.06	0.03	0.03	-0.01	0.04	-0.02	-0.02	-0.02	0.24			
Centrality_i	-0.06	-0.15	0.04	0.09	0.02	0.07	-0.01	-0.05	-0.07	-0.05	0.42	0.32		
Centrality_j	-0.06	-0.13	0.03	0.08	0.02	0.07	-0.02	-0.05	-0.07	-0.05	0.39	0.31	0.97	

Table 2: Categorical (Probit) Regression Analysis Varying Relative Preference Positions of i, j and Median Voter

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Actors I and j are allied or opposed	BOTH	ALLIED	ALLIED	ALLIED	OPPPOSED	OPPPOSED	OPPPOSED
Actor j closer/further from median voter	ALL	ALL	Closer	Further	ALL	Closer	Further
Network effects are	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH
Preference distance_i_mv	8.360***	7.959***	8.647***		9.248***	9.187***	9.258***
	-0.445	-0.821	-0.953		-0.368	-0.377	-1.109
Preference distance_j_mv	-2.525***	-6.671***	-8.172***		-1.483***	-1.016***	-2.284***
	-0.2	-0.769	-0.793		-0.159	-0.2	-0.808
Effective Power_i	-1.582	-6.775**	-12.55***		-7.172***	-15.03***	13.14***
	-1.024	-3.197	-2.625		-1.211	-1.505	-2.897
Effective Power_j	-0.628	-6.152***	-6.170***		-3.945***	-3.115**	-15.89***
	-0.843	-2.367	-2.315		-1.193	-1.385	-2.942
Effective Power_allies of i	0.0544	4.493***	4.356***		-2.031***	-2.204***	-6.169***
	-0.236	-0.515	-0.52		-0.385	-0.489	-1.25
Effective Power_opponents of i	-1.412***	-0.789	0.0528		1.637***	2.454***	-3.604***
	-0.264	-0.745	-0.75		-0.299	-0.4	-1.16
Error_by I in effective power of j	9.990***	-5.107***	-5.608***		11.49***	13.24***	13.00***
	-0.663	-1.64	-1.87		-0.909	-1.256	-2.026
Error_by I in effective power of allies	-0.948***	1.320**	1.060*		-0.939**	-1.110*	-0.59
	-0.344	-0.604	-0.601		-0.472	-0.586	-1.208
Error_by I in effective power of opponents	2.213***	0.588	1.490*		4.224***	4.714***	6.198***
	-0.239	-0.662	-0.775		-0.282	-0.385	-0.795
Tie strength_ij	-1.450***	-0.069	-0.0543		-0.804***	-0.842***	-0.176
	-0.131	-0.114	-0.119		-0.131	-0.138	-0.441
Tie affect_ij	-0.239***	-0.421***	-0.375***		0.0364	0.0563*	-0.0766
	-0.0256	-0.0556	-0.0578		-0.0301	-0.0338	-0.0685
Centrality_i	0.584	-3.297***	-2.884***		2.140***	2.612***	-0.388
	-0.363	-0.562	-0.587		-0.413	-0.454	-1.219
Centrality_j	-0.399	1.753***	1.751***		-2.304***	-2.141***	-2.620**
	-0.347	-0.553	-0.572		-0.384	-0.428	-1.136
Constant	-3.738***	-3.403***	-3.686***		-4.002***	-4.135***	-3.037***
	-0.151	-0.253	-0.31		-0.138	-0.143	-0.169
Observations	303248	141898	38494		161350	73252	73327
	.		.		.	.	.

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Categorical (Probit) Regression Analysis Comparing Results Across Autonomous and Networked Actor Processes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Actors I and j are allied or opposed	ALLIED	ALLIED	ALLIED	ALLIED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED	OPPPOSED
Actor j closer/further from median voter	Closer	Closer	Closer	Further	ALL	ALL	ALL	Closer	Closer	Closer	Further	Further	Further
Network effects are	NONE	ONLY	ONLY	NONE	NONE	ONLY	ONLY	NONE	ONLY	ONLY	NONE	ONLY	ONLY
Preference distance_i_mv	-0.409	24.74***	25.11***	7.862***	4.438***	11.43***	11.51***	3.301***	11.15***	11.22***	6.217***	16.47***	16.58***
	-0.41	-1.189	-1.269	-1.87	-0.486	-0.152	-0.171	-0.557	-0.147	-0.171	-1.124	-2.784	-2.878
Preference distance_j_mv	1.624***	-16.35***	-16.71***	-3.970***	1.049***	-2.482***	-2.626***	2.599***	-1.829***	-1.995***	0.447	-7.507***	-7.543***
	-0.599	-0.752	-0.847	-1.334	-0.277	-0.125	-0.133	-0.558	-0.167	-0.176	-0.616	-1.588	-1.593
Effective Power_i	-10.48***	-0.425	1.053	17.26***	-8.478***	-13.59***	-11.40***	-19.39***	-21.19***	-19.27***	1.761	31.56***	32.25***
	-2.37	-3.498	-3.315	-3.287	-2.512	-1.507	-1.512	-3.443	-1.831	-1.824	-2.787	-4.266	-5.204
Effective Power_j	-10.05***	-3.021	-3.083	-39.88***	4.075***	-11.01***	-9.935***	5.695***	-10.09***	-9.106***	-7.064	-30.12***	-27.96***
	-2.986	-4.929	-4.994	-13.69	-1.404	-1.024	-1.071	-1.631	-1.206	-1.251	-4.856	-5.564	-5.752
Effective Power_allies of i	1.555	6.732***	6.795***	1.572	-1.237**	-1.138***	-1.489***	-1.376*	-1.284**	-1.532***	-0.392	-7.829***	-8.095***
	-1.203	-1.21	-1.237	-1.523	-0.498	-0.433	-0.443	-0.775	-0.536	-0.541	-1.261	-1.515	-1.594
Effective Power_opponents of i	0.309	-1.758*	-1.794*	-5.224***	0.443	3.428***	2.985***	1.363**	4.151***	3.766***	-4.213**	-7.049***	-7.442***
	-0.869	-0.922	-0.949	-1.455	-0.556	-0.331	-0.326	-0.654	-0.412	-0.406	-1.87	-1.798	-2.592
Error_by I in effective power of j	0.472	-7.097**	-7.044**	24.55***	8.569***	12.69***	13.34***	10.38***	14.26***	14.76***	14.96***	6.821*	7.905**
	-3.068	-3.5	-3.44	-8.245	-0.89	-0.968	-0.999	-1.671	-1.049	-1.08	-1.899	-3.714	-3.703
Error_by I in effective power of allies	3.558**	3.948***	3.860***	5.941**	-0.696	-0.41	-0.45	0.603	-0.834	-0.806	-4.840***	2.808	2.11
	-1.386	-1.338	-1.354	-2.337	-0.667	-0.549	-0.556	-1.01	-0.645	-0.649	-1.626	-2.134	-2.211
Error_by I in effective power of opponents	0.973	3.036***	2.936***	-7.031***	1.339***	6.121***	5.780***	0.951	6.506***	6.220***	0.0788	8.142***	8.146***
	-0.765	-0.751	-0.748	-1.349	-0.512	-0.345	-0.347	-0.696	-0.416	-0.415	-1.254	-0.955	-0.989
Tie strength_ij			0.0609				-0.926***			-0.788***			-1.051
			-0.435				-0.159			-0.167			-0.683
Tie affect_ij			0.316***				0.0662*			0.0897**			-0.0967
			-0.11				-0.0345			-0.0378			-0.0838
Centrality_i			-3.432***				2.361***			2.214***			1.501
			-1.135				-0.524			-0.562			-1.959
Centrality_j			2.942***				-4.205***			-4.593***			0.429
			-1.142				-0.434			-0.471			-1.695
Constant	-1.480***	-11.20***	-11.36***	-2.045***	-3.050***	-4.701***	-4.069***	-2.802***	-4.611***	-3.842***	-3.128***	-4.584***	-5.122***
	-0.155	-0.586	-0.644	-0.236	-0.205	-0.0431	-0.139	-0.246	-0.0417	-0.145	-0.196	-0.769	-1.314
Observations	4393	34101	34101	4571	17605	143761	143745	7576	65684	65676	7420	65915	65907
	.	.	.	.	.	.	.	.	.	.	.	.	.

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

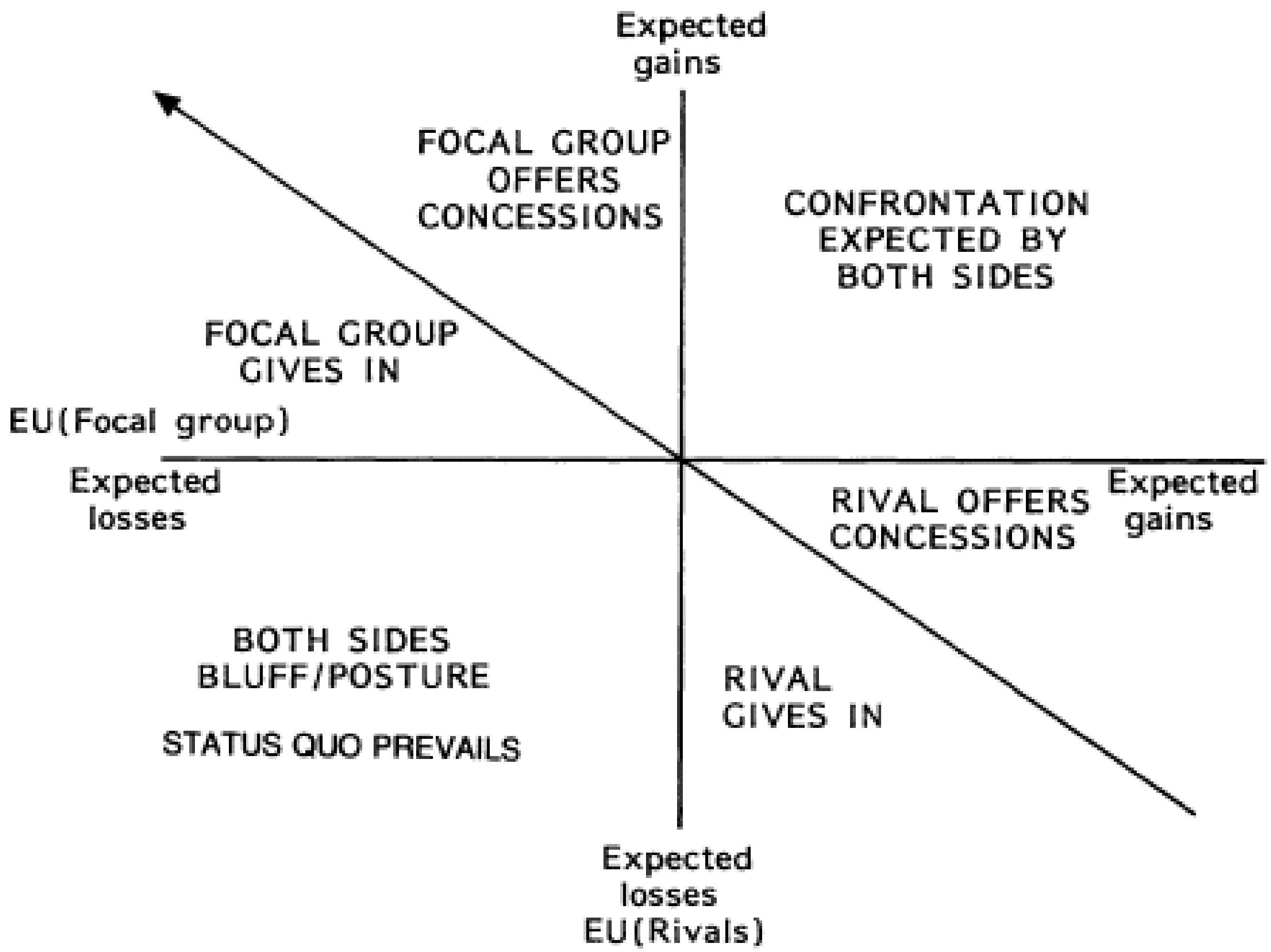
Table 4: Tobit Analysis of Extent of Movement of an Actor's Position from their Ideal Point

	ALL	ALL	AUT	NET	NET	NET
Preference Distance_i	0.673***	0.668***	0.542***	0.719***	0.634***	0.640***
	-0.011	-0.011	-0.047	-0.005	-0.008	-0.008
Effective Power_i	-1.785***	-1.742***	-1.732***	-1.975***	-1.346***	-1.336***
	-0.129	-0.129	-0.335	-0.060	-0.074	-0.074
Effective Power_allies of i	0.0915***	0.0782***	-0.06	0.105***	0.0671***	0.0375**
	-0.016	-0.016	-0.067	-0.013	-0.015	-0.015
Effective Power_opponents of i	0.297***	0.298***	0.379***	0.320***	0.225***	0.245***
	-0.024	-0.025	-0.081	-0.010	-0.011	-0.011
Error_of I on allies	-0.0968***	-0.104***	0.05	-0.0872***	-0.114***	-0.134***
	-0.025	-0.025	-0.102	-0.022	-0.024	-0.024
Error_or I on opponents	0.244***	0.242***	0.368***	0.268***	0.147***	0.163***
	-0.019	-0.019	-0.079	-0.011	-0.012	-0.012
Centrality_i (Beta = 0.5)	-0.182***				-0.561***	
	-0.014				-0.023	
Centrality_i (Beta = -0.5)		-0.182***				-0.434***
		-0.013				-0.019
Constant	0.143***	0.143***	0.143***	0.0782***	0.276***	0.232***
	-0.006	-0.006	-0.015	-0.001	-0.009	-0.008
Observations	37908	37908	4168	33740	33740	33740

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses

Figure 1: Expected Utility and Preference Evolution



Source: Reproduced from De Mesquita and Organski (1992)

REFERENCES

Acemoglu, D. & Robinson, J. A. 2006. *Economic origins of dictatorship and democracy*. Cambridge ; New York: Cambridge University Press.

Allas, T. & Georgiades, N. 2001. New Tools for Negotiators. *McKinsey Quarterly*, 2001(2): 86-91.

Barley, S. R. 2007. Corporations, democracy, and the public good. *Journal of Management Inquiry*, 16(3): 201-15.

Bernays, E. L. 1947. The Engineering of Consent. *Annals of the American Academy of Political and Social Science*, 250: 113-20.

Bonacich, P. 1987a. Power and Centrality - a Family of Measures. *American Journal of Sociology*, 92(5): 1170-82.

Bonacich, P. 1987b. Power and Centrality: A Family of Measures. *American Journal of Sociology*, 92: 1170-82.

Borgatti, S. P. 2006. Identifying Sets of Key Players in a Network. *Computational, Mathematical and Organizational Theory*, 12(1): 21-34.

Burk, W. J., Steglich, C. E. G., & Snijders, A. B. 2007. Beyond dyadic interdependence: Actor-oriented models for co-evolving social networks and individual behaviors. *International Journal of Behavioral Development*, 31(4): 397-404.

Burt, R. 1992. *Structural Holes: The Social Structure of Competition*. Cambridge: Harvard University Press.

Burt, R. 1997. The Contingent Value of Social Capital. *Administrative Science Quarterly*, 42: 339-65.

Burt, R. S. 1987. Social Contagion and Innovation: Cohesion versus structural equivalence. *American Journal of Sociology*, 92: 1287-335.

Burt, R. S. 2004. Structural holes and good ideas. *American Journal of Sociology*, 110(2): 349-99.

Cross, R., Borgatti, S. P., & Parker, A. 2002. Making invisible workvisible: Using social network analysis to support strategic collaboration. *California Management Review*, 44(2): 25-+.

De Mesquita, B. B. 1980. An Expected Utility-Theory of International Conflict. *American Political Science Review*, 74(4): 917-31.

De Mesquita, B. B. 1981. Risk, Power Distributions, and the Likelihood of War. *International Studies Quarterly*, 25(4): 541-68.

De Mesquita, B. B. 1983. The Costs of War - a Rational-Expectations Approach. *American Political Science Review*, 77(2): 347-57.

De Mesquita, B. B. 1984. Forecasting Policy Decisions - an Expected Utility Approach to Post-Khomeini Iran. *P S*, 17(2): 226-36.

De Mesquita, B. B. 1985. The War Trap Revisited - a Revised Expected Utility Model. *American Political Science Review*, 79(1): 156-77.

De Mesquita, B. B. 1992. *Predicting Politics*. Columbus, OH: Ohio State University Press.

De Mesquita, B. B. & Lalman, D. 1986. Reason and War. *American Political Science Review*, 80(4): 1113-29.

De Mesquita, B. B. & Lalman, D. 1987. Modeling War and Peace. *American Political Science Review*, 81(1): 221-30.

De Mesquita, B. B. & Lalman, D. 1988. Empirical Support for Systemic and Dyadic Explanations of International Conflict. *World Politics*, 41(1): 1-20.

Feder, S. A. 2002. Forecasting for policy making in the post-cold war period. *Annual Review of Political Science*, 5: 111-25.

Freeman, L. C., White, D. R., & Romney, A. K. 1989. *Research methods in social network analysis*. Fairfax, Va.: George Mason University Press.

Green, A., Barma, N., Abdollahian, M., Nunberg, B., & Perlman, D. 2010. At The Frontier Of Practical Political Economy. *Policy Research Working Paper*, 5176: 1-32.

Grossman, G. M. & Helpman, E. 2001. *Special interest politics*. Cambridge, Mass.: MIT.

Knoke, D. 1990a. *Organizing for collective action : the political economies of associations*. New York: A. de Gruyter.

Knoke, D. 1990b. *Political networks : the structural perspective*. New York: Cambridge University Press.

Knoke, D. 1996. *Comparing policy networks : labor politics in U.S., Germany, and Japan*. New York: Cambridge University Press.

Knoke, D. & Yang, S. 2008. *Social network analysis*. 2nd ed. Los Angeles,: Sage Publications.

Laumann, E. O. & Knoke, D. 1987. *The organizational state : social change in national policy domains*. Madison, Wis.: University of Wisconsin Press.

Mercken, L., Snijders, T., Candel, M., Steglich, C., & De Vries, H. 2005. Why adolescents start to smoke: Peer influence versus peer selection processes. *Psychology & Health*, 20: 170-70.

Owen-Smith, J. & Powell, W. W. 2004. Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community. *Organization Science*, 15(1): 5-21.

Persson, T. & Tabellini, G. E. 2002. *Political economics : explaining economic policy*. Cambridge, Mass. London: MIT.

Powell, W. W., White, D. R., Koput, K. W., & Owen-Smith, J. 2005. Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. *American Journal of Sociology*, 110(4): 1132-205.

Scott, J. 1988. Social Network Analysis. *Sociology*, 22(1): 109-27.

Snijders, T. A. B., Steglich, C. E. G., & van de Bunt, G. G. 2008. Introduction to Actor-Based Models for Network Dynamics. *Mimeo*.

Steglich, C. E. G., Snijders, T. A. B., & Pearson, M. 2007. Dynamic Networks and Behavior: Separating Selection from Influence. *Mimeo*.

Wasserman, S. & Faust, K. 1997. *Social network analysis : methods and applications*. Repr. with corrections. ed. Cambridge [England] ; New York: Cambridge University Press.