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Alliance formation in a side-taking experiment

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Abstract

We investigate in a laboratory experiment how people choose sides in disputes. In an eight-player side-taking game, two disputants at a time fight over an indivisible resource and other group members choose sides. The player with more supporters wins the resource. Fights occur randomly between any two individuals in the group. Players choose sides by ranking their loyalties to everyone else in the group and they automatically support the higher ranked disputant. We manipulate participants' information about other players' loyalties and also their ability to communicate with the group using chat messages. We find that people spontaneously and quickly form alliances and increased information causes more alliance-building. In contrast, we observe little evidence of bandwagon or egalitarian strategies. Finally, when chat communication was available, some groups invented novel rank rotation schemes to equalize payoffs while choosing the same side to avoid the costs of evenly matched fights.

Keywords: alliances, bandwagon, egalitarian, conflict, experimental economics

Introduction

Choosing sides is a common predicament at every scale of human social and political life. People take sides in conflicts between friends (DeScioli & Kurzban, 2009), colleagues take sides in conflicts at the workplace (Kaukiainen et al., 2001), voters take sides in elections (Huddy, 2013), members of congress take sides on legislation (Fowler, 2006), jurors take sides in trials (Devine et al., 2001), and nations take sides in international conflicts (Snyder, 1997; Walt, 1997). People face difficult tradeoffs when deciding which side, if any, to support in disputes, especially when bound by prior loyalties and obligations. Here we investigate the strategies people use to choose sides. We report a laboratory experiment that recreates incentive structures that occur in side-taking problems. We test for alliance, bandwagon, and egalitarian strategies in different information and communication treatments.

Fighting is pervasive in humans and non-human animals because of limited resources such as food, shelter, mates, and status. Fighting is a mixed-motive game because opponents have both conflicting interests about the contested resource and shared interests in limiting the costs of fighting escalation (Schelling, 1960). Fights, disputes, and arguments need not be violent. Aggression is usually restrained and many disputes are resolved with low cost threat displays such as a dog's bark, a person's angry scowl (Reed, DeScioli, & Pinker, 2014), or a political group's protest demonstration. Fighting occurs even in the closest relationships among family and friends whose interests are otherwise mostly aligned (Richardson, 2014). Conflict often arises unexpectedly such as when two children realize there is only one cookie left, two buyers bid on the same house, two political parties react to a scandal, or two nations discover oil reserves at their border.

Fighting can be analyzed using models from game theory. Players fight over an indivisible resource worth *V*, and they decide the costs, *C*, they are willing to endure from effort or injury to win the fight. One of the best known models is the hawk-dove game (Maynard Smith, 1982) in which two players decide to fight (hawk) or flee (dove). If one player fights then they win the resource, but if both fight, then both players pay a fighting cost, *C,* and the winner is randomly determined. If they both flee, then the winner is randomly determined with no fighting costs. In the war of attrition (Hammerstein & Parker, 1982), players continue to invest in fighting until one party concedes. In lottery contests, players make investments to increase the probability of victory, and in all-pay auctions, the highest bidder wins but everyone pays their bid amount (Dechenaux et al. 2014). All of these models highlight the tension between the gains from aggression and the risk of costly escalated conflict. Hence, previous research also examines mechanisms for low-cost conflict resolution such as fighting assessment, threat displays, and other signals (Arnott & Elwood, 2009; Hammerstein & Parker, 1982).

We design a side-taking game to extend models of fighting to include bystanders who choose sides. Humans are unusual among animals in the extent to which bystanders intervene in other individuals' disputes (Harcourt, 1992). In most non-human species, fights occur among two individuals or two well-defined groups. However, in a few animal species including dolphins, hyenas, and several primates, individuals show more flexible side-taking behavior (Connor, 2007; Harcourt, 1992; Holekamp et al., 2007). Humans, in particular, live in dense social networks in which coalitions are unstable and side-taking is unpredictable (DeScioli & Kurzban, 2013). This increases the complexity of fighting because disputants need to assess not only the opponent's physical power but also their ability to recruit supporters (Harcourt, 1992). In fact, evolutionary researchers have argued that the adaptive problems surrounding complex coalitional tactics explain the expansion of brain size in human evolution (Dunbar, 1998; Humphrey, 1976; Whiten & Byrne, 1997).

The side-taking game focuses on the perspective of bystanders. There is a group of players who each choose a *loyalty ranking* that specifies who they support for all pairs of opponents.[1] Fights occur between randomly paired opponents and bystanders choose sides automatically based on their loyalty rankings. The fighter with more supporters wins the resource, *V*, which is acquired with a costless threat display. If a tie occurs, then the fight escalates and all players pay the fighting cost, *C*. This reflects observations in human and non-human research showing greater risk of costly escalation when sides are evenly matched (Arnott & Elwood, 2009; Cooney, 1998, 2003; Dechenaux et al., 2014). This basic stage game is repeated and players can change their loyalties from round to round.

Importantly, the resource *V* is indivisible, as in the models above, and is not shared with the winner's supporters. This absence of direct compensation is a defining feature of the bystander role and contrasts with other approaches in which a coalition's winnings are shared (Mesterson-Gibbons et al., 2011; Murnighan, 1978; Ray, 2007; Riker, 1962). When winnings are transferrable, players typically seek the smallest winning coalition to maximize their own portion of the spoils (Riker, 1962). However, the stakes of many conflicts are not immediately and readily divisible such as the passage of legislation, a defendant's acquittal, or a nation's sovereignty against an invader. When a disputant does not divide the winnings, they tend to prefer as many supporters as possible, which characterizes many social and political conflicts. Presidential candidates, lawmakers, political activists, and invaded nations prefer maximum numbers of supporters. Last, indivisibility creates an asymmetry between the roles of fighter and

[1] A web application for visualizing the side-taking game is available at: http://pdescioli.com/alliance.1player.6.3.14/SideTaking.6.3.14.php

bystander in which the bystander's main problem is not capturing a portion of the winnings but instead managing their fighting costs and ongoing relationships to each side.

We consider three strategies for choosing sides drawn from previous empirical research. In the *bandwagon strategy*, an individual sides with the more powerful disputant (Snyder, 1997; Walt, 1997). This can be based on the disputants' fighting abilities, relative social status, as well as their expected number of supporters. For instance, hyenas use a bandwagon strategy by always siding with the higher status fighter (Holekamp et al., 2007). Similarly, human groups include hierarchical authority relationships (Fiske, 1992) in which group members support higher status against lower status individuals. When used collectively, a bandwagoning group can achieve consensus and avoid the costs of gridlock and escalation in more divided groups.

Next, in the *egalitarian strategy*, individuals side with less powerful against more powerful individuals (Boehm, 1999; Walt, 1997; Waltz, 1979). Boehm (1999) reviews ethnographic evidence that many human groups show anti-hierarchical behavior in which groups suppress status-striving in their members by opposing high-status individuals. Similarly, scholars in international relations find that weaker nations sometimes align to oppose powerful nations to balance power (Walt, 1997; Waltz, 1979).

A third decision rule for choosing sides is an *alliance-building strategy* in which individuals favor the disputant who is more likely to support them in their own disputes (Snyder, 1984, 1997). For instance, two individuals can improve their power by forming an alliance in which they side with each other, instead of siding with (or against) the powerful. Alliance-building is observed in many social contexts from close relationships to politics to international relations (Cooney, 1998, 2003; DeScioli & Kurzban, 2014; Snyder, 1984, 1997). For example, previous research found strong correlations between participants' rankings of close friends and their perceptions of friends' ranks of them. Similar findings were obtained by analyzing millions of ranked friendships on the social network MySpace (DeScioli et al., 2011).

It is difficult to evaluate the best strategy in the side-taking game because bystanders' decisions do not directly affect their own winnings but only other players' winnings. Hence, non-cooperative game theory offers little guidance for a one-shot version of the game (except that players should avoid costly ties) but repeated play can allow a variety of trigger strategies (Fudenberg & Tirole, 1991). Recent research developed additional analytic and simulation tools to understand the properties of the side-taking game (Kimbrough & DeScioli, 2015). If we assume that players can make binding pacts, enforced by repeated play and reputation, then it can be rational for two players to agree to improve their ranks of each other at the expense of a third-party, forming an alliance and thereby acquiring greater support for future disputes with other group members (for a formal model, see Kimbrough & DeScioli, 2015). Modeling this idea suggests that loyalties are unstable because there are always individuals who can form advantageous loyalty pacts at the expense of other players (Kimbrough & DeScioli, 2015). This is expected to occur when players do not suffer immediate penalties from betrayals such as when backstabbing is concealed by secrecy. We also used simulations to further examine stability by programming agents to use side-taking algorithms (Kimbrough & DeScioli, 2015). We find that groups achieve stable loyalty rankings when agents use a re-ranking algorithm to form alliances by sequentially ranking other players according to how those players rank them.

Despite previous observations and theories, it is unknown whether people spontaneously apply any or all of these strategies when confronted with a real and imminent problem of choosing sides. We use an economic game with real monetary payoffs to present participants with the problem of choosing sides. The game is deliberately simplified to include only the most essential elements of a side-taking problem: Two players dispute over a resource, other players choose sides, and this process repeats. By using a minimal social environment, we can investigate what strategies, if any, people use to choose sides, while excluding potentially confounding complexities such as identities, relationships, entitlements, and histories. We test for the minimal conditions under which people exhibit bandwagon, egalitarian, and alliance behaviors. This approach is analogous to previous research on the minimal conditions required for perception of agency (Heider & Simmel, 1944), group identity (Tajfel & Turner, 1979), cooperation (Axelrod, 1984), and respect for property (DeScioli & Wilson, 2011). Finally, we manipulate players' information about other players' loyalties by displaying this information in a table and by allowing chat communication. This allows us to test whether people track other people's loyalties and, if so, how they use this information in taking sides.

Methods

Participants and procedure

We recruited 200 participants (47% female, age: M = 22, SD = 5 years) for experimental sessions at the Harvard Decision Sciences Laboratory and the CRABE Lab at Simon Fraser University (half of sessions per treatment in each location). We chose the sample size (in advance) to provide sufficient power to detect medium effect sizes for differences in participants' decisions across conditions. Participants entered the computer lab and were seated at private computer terminals. They completed a consent form and then read the instructions (Appendix A) which were provided on the computer and as a paper copy. Participants were required to answer two comprehension questions to proceed. Participants began the experiment with a $5.00 endowment. They participated in 20 periods of the side-taking game in which their earnings could increase or decrease each period. After the game, participants were paid the sum of the endowment and their profits from the game. Sessions lasted 75 minutes. Participants earned *M* = \$18.44, *SD* = \$5.12. The experiment software was programmed in z-Tree (Fischbacker, 2007).

Game design and measures

We designed an eight-player side-taking game to observe how participants choose sides in other people's disputes. The game is played anonymously on a computer network. There are eight players labeled with letters A through H. Two players at a time are randomly chosen to dispute over a resource with a cash value (\$1.50). The other six players are bystanders who choose sides, and the disputant with more supporters wins the resource. (The supporters do not earn money in other players' disputes.) When the dispute is lopsided (7 vs. 1, 6 vs. 2, or 5 vs. 3), the fight is settled with a costless threat display and no one pays a fighting cost. If a tie occurs (4 vs. 4), then the winner is chosen randomly, the dispute escalates, and all players (both fighters and supporters) pay a fighting cost which is set to \$0.10.

Participants choose sides by ranking the other players. In the decision stage, each participant ranks the other seven players highest to lowest from 1^{st} to 7^{th}. When a fight occurs, bystanders automatically side with the player they ranked higher in the previous decision stage. In the fighting stage, there is a series of four disputes between randomly paired players. Each participant acts as a disputant once and a bystander three times per period. After the fights, participants return to the decision stage in which they observe a cumulative fight history showing which fights occurred and whose side each player chose.

The decision stage (90 sec) and fight stage (60 sec) are repeated for a total of 20 periods. Prior to the first period, there is an initial fighting stage in which participants' rankings are assigned by the experimenter and there are four fights. This is designed to begin the fight history prior to participants' ranking decisions. In periods 1-20, participants simultaneously choose their rankings in the decision stage. Repeating play for 20 periods allows players to condition their decisions on other players' previous decisions, creating the potential for bandwagon, egalitarian, alliance-building and other strategies.

Alliance-building measure. For each ranking decision, we measure alliance-building as the correlation between a participant's ranking in period *t* and other players' ranks of ego in the previous period, *t* - 1 (DeScioli & Kurzban, 2009; DeScioli et al., 2011). This metric varies from -1 to 1 with positive values indicating that participants support players who support them, and negative values indicating the opposite, participants tend to side with players who tend to oppose them.

Bandwagon and egalitarian measure. We measure bandwagon and egalitarian strategies as the correlation between a participant's rankings in period *t* and other players' power in the previous period, *t* - 1. We calculate an individual's power as the average rank of that player by other players (excluding ego), which can vary from 1 (most power) to 7 (least power). This correlation metric varies from -1 to 1 in which positive values indicate bandwagon decisions to support powerful individuals (those with high support from other players) and negative values indicate egalitarian decisions to oppose powerful individuals.

Experimental design and hypotheses

In a 2x2 experimental design, we manipulate (1) the information available about other players' rankings (table / no table) and (2) whether participants are able to chat with the group (chat / no chat). In the table treatment, participants observe a table showing all eight players' rankings of everyone else in the previous period. In the no-table treatment, participants do not have this information and view only the fight history (available in all treatments). This manipulation allows us to test whether participants use additional information about other players' rankings to choose their own rankings by examining how decisions differ when more information is available.

In the chat treatment, participants view a chat box during the decision stage in which they can send messages to the whole group and view other players' messages as they accumulate during a decision stage. We added a popup reminder that appears at the end of the decision stage to help participants remember to submit their new rankings before the decision stage ends.[2] Participants in the chat treatment were told that they could send any messages except information about their identities, threats, side payments, or profanities. They were told that chats would be monitored and violations of these rules would disqualify them (no violations occurred).

The alliance-building hypothesis predicts that participants will rank other individuals according to how those individuals rank them. That is, values for the alliance-building measure will be significantly greater than zero. The bandwagon hypothesis predicts that participants will rank other individuals according to their overall power in the group and the egalitarian hypothesis predicts the opposite. Further, each hypothesis predicts greater use of each strategy, respectively, with greater information and communication. Finally, in the chat treatment the

[2] The reminder for the chat treatment caused a software error in which an error-checking subroutine was bypassed, allowing a few participants to submit inadmissible rankings such as two rank 5 values. This occurred in less than 1% of decisions and 0.2% of individual ranks and was not mentioned by participants either in chats or comments, suggesting that it did not affect game play.

ability to communicate with language widens the strategy space by allowing players to discuss agreements about their ranking decisions. Hence, this treatment also allows us to describe any additional side-taking strategies participants might devise by using language and discussion.

Results

Alliance, bandwagon, and egalitarian strategies in periods 11-20

We first examine alliance-building strategies in the second half of the experiment, periods 11-20, after participants had time to interact and understand the game. We aggregate the data by averaging alliance-building across periods 11-20 for each participant and then averaging these values across participants (Figure 1, panel A). The alliance-building means statistically differ from zero in the table, no-chat treatment, $t(47) = 7.36$, $p < .001$, the table, chat treatment, $t(55) = 6.81$, $p < .001$, and the no-table, no-chat treatment, $t(47) = 6.48$, $p < .001$. This value did not differ from zero in the no-table, chat treatment, $t(47) = 0.40$, $p = .69$. These findings show that in three of the four treatments participants' rankings are predicted by other players' ranks of ego in the previous period, whereas this did not occur in the no-table, chat treatment.

We analyzed mean alliance-building values with a 2 (table / no-table) x 2 (chat / no-chat) ANOVA with averages at the individual level as the dependent variable. We found a main effect of the table treatment in the predicted direction of increased alliance-building, $F(1, 196) = 24.48$, $p < .001$. We found a main effect of chat, $F(1, 196) = 10.82$, $p < .01$, but, importantly, chat reduced alliance-building. Last, there was a marginally significant interaction, $F(1, 196) = 3.38$, $p = .07$. This analysis shows that participants used information from the rankings table when making their decisions, and in particular, they used it to more closely correlate their rankings to other players' ranks of ego. In contrast, chat capability appeared to suppress alliance-building particularly in the no-table treatment.

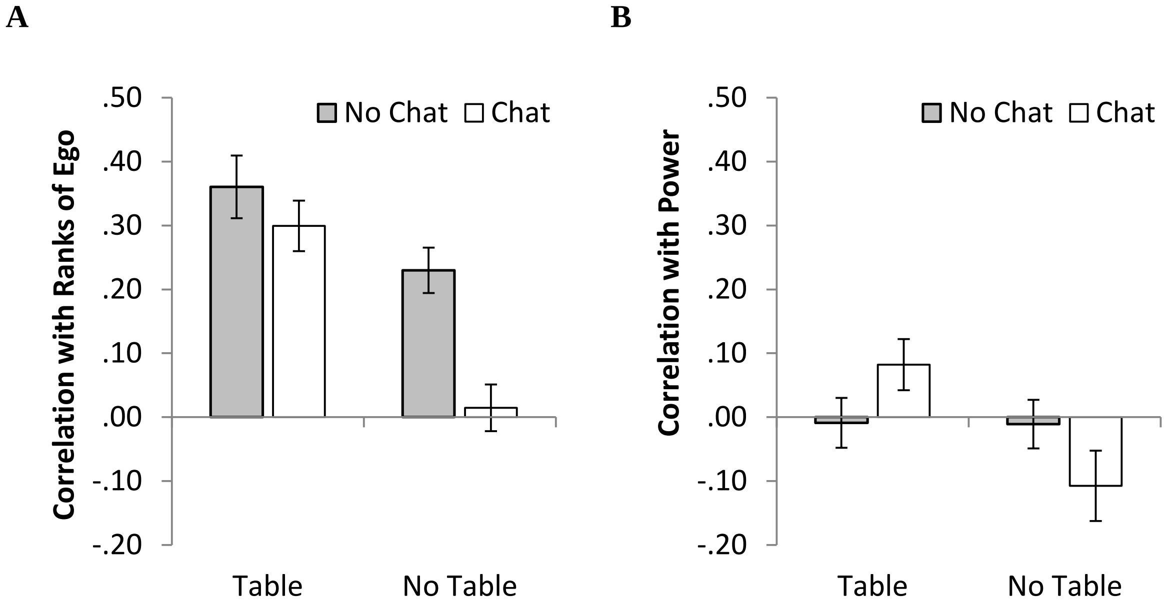

Figure 1. Mean (*SE*) values for alliance-building (A) and bandwagon /egalitarian (B) measures, periods 11-20.

We conducted the same analysis for bandwagon and egalitarian strategies in periods 11-20 (Figure 1, panel B). These values did not significantly differ from zero in the table, no-chat treatment, $t(47) = 0.23$, $p = .82$, or in the no-table, no-chat treatment, $t(47) = 0.28$, $p = .78$. Bandwagoning was significantly greater than zero in the table, chat condition, $t(55) = 2.06$, $p < .05$, and it was marginally significantly less than zero (egalitarian) in the no-table, no-chat treatment, $t(47) = 1.95$, $p = .057$. A 2x2 analysis of variance showed a main effect of table, $F(1, 196) = 4.85$, $p < .05$, no main effect of chat, $F(1, 196) = 0.00$, $p = .95$, and a significant interaction, $F(1, 196) = 4.66$, $p = .03$. In sum, we find little evidence overall for bandwagon or egalitarian strategies. Participants' rankings showed small correlations with other participants' power that differed from zero only in one treatment (chat, table).

Side-taking dynamics

We next examine the dynamics of side-taking strategies over time. Figure 2 shows alliance-building across all 20 rounds. The data show alliance-building increasing in early rounds, presumably as participants better understand the game. Moreover, alliance-building appears greater in the table than the no-table treatment.

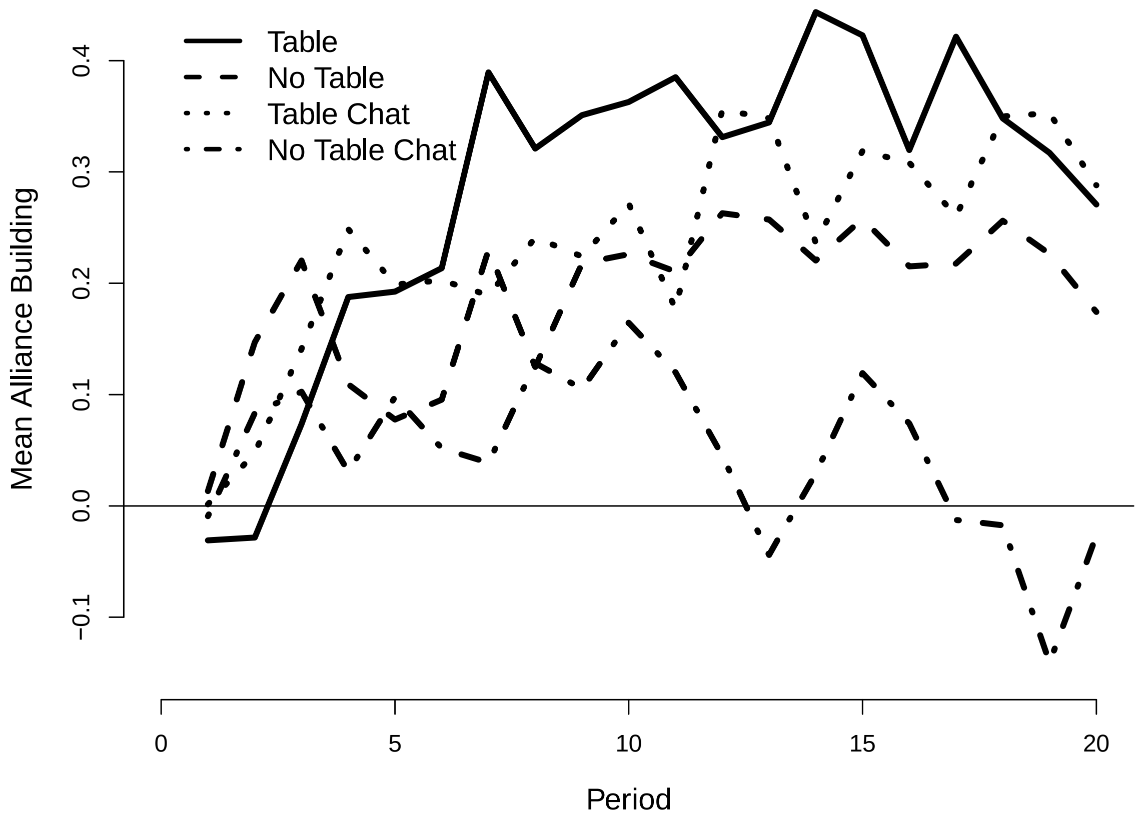

Figure 2. Mean alliance-building in table and chat treatments for all periods 1-20.

These impressions are supported by a regression analysis. We estimate a GLS regression in which the dependent variable is the alliance-building metric and the independent variables are table and chat treatments, 1/period (to model learning effects), and interaction terms. We include random effects for each participant to control for repeated measures, and we cluster standard errors at the session level to control for within-session correlations. In all regressions we estimated an exponential rather than a linear trend because this is consistent with the visual evidence in Figure 1 that the greatest changes occur early in the session.

Table 1 (column 1) shows the results. We find evidence of significant increases in alliance-building over time in the table treatments. A negative and significant coefficient on the chat treatment dummy suggests that chat reduces alliance building, though there is still significant increase over time in the table-chat treatment (Wald test, $\chi^2 = 6.73$, $p = .01$). In general, these data indicate that alliance-building became more common over time in the table treatments.

Table 1 (column 2) also reports the same analysis for bandwagoning and egalitarianism (positive and negative correlations with power, respectively). We find that the main effects of treatment and 1/period are not significant. There is a significant interaction between both the chat and table treatments and 1/period. The coefficient values show that bandwagon strategies became less common over time, except when table and chat were interacted (Wald test, $\chi^2 = 0.84$, $p = .36$).

	(1) Alliance-Building	(2) Bandwagon/Egalitarian
Table	0.181	-0.019
	(0.100)	(0.080)
Chat	-0.206*	-0.165
	(0.091)	(0.156)
1/Period	-0.437	-0.065
	(0.237)	(0.058)
Table*Chat	0.115	0.226
	(0.142)	(0.182)
Table*1/Period	-0.658*	0.546*
	(0.291)	(0.218)
Chat*1/Period	0.489	0.877**
	(0.302)	(0.332)
Table*Chat*1/Period	-0.133	-0.990*
	(0.437)	(0.429)
Constant	0.246**	0.006
	(0.064)	(0.041)
Observations	4000	4000
Wald Chi-Sq.	62.96	48.46

* $p < .05$, ** $p < .01$

Clustered standard errors in parentheses

Table 1. GLS Regression Analysis of Ranking Decisions, All Treatments. Column (1) shows the effects of treatment status and 1/Period on the correlation of own ranks with others' ranks of ego at time *t-1*. Column (2) shows the effects of treatment status and 1/Period on the correlation of own ranks and others' power at time *t-1*.

Best friends and enemies

We next investigate which ranks were of particular focus in alliance formation. We expect alliance-building to lead to more mutual ranks in which ego's rank of alter is the same as alter's rank of ego because alliance-builders do not tolerate discrepancies in support. We examined the percent of ranks that are mutual for ranks 1 through 7 (Figure 3). Chance is 12.5% mutual (1/8). Rank 1 had the greatest percentage and was greater than chance in all treatments. This is consistent with the idea that "best friends" are distinctive compared to lower ranks (DeScioli et al., 2011). The table treatment showed increased mutual ranks compared to the no-table treatment. There is also a striking effect of the table treatment on rank 7 who are always-opposed enemies. In the no-table treatments, rank 7 is not differentiated from ranks 2-6, but in the table treatments, rank 7 is the second most mutual after rank 1. This shows that greater information about ranks creates mutual enemies. In short, alliance-building focuses particularly on best friends (rank 1) and next on enemies (rank 7) but only when there is sufficient information about how other players rank ego.

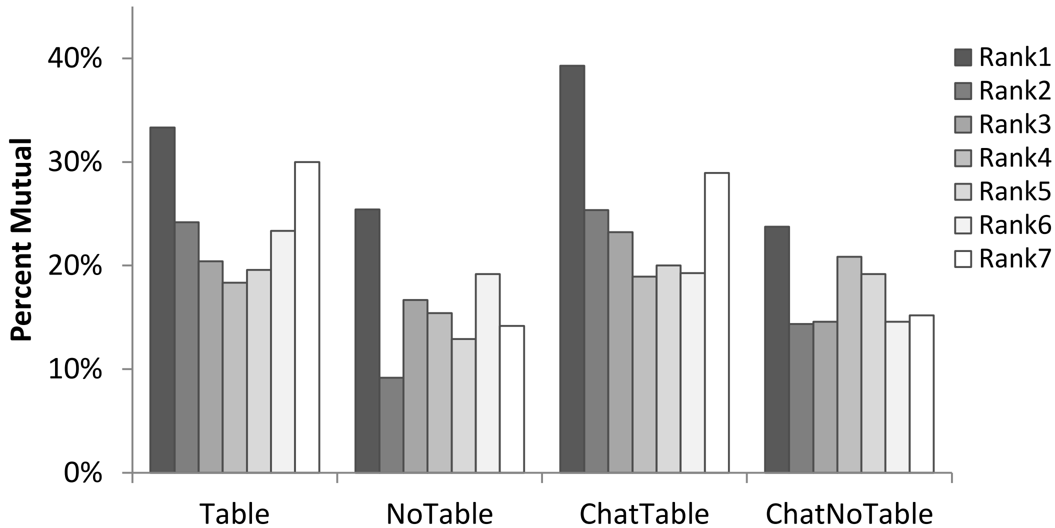

Figure 3. Percent mutual for each rank level, periods 11-20.

The content of chats

We identified at least three strategies discussed by participants in chats. The first strategy is rank pacts in which two players agree to support each other. For instance, the second chat entry in Session 1 was "I will support you if you support me." In Session 7, Person H wrote, "@Person B: I will keep support you if you still help me," and Person B responded, "ok, I got your back H." Rank pacts also specified particular ranks such as "1 for 1?" "2 for 2?" and "yo, F, I'll put you 3rd if you put me in your top 4." We observed these dyadic rank pacts in roughly half of the sessions.

The second strategy is forming teams in which multiple individuals all support teammates over outsiders. In Session 2, Player E wrote, "Attention DEFGH. Let's make some money. Rank each other highest," and later, "good job DEFGH coalition." In Session 5, Player E wrote, "A, B, F? Wanna like team up?" In Session 6, player H wrote, "OK, if we form a team of five and always support each other we will come out well." We observed chats about forming teams in three of the thirteen chat sessions.

The third strategy is rotating ranks in which all eight players choose the same rankings and then rotate ranks together each round. For example, in Session 3 a player wrote, "Let's all basically support the same people. Say EFGH for 4 rounds and then switch. We will minimize the losing costs." In Session 4, a player wrote, "If we all rank the same way, there will never be a tie. Then we just switch the order next round." In Session 5, a player wrote, "what if we all chose the same? and then shuffled every round?" In Session 6, a player wrote, "we all just need to agree to do the same rankings every round. I'll do abcdefgh this round. And then rotate through the list." In Session 11, a player wrote, "What if we all choose 4 people to support this round?

Then the other 4 we will support next round, then every second round everyone will win 1.5." We observed discussion of coordinated rank rotation in roughly half of sessions.

The fact that participants invented rank rotation schemes shows that language allowed participants to develop a novel and unanticipated side-taking strategy. Although unexpected, a rotation strategy fits with previous theories about how bystanders can use dynamic coordination to choose sides in disputes (DeScioli & Kurzban, 2013).

Rank rotation and power differences

We examined the consequences of the rank-rotation strategy by looking at the mean power difference across all possible (28) fights in a group. When participants agree on a common ranking, they will choose the same side leading to large power differences in fights (7 vs. 1). Figure 4 shows the mean power difference for chat sessions. Sessions 4, 6 and 11 discussed rank rotation in the chats and they show greater mean power differences than the other sessions. In contrast, some groups such as Sessions 3 and 10 discussed rank rotation but did not show substantial success in agreeing on ranks. The successful sessions (4, 6, and 11) had a mean power difference of M = 3.91 which is roughly two times greater than the other sessions, M = 1.99. Moreover, the range of the rank-rotation sessions, M = 3.14 - 4.39 did not overlap with the range in the other ten sessions, M = 1.68 - 2.39. Similarly, unanimous side-taking occurred in M = 39% of fights in rank-rotation sessions, nearly ten times greater than in the other sessions M = 4%. The range of unanimous side-taking in rank-rotation sessions M = 25% - 51% did not overlap with the other sessions, M = 2% - 7%. Finally, costly ties occurred in M = 11% of fights in rank-rotation sessions, which is about three times less than in the other sessions, M = 29% (which approximated chance, 31% ties, see simulation data, Kimbrough & DeScioli, 2015). The range of tied side-taking in rank-rotation sessions *M* = 7% - 18% did not overlap with the other sessions, *M* = 23% - 35%. The data on ties shows that three out of thirteen groups successfully used rank rotation to decrease the chance of ties and fighting costs. Finally, the three successful rank-rotation sessions also differed markedly from sessions without chat. The no-chat sessions had mean power differences with a range of *M* = 1.51 – 2.39, unanimous side-taking with a range of *M* = 1% - 6%, and tied side-taking with a range of *M* = 23% - 38%. These ranges are non-overlapping with the values observed for the three rank-rotation sessions in the chat treatment.

These data show that chat created the potential for some groups to invent correlated rank-rotation strategies. Three groups successfully implemented rank rotation and the result was a marked increase in power differences and unanimous side-taking along with a decrease in the frequency of costly ties.

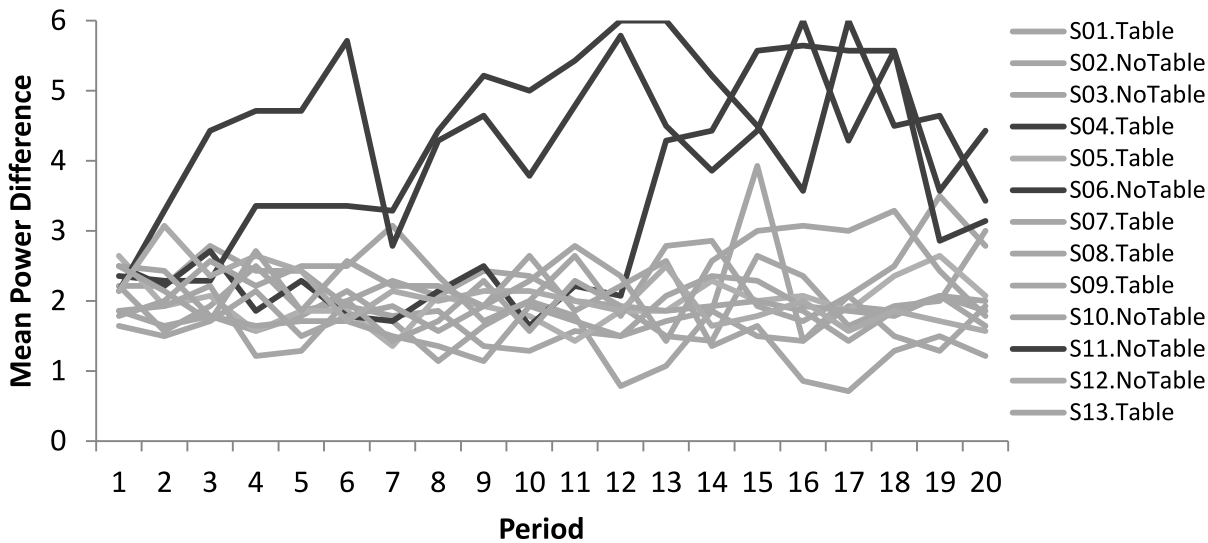

Figure 4. Mean power difference in fights for sessions in the chat treatment. Groups that successfully agreed on rank rotation are shown in black and other groups are shown in gray.

Discussion

We find evidence that people are natural alliance builders. When confronted with real side-taking problems, participants spontaneously supported group members who supported them in previous fights. In contrast, participants did not tend to support or oppose powerful players. The information treatment shows that participants used additional knowledge of other players' loyalties to facilitate alliance formation but not bandwagon or egalitarian strategies. Chat communication sometimes suppressed alliance-building by allowing participants to discuss not only dyadic rank pacts but also teams and rotating ranks in the group.

These observations show that people readily form alliances even in the minimal social environment created by the side-taking game. Participants were depersonalized without names, identities, prior relationships, or previous entrenched interests. Nonetheless, a relatively simple game consisting of pairwise disputes and bystanders who choose sides was sufficient to quickly evoke alliance formation within a few rounds of the game. Moreover, participants created not only minimal groups (Tajfel & Turner, 1979) with simple boundaries but rather interlaced alliance networks of divided loyalties. To do so, they had to track information about other players' rankings in an unfamiliar context of a stylized economic game.

The absence of bandwagon and egalitarian strategies in the present experiment does not necessarily imply that people do not use these strategies. Instead, it shows that a minimal side-taking environment is not enough to elicit these behaviors. Future research can examine which additional social elements are needed to observe bandwagon and egalitarian strategies. For instance, presenting a list of all players' cumulative earnings might facilitate ranking loyalties based on power. Or, increasing the fighting cost might cause participants to bandwagon to coordinate their decisions (Van Vugt, 2006). Varying the communication technology is also likely to affect players' strategies. The current chat mechanism showed all chats to everyone in the group. Private chats might facilitate egalitarian conspiracies against powerful individuals or smaller alliances that destabilize group-wide agreements.

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