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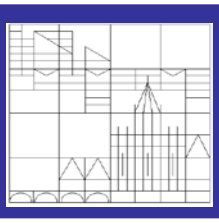

Communication and conflict management

Gerald Eisenkopf

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Abstract

The paper studies an experimental conflict in a repeated game and tests the robustness of communication as an *intermediate* conflict resolution instrument. The results show a strong and persistent impact of communication. Most conflict parties refrain from conflict expenditures even after the opportunity for communication has expired. Third party involvement with punishment options do not enhance this effect while the indivisibility of the contest prize reduces it. The initial intensity of the conflict has a small but long-term negative impact on conflict resolution.

Keywords: Conflict Resolution, Experiment, Communication, Social Preferences

JEL Codes: C92, F5, H8

1. Introduction

In most conflicts people invest resources to gain economic prizes. Some people even spend seemingly excessive amounts in order to prevent their opponents from gaining that prize (Eisenkopf and Teyssier 2013, Sheremeta 2013, Dechenaux, Kovenock and Sheremeta 2014). Since conflict expenditure does not produce any value and may impose a negative externality on third parties, it is desirable to resolve such conflicts. While communication between conflict parties reduces such expenditure in general (Harbring 2006, Cason, Sheremeta and Zhang 2012, Leibbrandt and Sääksvuori 2012, Eisenkopf and Bächtiger 2013) it is clearly not an omnipotent resolution instrument. Hence it remains important to disentangle factors which may jeopardize the effectiveness of communication. Since 'real' conflict data suffer from selection and endogeneity problems and typically do not allow for a causal identification of such factors (Abbink 2010), I rely on experimental data to address the research question.

In the experiment two opposing parties are locked into a conflict situation, more specifically a variation of the Tullock contest (Tullock 1980).[1] After the conflict has started a window of opportunity arises for some contestants. They can communicate with each other in order to settle the conflict. In some cases a third party joins the communication and may even be able to punish misbehaving contestants. However, this window of opportunity closes eventually and the contestants fall back into the initial conflict situation. The question is now ro which extent communication can reduce the conflict expenditure, whether any such reduction is stable once the opportunity for communication is gone and whether third party intervention might enhance the impact of direct communication.

The experiment captures three typical problems of conflict resolution processes. The novel contribution of the paper is that it shows precisely how these features influence the impact of communication as a conflict resolution device. First, conflict *resolution* processes face temporary constraints. They occur only after initial conflict expenditures. This property distinguishes resolution from conflict *prevention* (Ramsbotham, Miall and Woodhouse 2011). The distinction matters because the concept of reciprocity suggests that an initial conflict history induces some contestants to retaliate against the opponent instead of seeking an accommodating agreement. As

[1] The Tullock contest is arguably the most widely used model for the experimental study of conflicts (Abbink 2010, Dechenaux, Kovenock and Sheremeta 2012). It resembles key features of theoretical conflict models in political sciences (Kydd 2006, Favretto 2009, Sambanis and Shayo 2013). The contestants can invest resources in order to increase the probability to win a prize. Any increase in investment simultaneously reduces the probability of the opponent to win the prize in the specific round.

mentioned above, several experimental studies have analyzed the impact of communication in conflicts[2] but the literature provides no direct information on how such conflict experience influences the impact of communication. The seminal paper by Isaac and Walker (1988) on the impact of communication on voluntary contributions observes that people tend to fail to agree on an efficient outcome if they provided low contributions before the communications started. As an additional temporary constraint, contestants talk with each other but eventually go home. Evidence from experiments on communication in a Bertrand oligopoly suggests a limited long-term effect (Fonseca and Normann 2012). Meanwhile Isaac and Walker (1988) observe that voluntary contributions deteriorate significantly from group optimality after communication has ended.

The temporary constraints also relate to the second typical feature of conflict resolution. Any accommodating agreement cannot be imposed and enforced by a powerful authority such as a court of law.[3] This paper studies whether third party interventions with targeted sanctions can replace such arbiters and support 'pure' communication. Such third party interventions have received little attention in the relevant experimental literature even though they play a prominent role in many studies on interpersonal conflict resolution[4]. Eisenkopf and Bächtiger (2013) study the impact of third party interventions on the *prevention* of common pool resource exploitation. They find that communication and third party punishment act as complementary inputs which in combination deter almost all inefficient and unilateral uses of common pool resources.

As a third feature of conflict resolution processes, the paper takes into account that it is particularly difficult to make accommodating agreements between conflict parties when prizes are indivisible.[5] Some theories of (static) social preferences explain conflicts and their resolution as a coordination problem. Inequity averse people (as in Fehr and Schmidt (1999)) try to achieve payoff-symmetric outcomes in binary conflicts. In symmetric conflicts with multiple prizes this implies that they want to match the expenditure of the opponent. Such a preference yields multiple

[2] See also the survey in Dechenaux et al. (2014)

[3] The first Minsk Protocol from September 2014, an agreement to halt the war in the Donbass region of Ukraine, provides a recent example for such an incomplete and unenforceable contract. Even a subsequent additional memorandum did not eliminate ceasefire violations and clarify different interpretations of the agreed text.

[4] The interest in third party interventions is most obvious in political sciences (e.g. Bercovitch, Anagnoson and Wille 1991, Carnevale and Choi 2000, Greig 2001, Wall, Stark and Standifer 2001, Smith et al. 2002, Kydd 2003, Greig 2005, Kydd 2006, Svensson 2007, Favretto 2009, Goltsman et al. 2009, Kydd 2010, Ramsbotham et al. 2011) but other disciplines like psychology or legal studies have also taken an interest in the topic (Carnevale and Pruitt 1992, Conlon, Moon and Ng 2002, Subourne 2003, Mawritz, Folger and Latham 2014).

[5] The fact that the Western Wall and the Al Aqsa Mosque are at the very same location is a major complication in the negotiations about the future status of Jerusalem amid the entire Israel—Palestinian peace process. Since these holy sites of Judaism and Islam are inseparable each party wants to exercise control about them.

equilibria and communication can help the contestants to coordinate on the most efficient equilibrium, i.e. the sharing of the prizes at minimum expenditure. However, once prizes are non-divisible and people care about ex-post outcomes such coordination is not feasible.

The results show that contestants typically cannot achieve a cooperative outcome without communication. The level of pre-communication conflict intensity has a statistically significant adverse impact on subsequent conflict resolution. However, in most conflicts communication reduces expenditure to a minimum level where it remains until the very end of the experiment, i.e. well after the end of the any verbal interaction. Subjects agree on a minimum effort level which maximizes the aggregate income and ensures equality in (expected) incomes. Conflict resolution is more likely to fail in the second setting in which one large prize does not allow for equality of ex-post incomes. Third party interventions do not improve on this outcome even with a punishment option. Overall, the results show that temporary constraints, contract incompleteness and the indivisibility of prizes provide restrictions on the effectiveness of communication as a conflict resolution device. Nevertheless, communication frequently resolves conflicts even in the face of these restrictions. The next section describes the experiment in greater detail and section three provides procedural details. Section 4 provides the behavioral predictions while section 5 documents the results and section 6 concludes.

2. The Experimental Design

In the experiment, I induced conflict via a Tullock contest (Tullock 1980). Two players (call them A1 and A2) played this contest with each other for 50 rounds. At the beginning of a round each player A received an endowment of 1000 points (= .5 €) and could invest these points as conflict expenditure. Any points not invested were added to the player's point balance. As soon as every contestant had made a decision, the computer determined according to the probabilities defined by investment levels which of the two players would win the round. The probability of a player winning the round was equal to the total number of points invested by her, divided by the sum of points invested by both players A. If no player A had invested any points, the winning probability was 50% for each player. After the lottery each player A was informed about whether she had won or lost. Each player A also learned about how many points the other player A had invested in that round. Of course, participants did not know the identity of their opponent(s). The experiment then proceeded to the next round.

Each contest also affected a third party (Player T). This player T was attached to two contests simultaneously and received 1500 points per round. The investments of the players A in both contests reduced this endowment. More specifically, 4 points of investment by any player A reduced T's payoff by 1 point. Hence, player T's payoff was equivalent to the average income of the involved four players A in each round. During the experiment, however, player T only learned about the decisions and their payoff consequences from one contest while she did not learn anything about the other contest until the end of the experiment. This procedure guaranteed a behavioral independence between the two conflicts.

The experiment followed a 2 × 4 design with two conflict settings and four treatments within each setting. In the first ten rounds (out of 50) the subjects engaged in the conflict and knew about their specific setting. The two settings were identical in everything but the prize allocation procedure.

- In the *Multiple Prizes Setting* a player received a prize of 1000 points each time she won a round. The prize money was added to the winner's point balance at the end of the round.
- In the *One Prize Setting* two players competed for a single prize of 50,000 points. More specifically, a computer program determined randomly at the end of the experiment which of the 50 rounds was relevant for the prize allocation. The winner of that specific round received the 50,000 points. In all other rounds the respective winner received no prize at all. Of course, at the end of a round each player A was informed about whether she had won or lost that specific round.

At the end of the 10th round the subjects also learned about their specific treatment. The four experimental treatments had the same characteristics in both settings. They varied the conflict management mechanisms in rounds 11-25. Three of the four treatments allowed for pre-play communication in each round. During this communication stage the involved participants could send free-form messages to each other. All communication took place via onscreen chat boxes and lasted for 60 seconds per round. All participants were told not to reveal their identity. The four treatments differed as follows:

- In the *Communication Treatment* only the contesting players A could chat with each other in rounds 11-25. Player T suffered from any investment but was not involved in the interaction. Player T did not receive any information about the decisions during the entire experiment.

- In the *Mediation Treatment* the contesting players A and player T could chat with each other in rounds 11-25. Player T also received information about the decisions of the two players A in this contest in each of the 50 rounds.
- In the *Punishment Treatment* the contesting players A and player T could chat with each other in rounds 11-25. Moreover, player T could arbitrarily take points away from any of the two players A at the end of each of these rounds. The withdrawal of one point implied a cost of .2 points to player T. Again, player T received information about the decisions of the two players A in this contest in each of the 50 rounds.
- In the *Control Treatment* the contesting players A could NOT chat with each other in rounds 11-25. They had the possibility to write about their behavior while subjects in the other treatments chatted with each other. As in the Communication Treatment, the relevant player T suffered from any investment but did not receive any information about the decisions during the entire experiment.

Table 1 shows the timeline of the two settings and the treatments. Within a specific setting all subjects received identical instructions about the experiment and its four treatments before the experimental session started (see appendix). They learned about their specific roles (i.e., player A or T) immediately before round 1. During the first ten rounds player T was a passive observer in some conflicts but players A did not know whether they were observed. Players A learned about the assigned treatments and third party involvement in round 11. A Player T also learned at this time whether she was able to punish a player A in the contest in which she was actively involved. As mentioned above, the players T never learned about the decisions and the specific treatment conditions in the other contest that affected her payoff. They could only infer that the conflict was from either the Control or the Communication Treatment. From round 26 onwards the game resumed as in the first ten rounds. Again, player T was a passive observer in some conflicts (the same as in the first rounds) but players A now knew whether they were observed or not.

Table 1: The experimental design across the 50 rounds

Settings	Rds. 1-10		Rounds 11-25	Rds. 26-50
Multiple Prizes (1000 points per round) or *One Prize* (50,000 points in a randomly chosen round)	No Communication	After Round 10: Treatment Revelation	*Control*: No Communication. T cannot observe decisions	No Communication
			Communication: Communication between the two contestants. T cannot observe decisions.	
			Mediation: Communication between the two contestants and T. T observes decisions.	
			Punishment: Communication between the two contestants and T. T observes decisions and can punish.	

Procedure

I conducted 12 sessions with a total of 273 subjects[6]. All sessions took place between January and December 2014 at the Lakelab at the University of Konstanz. Subjects were students from the University of Konstanz who were recruited with the software "ORSEE" (Greiner 2004). The experiments were computerized with the software "z-Tree" (Fischbacher 2007). Each subject participated in one of the treatments only. They received written instructions and comprehension questions that had to be answered correctly before the experiment could start. An English translation of the instructions is included in Appendix A of this paper. The sessions lasted approximately 120 minutes and subjects received on average 34.50 Euro. All subjects received their payment privately at the end of their session.

[6] I do not include two additional subjects in the analysis. One subject in the Communication Treatment felt sick during the experiment and asked to leave the lab. She and the other subject involved in the specific conflict have been excluded from the sample. I also informed the affected Third Party about the leaving person. However since she did not mention this event in her discussions in her chat room correspondence in the other conflict in the Mediation Treatment I kept these subjects in the sample. All other participants in the session were told that their outcomes were not affected by the leaving person.

3. Behavioral Predictions

The experimental game yields a unique equilibrium across all settings, treatments and rounds if we assume common knowledge that all players are rational, risk-neutral and purely selfish. In this case, any communication represents cheap talk and players T will not punish. More precisely, the utility function of a player A_i (with $i \in \{1,2\}$) with such preferences in the Multiple Prizes Setting in any round t is as follows:

$$U_{A_i,t} = 1000 + \frac{c_{it}}{c_{it} + c_{jt}} 1000 - c_{it} \tag{1}$$

Player A_i thus wins the prize of 1000 points with a certain probability, which depends on her own cost of investment (c_{it}) in that round relative to the investments of both contestants ($c_{it} + c_{jt}$). The equilibrium investment in the last round is therefore 250 points for each contestant. Via backward induction we obtain the same prediction for any of the 50 rounds. The One Prize Setting yields the same stage game equilibrium. The expected prize per round is $\frac{1}{50} \times 50{,}000 = 1000$.

However, the literature review in the introduction already suggested that such a prediction does not capture the benefits of communication. Inequity aversion, as modelled in Fehr and Schmidt (1999), provides an explanation how communication acts as a coordination device in conflicts. In line with Fehr and Schmidt (1999), an agent in the conflict game has the following utility function in the stage game:

$$\begin{aligned} U_{A_i} = 1000 + \frac{c_{it}}{c_{it} + c_{jt}} 1000 - c_{it} - \left(1 - \frac{c_{it}}{c_{it} + c_{jt}}\right) \alpha \left(1000 - c_{jt} + c_{it}\right) \\ - \left(\frac{c_{it}}{c_{it} + c_{jt}}\right) \beta \left(1000 - c_{it} + c_{jt}\right) \end{aligned} \tag{2}$$

with $\alpha \geq \beta$ and $1 > \beta \geq 0$. I assume common knowledge about identical α and β across agents and rounds. People dislike (with intensity α) if they are worse off than their competitor. They also dislike (with intensity β) if they are better off. Appendix B in Herrmann and Orzen (2008) provides a theoretical analysis of this stage game. The symmetric equilibrium investments are

$$\frac{(1 + \alpha - \beta)500}{(2 + \alpha - \beta)} = {c_{jt}}^* = {c_{it}}^*.$$

Hence, Fehr-Schmidt preferences increase conflict expenditure. If communication acts only as a coordination device it does not influence this outcome.

However, the stage game analysis is inappropriate for the analysis of behavior in the Multiple Prizes Setting. In this setting subjects compete for relatively small prizes in each round. If α and β are sufficiently large, this setup provides a sufficient condition for multiple equilibria across rounds. In this case the participants want to have equal aggregate monetary payoffs at the end of the experiment. They know that if they make the same investments, each of them wins the prize in about half of all rounds. In this case communication allows people to coordinate on zero investments, the pareto-dominant equilibrium that ensures equal incomes. With static preferences, such coordination is stable even once communication is not possible anymore. An alternative strategy is taking turns (Leibbrandt and Sääksvuori 2012). Both players alternate between asymmetric investments of 0 and 1. This minimal investment ensures that they have exactly the same aggregate payoff after 50 rounds at a negligible expenditure.

A similar reasoning also applies to the One Prize Setting as long as people care about equality of opportunities (or expected outcomes) rather than equality of actual outcomes. Since the Multiple Prizes Setting allows for both types of equalities, the impact of communication as a coordination device should be stronger in this setting.

Hypothesis 1 (Coordination with static Fehr-Schmidt preferences):

1. Once communication is possible, conflict expenditure decreases.
2. The effects persist after round 25 once communication is not possible anymore.
3. The effects are stronger and more likely to persist in the Multiple Prizes Setting than in the One Prize Setting.

Within each setting the treatments vary the degree of social pressure. The Mediation Treatment includes the third party into the communication process. This may induce the conflict parties to take the externalities of their behavior more strongly into account. The literature on the sustainability of cooperation[7] does not suggest that this effect is particularly strong, unlike the additional sanctioning mechanism of the third party in the Punishment Treatment. This mechanism (and the threat of using it) provides for a rather extreme case of social pressure. Since it lasts only from round 11 to round 25, its impact should also decline afterwards.

[7] See, for example, the survey of Chaudhuri (2011).

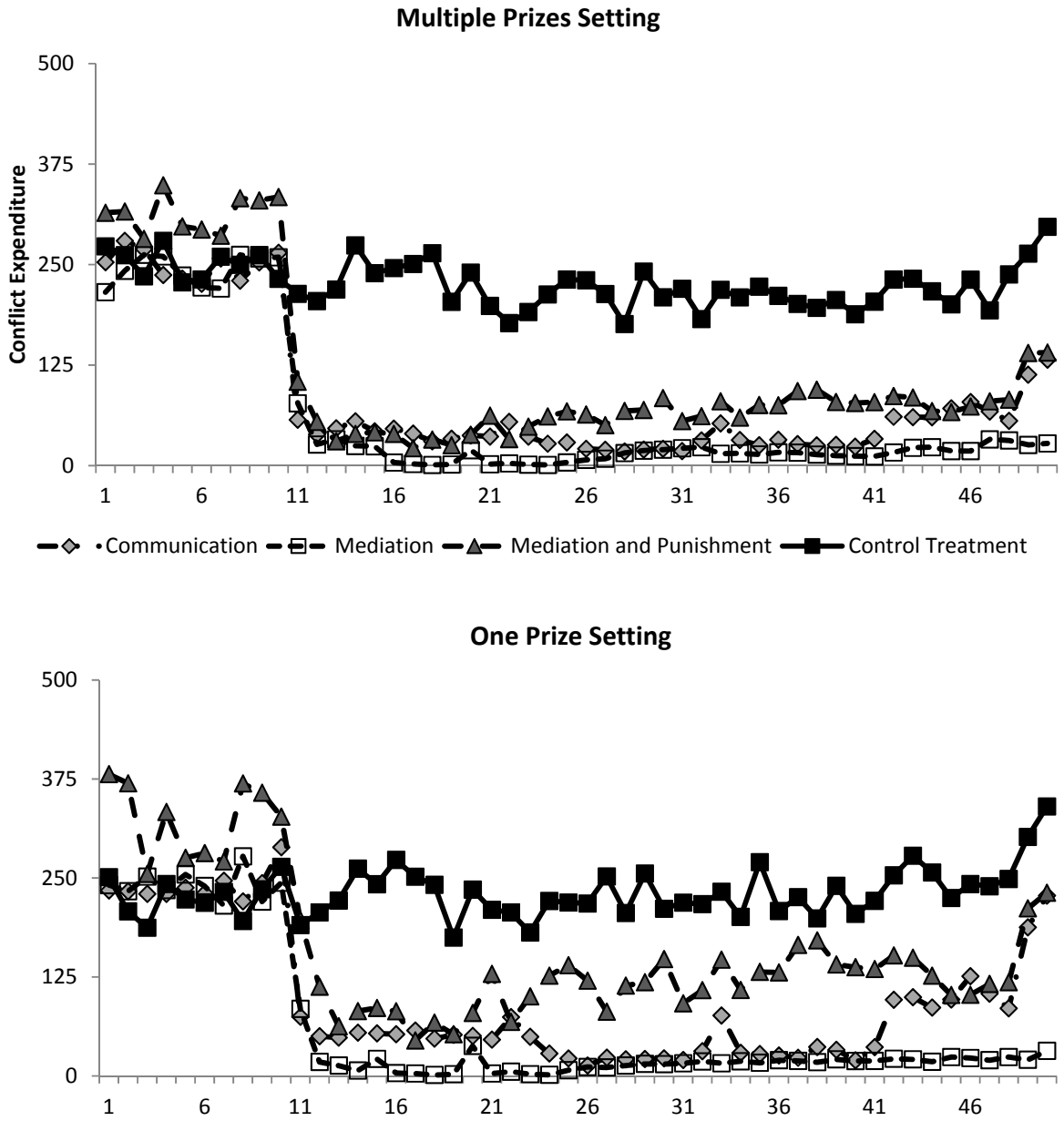
Hypothesis 2 (Treatment differences in preference alignment). Between round 11 and round 25, the expenditure levels are ordered as follows across the treatments:

$$\text{Control} > \text{Communication} \geq \text{Mediation} > \text{Punishment}.$$

4. Results

The expenditure level of the contestants over time forms the key variable for the analysis. Figure 1 shows the development of this expenditure across the different settings, treatments and the 50 rounds. Note that in 6 out of altogether 109 conflicts, the contestants managed to resolve the conflicts on their own in the first 10 rounds. I ignore these cases in the subsequent treatment comparisons.

Figure 1: Average conflict expenditure across settings, treatments and over time



The most prominent observation in Figure 1 is the steep decline in expenditure in round 11 across all treatments except the control treatment. Once communication is possible, the expenditure level decreases well below the Nash equilibrium. Note that the decrease is highly significant ($p <$ .01) in all treatments and settings. This holds both for comparisons between the resolution treatments and the respective control treatments as well as for intragroup comparisons between rounds 1-10 and rounds 11-25, using Wilcoxon rank-sum tests and signed-rank tests respectively

to compare the average conflict expenditure in a pair of contestants across the respective time frame. Rank-sum tests also show that the differences between the various resolution treatments are not significant. This holds for comparisons of different treatments within the same setting as well as for comparisons of the same treatment across settings. Hence, I will pool the different treatments for the subsequent analysis. Across all resolution treatments, the expenditure in rounds 11-25 is slightly higher in the One Prize Setting than in the Multiple Prizes Setting.

In rounds 26-50, contest expenditure increases again in the resolution treatments. Compared to rounds 11-25 the increase is significant in the One Prize Setting but not in the Multiple Prizes Setting, according to the signed-rank test. A comparison of average expenditure at contest level in rounds 26-50 with rounds 21-25 only (which ignores any expenditure in the settlement process) yields significant differences in both settings (both p-values $< .1$). However, the average expenditure level is still low in comparison to the first ten rounds

Result 1:

1. Once communication is possible, conflict expenditure decreases.
2. The effects persist after round 25 once communication is not possible anymore.
3. The effects are equally strong in both settings but they are more likely to persist in Multiple Prizes Setting than in the One Prize Setting.
4. Third party interventions with or without punishment options do not provide an additional effect.

The first two parts of this result confirm the respective two statements in Hypothesis 1. The third part of this result only provides qualified support for the third statement in Hypothesis 1 while the fourth part contradicts Hypothesis 2.

Now the focus is on the difference between the Multiple Prizes Setting and the One Prize Setting and why Multiple Prizes lead more often to successful conflict resolution. To do so I disentangle different resolution patterns for the individual conflicts. Table 2 provides an overview of average and median expenditures as well as successful conflict settlements across settings and treatments, differentiating for the levels before, during and after the specific interventions. I consider a conflict as (temporarily) settled if the average expenditure in the last five rounds of the treatment phase (i.e., rounds 21-25) or the entire experiment (i.e., rounds 46-50) is smaller or equal

to one. Most conflicts see a long-term settlement, i.e. successful conflict resolution. However, the One Prize Setting results in more unresolved conflicts. In these unresolved conflicts the expenditure levels can be very high. This explains why the differences between the different resolution treatments are not significant.

Table 2: Average contest expenditure across treatments

Settings	**Treatments**		**Rounds 1-10**	**Rounds 11-25**	**Rounds 26-50**
Multiple Prizes Setting	Control	Mean	275.13	226.5	197.8
		Median	283.6	236.5	169.6
		Settlements /N	1/14	1/14	1/14
	Communication	Mean	260.4	31.8	29.0
		Median	250,8	1	1
		Settlements /N	0/14	13/14	10/14
	Mediation	Mean	246.4	16.2	18.1
		Median	213.3	1	1
		Settlements /N	0/14	14/14	8 / 14
	Punishment	Mean	305.6	2.2	29.3
		Median	289.4	1	1
		Settlements /N	1/14	14/14	12/14
One Prize Setting	Control	Mean	225.9	222.5	238.7
		Median	182.5	223.3	227.3
		Settlements /N	1/13	1/13	1/13
	Communication	Mean	239.5	51.2	63.0
		Median	108.5	1	60.2
		Settlements /N	0/13	9/13	4/13
	Mediation	Mean	241.3	14.4	19.4
		Median	270.4	1	1
		Settlements /N	2/14	12/14	9/14
	Punishment	Mean	322.2	95.9	134.8
		Median	285.5	1	2
		Settlements /N	1/13	9/13	6/13

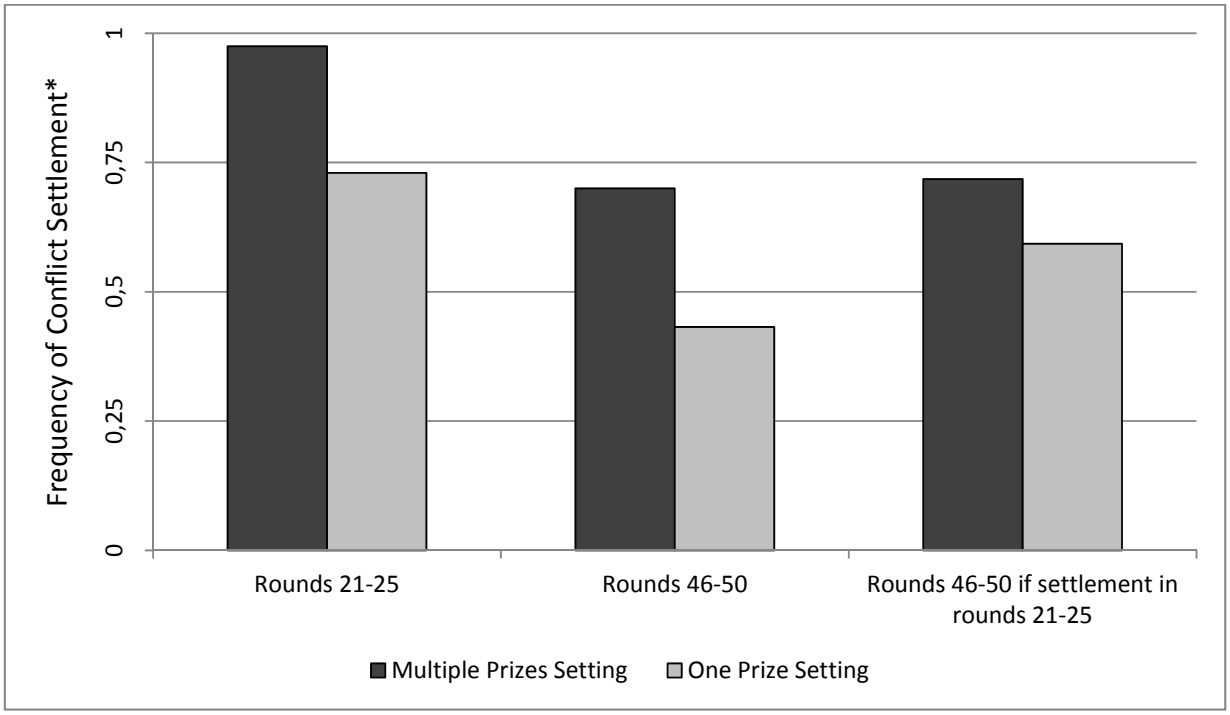
A conflict is (temporarily) settled if average expenditure in rounds 6-10 / 21-25 / 46-50 is smaller or equal to 1.

Note that the threshold "≤ 1" in Table 2 for conflict settlement takes into account that some groups agreed on taking turns such that one contestant provided a positive investment and the other one an investment of zero before changing the roles in the following round. That occurred more frequently in the Multiple Prizes Setting than in the One Prize Setting (15% vs 5.4% for all conflicts in rounds 26-50). A key motive for this difference is that the role-shifting guarantees equal payoffs with multiple prizes but not with a unique prize.

Figure 2 combines the data on conflict settlements in the three treatments with communication across the two settings.

Figure 2: The share of settled conflicts across the different settings and stages of the experiment

(Without observations from the Control Treatment and conflicts with settlements in round 1-10)



* A conflict counts as (temporarily) settled if the group expenditure in rounds 21-25 / 46-50 is smaller or equal to 1.

The first pair of bars in Figure 2 shows that all but one conflict in the Multiple Prizes Setting (or 97.5%) are settled in rounds 21-25. In the One Prize Setting, 73.6% of the conflicts are at least temporarily settled. This is still an impressive number but a Fisher exact test reveals that the One Prize Setting contains more unsettled conflicts (p <.05). The second pair of bars shows that, at the end of the experiment, 70% of all conflicts in the Multiple Prizes Setting and 42.3% in the One Prize Setting are settled. Again, this difference in settlement rate is significant according to the Fisher exact test (p <.05). Note that all conflicts with a settlement in rounds 46-50 also saw a settlement in rounds 21-25. These settlements remained permanent throughout rounds 26-50. Restricting the comparison of final settlements to those conflicts that also had seen a settlement in rounds 21-25 does not show significant differences anymore (72% vs 59%, as the third pair of bars in Figure 2 shows).

Result 2: Communication is a successful long-term coordination device. The equalization of *expected* payoffs is sufficient for permanent conflict resolution in about half of all cases. The opportunity to achieve approximately equal *actual* payoffs enhance the effectiveness of communication.

Results from a quantitative content analysis of the chatroom communication support these main results. The analysis follows the approaches in previous contest studies like Cason et al. (2012), Leibbrandt and Sääksvuori (2012) or Eisenkopf (2014). The procedure of the analysis and descriptive statistics are described in Appendix II in greater detail. Most groups agree already in round 11[8] on minimal investments and there are few incidents of critique or insulting comments. However, in the Multiple Prizes Setting the contestants are much more likely to agree on taking turns than in the One Prize Setting. Interestingly, only about 10% of mediators actually threaten with punishment if they can impose sanctions (see below).

The impact of conflict intensity on resolution

Now the focus turns on how the first ten rounds in the first experiment influence the subsequent outcomes of conflict resolution. Table 3 shows the outcome of four random-effect GLS estimations in which conflict intensity in the first rounds (Group Input rounds 1-10) is a predictor for subsequent investments. All models focus on the three treatments with communication possibilities, using the communication treatment as benchmark. They control for the different treatments and settings. The results are robust to changes in these control variables, e.g. interaction terms between settings and treatments.

In Model 1 the dependent variable is the conflict expenditure in the treatment phase (rounds 11-25). It shows that the initial conflict history has a significant impact on the subsequent conflict resolution outcome. More intense conflicts are more difficult to resolve. Model 2 shows that this also holds for those conflicts which eventually achieve a (temporary) resolution. Of course, the coefficient is much smaller than in the first model because the conflict parties eventually get to the most efficient expenditure levels. While the coefficients for the conflict history appear rather small they are surprisingly persistent as Models 3 and 4. In Model 3, the dependent variable is the conflict expenditure in the post-treatment phase (rounds 26-50). The impact of conflict history is essentially

[8] Therefore both the number and the length of messages decreases across rounds.

the same as in model 1. Model 4 uses the same dependent variable as Model 3 but is restricted to those conflicts that achieve a temporary resolution in rounds 21-25 (like Model 2). The weakly significant impact in this very conservative estimation suggests that using communication as a conflict resolution device is more difficult in more intense conflicts.

Result 3: Initial conflict intensity has a significant negative impact on subsequent reduction in conflict expenditure.

Table 3: The impact of conflict history on treatment and post-treatment expenditure

	Model 1		**Model 2**		**Model 3**		**Model 4**	
Dep. Var.:	Input rounds 11-25		Input rounds 11-20		Input rounds 26-50		Input rounds 26-50	
Sample	All conflicts with communication		Settlement in rounds 21-25		All conflicts with communication		Settlement in rounds 21-25	
Group Input rounds 1-10	.164**	(.078)	.036**	(.018)	.153**	(.066)	.046*	(.027)
One Prize Setting	37.273*	(20.920)	-3.611	(4.984)	46.927**	(21.398)	11.802	(12.468)
Mediation	-25.362	(22.392)	17.201**	(7.278)	-26.651	(18.906)	-4.534	(13.154)
Punishment	-4.385	(30.836)	-3.591	(3.459)	24.823	(29.049)	2.606	(16.607)
Round	-1.688***	(.590)	-2.760**	(1.140)	1.868***	(.521)	1.408**	(.548)
Constant	-25.260	(43.207)	42.563*	(20.637)	-133.830***	(48.184)	-60.891	(27.085)
N	2460 (82 conflicts)		1420 (71 conflicts)		4100 (82 conflicts)		3550 (71 conflicts)	
R^2	.085		.048		.118		.027	

*** p < .01; ** p < .05; * p < .1. All models report results from random-effects GLS regressions with standard errors clustered at the level of conflicts (i.e., the interacting pair of contestants)

A note on punishment

Since communication resolved most conflicts there are too few observations to study quantitatively whether punishment would have improved conflict resolution. However, it is interesting to observe that only one conflict with a temporary settlement or a permanent resolution saw the application of punishment. Among the unresolved conflicts in the punishment treatment

three included actual punishment decisions. Obviously these decisions did not have a strong deterrence effect. As mentioned above, the analysis of the communication shows that few mediators even communicated potential sanctions. In the few cases with actual punishment, the third parties provided either none or a rather poor motivation for their sanctions which suggests that punishment as a conflict resolution device requires at least a certain degree of sophistication on behalf of the third party in order to be effective.

5. Conclusion

Many studies have shown how communication between people reduces their conflict behavior. In this paper I used experimental data in order to test the robustness of this effect. The paper extends the literature by studying three potential limitations of communication as a conflict resolution device. In general the results show a strong impact of intermediate communication, as most conflict parties reduce their expenditure. In many cases the effect is also quite persistent once communication between conflict parties is not possible anymore.

As a first limitation, it was not clear whether preceding conflict experience limits its effectiveness, and to which extent. Isaac and Walker (1988) observe that people fail to agree on an efficient outcome if they provided low contributions before the communications started. At the qualitative level, the results confirm this effect also for a conflict setting but the quantitative impact is rather low.

Second, it was unclear whether any coordination effect persists once communication between the conflict parties is not possible anymore. While I observe a substantial long-term effect in many conditions, the indivisibility of the prize reduces the stability of agreements between the contestants to some extent.

Third, the literature provided little evidence whether bipartisan communication would benefit from other additional conflict resolution tools such as third party intervention or punishment. Here the results do not identify significant added value for these additional measures.

Overall the experiment confirms that communication is the most effective form of conflict resolution even in a rather restrictive environment. This insight may suggest to some that the external validity of the results is questionable. After all, most people can immediately provide cases in which conflict resolution failed. On the other hand, there are probably more situations in which a quiet word or the intervention of a benevolent bystander prevents or restrains conflicts. These

outcomes just receive less attention because they do not influence our daily routines as conflicts do. They certainly also receive less attention in the media.

The experiments in this paper relied on the Tullock Contest to model the conflict. The discussion of the literature in the introduction of this paper showed that this type of contest is perhaps the most popular tool in the theoretical and experimental literature in Economics and Political Sciences to study conflicts. After all, people do actually invest resources to gain a prize at the expense of the opponent. Sometimes these investments are excessively high indicating that motives like envy drive this behavior. However, such a motive is purely outcome oriented and can be incorporated in theoretical frameworks, e.g. using preferences as described in Fehr and Schmidt (1999). Indeed, such preferences provide a rather good explanation of the experimental behavior. This implies that experimental Tullock contests capture the essence of purely economic conflicts.

However, many conflicts do not just rely on economic factors but also on perceived grievances. Some models of reciprocal behavior take considerations of kindness or unkindness into account (Levine 1998, Falk and Fischbacher 2006). Hopfensitz and Reuben (2009) provide nice evidence on how unfair distributions can trigger negative emotions and induce vicious cycles of punishment. My result on the impact of conflict history on resolution success suggests that such attitudes also apply in a repeated Tullock contest. However, in most cases experimental participants have no serious negative attitudes towards their opponents in such a contest. Therefore, experimental researchers intending to study additional limits of communication as a conflict resolution instrument might take recruit their experimental participants from hostile groups.

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Appendix I: Experimental Instructions (for both settings, differences are indicated)

Welcome to this economic experiment.

Your decisions and the decisions of the other participants will affect your payoff. Hence, it is important that you read these instructions carefully. Please contact us before the experiment starts if you have any question.

Please do not talk with the other participants during the experiment.

Otherwise we might exclude you from the experiment and any subsequent payment.

During the experiments we always talk about points that determine your income. At the end of the experiment we convert all points into Euros, using the following exchange rate.

2000 points = 1 Euro

You get your payments at the end of the experiment in cash. Now we explain you the experiment in detail.

Experimental Setup

In this experiment we distinguish between two participants A (A1 and A2) and one participant B. We describe the role of participant B below. We focus at first on participants A. The experiment consists of 50 rounds. In the beginning two randomly chosen participants A are matched with each other. They interact with each other throughout all 50 rounds.

Multiple Prizes Setting	*One Prize Setting*
In each round exactly one of the participants A can win 1000 points. The success probability depends on the level of the respective investments in that round.	At the end of the experiment (i.e., after round 50), exactly one of the two participants A can win an additional 50000 points. The success probability depends on the level of the respective investments in one round which will be chosen by a random device at the end of the experiment.

At the beginning of each round, each participant A gets 1000 points. Each participant A can investment as many of these points as she wants (i.e., between 0 and 1000 points). All points not invested in a round will accrue to the personal account of that participant A. The relationship between the two investments determines the success probability. If both participants A invest the same amount, their success probabilities are 50% each. This also holds if both participants A invest 0 points. If you invest more than the other participant, your success probability is also higher. Of course, this still implies that the participant with the higher investment may not win the prize. The exact formula for the success probability (of participant A1) is:

$$Success\ Probability = \frac{Investment\ Participant\ A1}{Investment\ Participant\ A1 + Investment\ Participant\ A2}$$

Considering this probability, the computer uses a random mechanism to assign the 1000 points to one of the participants. At the end of each round both participants receive information about both investments and who win the prize in the round. (*Setting 2*: At the end of each round both participants receive information about both investments and who would win the prize if the round is chosen at the end of the experiment.)

The investments of participants A also have an impact on the payoff for participant B. More specifically increasing investments decrease the payoff of participant B. Participant B gets 1500 points per round. Every invested point by one participant A reduces B's payoff by .25 points. Note that the investment decisions of four participants A (two pairs) influence the payoff of player B. However player B observes only the decisions from one pair.

Examples

The numbers for the following examples have been arbitrarily chosen.

Multiple Prizes Setting

Example 1:

Participant A1 invested 10 points and participant A2 50 points. Therefore, participant B gets a reduction of 15 points from this pair ((50+10)*.25). The probability of participant A1 to get the 1000 points in that round is 1/6.

$$Probability = \frac{10}{10+50} = \frac{1}{6}$$

In consequence, the probability for player A2 is 5/6.

If A1 gets the prize her income in this round is

$$1000 + 1000 - 10 = 1990$$

Participant A2 would get 950 points in this case (1000 – 50).

One Prize Setting

Example 1:

Participant A1 invested 10 points and participant A2 50 points. Therefore, participant B gets a reduction of 15 points from this pair ((50+10)*.25). The probability of participant A1 of getting 50000 points is 1/6, if this round is chosen at the end of the experiment.

$$Probability = \frac{10}{10+50} = \frac{1}{6}$$

In consequence, the probability for player A2 is 5/6.

If A1 gets the prize her income in this round is

$$50000 + 1000 - 10 = 50990$$

Participant A2 would get 950 points in this case (1000 – 50).

If A1 does not get the prize her income in this round is

$$1000 - 10 = 990$$

Participant A2 would get 1950 points in this case (1000 + 1000 – 50).

Example 2:

Participant A1 invested 600 points and participant A2 400 points. Therefore, participant B gets a reduction of 250 points from this pair ((600+400)*.25). The probability of participant A1 to get the 1000 points in that round is 6/10 or 60 %.

$$Probability = \frac{600}{600 + 400} = \frac{6}{10}$$

In consequence, the probability for player A2 is 4/10 or 40%.

If A1 gets the prize her income in this round is

$$1000 + 1000 - 600 = 1400$$

Participant A2 would get 600 points in this case (1000 – 400).

If A1 does not get the prize her income in this round is

$$1000 - 600 = 400$$

Participant A2 would get 1600 points in this case (1000 + 1000 – 400).

If A1 does not get the prize in this chosen round her income in this round is

$$1000 - 10 = 990$$

Participant A2 would get 50950 points in this case (50000 + 1000 – 50).

If this round is not chosen, participant A1 would get 990 points and A2 950 points.

Example 2:

Participant A1 invested 600 points and participant A2 400 points. Therefore, participant B gets a reduction of 250 points from this pair ((600+400)*.25). The probability of participant A1 of getting 50000 points is 6/10 or 60% if this round is chosen at the end of the experiment.

$$Probability = \frac{600}{600 + 400} = \frac{6}{10}$$

In consequence, the probability for player A2 is 4/10 or 40%.

If A1 gets the prize her income in this round is

$$50000 + 1000 - 600 = 50400$$

Participant A2 would get 600 points in this case (1000 – 400).

If A1 does not get the prize her income in this round is

$$1000 - 600 = 400$$

Participant A2 would get 50600 points in this case (50000 + 1000 – 400).

If this round is not chosen, participant A1 would get 400 points and A2 600 points.

Variations

Using a random mechanism the computer decides in the beginning of the experiment under which experimental variation the participants make their decisions. There are four different variations of the experiment which we describe in detail now. **These variations concern rounds 11-25 only.** You will learn in round 11 which variation is relevant for you. During the first 10 rounds and the last 25 rounds, the experiment proceeds as mentioned above. As participant B you cannot make any decisions in these rounds.

Variation 1: Both participants A, but not participant B, can chat with each other for 60 seconds in each round before they make their decisions. This holds for the rounds 11-25. At the end of each round both participants A, but not participant B, receive information about the relevant decisions and the prize allocation.

Variation 2: Both participants A and participant B can chat with each other for 60 seconds in each round before they make their decisions. This holds for the rounds 11-25. At the end of each round both participants A and participant B receive information about the relevant decisions and the prize allocation.

Variation 3: Both participants A and participant B can chat with each other for 60 seconds in each round before they make their decisions. After learning about the decisions and the prize allocation, participant B can reduce points from each participant A. Note that the payoff of a participant A in a round cannot be negative. Each reduced point costs participant B .2 points. Hence a withdrawal of 10 points for any participant A costs B 2 points. This holds for the rounds 11-25. At the end of each round both participants A and participant B receive information about the relevant decisions and the prize allocation.

If you want to send a chat message, please type the text and press the enter key 

To protect your anonymity it is important that you do not reveal any information about your personal characteristics or your seat number in these chat messages.

Variation 4: Neither participants A nor participant B can chat with each other for 60 seconds in each round before they make their decisions. This holds for the rounds 11-25. At the end of each round both participants A, but not participant B, receive information about the relevant decisions and the prize allocation.

An example on the reduction of points in variation 3.

The numbers for the following examples have been arbitrarily chosen.

Multiple Prizes Setting

Participant A1 invested 200 points and participant A2 300 points. Therefore, participant B gets a reduction of 125 points from this pair ((200+300)*.25). Participant A1 has received the prize, her income in that round is

$$1000 + 1000 - 200 = 1800$$

Participant A2 has received 700 points in that round (1000-300).

Participant B learned about the payments and the decisions and reduces 200 points form participant A1 and 250 points from participant A2. The final payoffs for participant A1 are therefore 1600 points ($1000 + 1000 - 200 - 200 = 1600$) and

One Prize Setting

Participant A1 invested 200 points and participant A2 300 points. Therefore, participant B gets a reduction of 125 points from this pair ((200+300)*.25). For participant A1 the income in that round is

$$1000 - 200 = 800$$

Participant A2 has received 700 points in that round (1000-300). If the round is chosen at the end of the experiment, participant A1 will get the 50000 points. However, the participants do not know whether the round will be chosen.

Participant B learned about the payments and the decisions and reduces 200 points form participant A1 and 250 points from participant A2. The final payoffs for participant A1 are

450 points for participant A2 (1000 – 300 -250). For participant B his income of 1500 points will be reduced by 125 points and an additional 90 points (.2*(200+250)). On top of it, further reductions apply from any expenditure of two other participants A whom participant B cannot observe.

therefore 1600 points ($1000 - 200 - 200 = 600$) and 450 points for participant A2 (1000 – 300 -250). For participant B his income of 1500 points will be reduced by 125 points and an additional 90 points (.2*(200+250)). On top of it, further reductions apply from any expenditure of two other participants A whom participant B cannot observe.

Procedure

One round proceeds as follows

Multiple Prizes Setting

1. Each participants A gets 1000 points, each participant B 1500 points.
2. Rounds 11-25: Communication between the participants A (Variation 1) or between participants A and B (Variations 2 and 3).
3. Investment decisions of participants A: The invested points will be reduced from the 1000 points.
4. The computer allocates the prize to one participant A.
5. Rounds 11-25: Participant B can reduce points from the participants A (Variation 3)
6. Full information about relevant decisions and prize allocations.

One Prize Setting

1. Each participants A gets 1000 points, each participant B 1500 points.
2. Rounds 11-25: Communication between the participants A (Variation 1) or between participants A and B (Variations 2 and 3).
3. Investment decisions of participants A: The invested points will be reduced from the 1000 points.
4. The computer decides which player A wins the round.
5. Rounds 11-25: Participant B can reduce points from the participants A (Variation 3)
6. Full information about relevant decisions and prize allocations.
7. Round 50: The computer decides which round is relevant for the payment of the prize.

At the end of the experiment we will ask you to fill in a short questionnaire. We will add up all your earned points, convert them in Euro and pay of you in cash.

Appendix II Analysis of Communication

The procedure of the content analysis resembles the approaches in Cason et al. (2012), Leibbrandt and Sääksvuori (2012) or Eisenkopf (2014) who again built there procedures on many similar previous studies, in particular Brandts and Cooper (2007). First, I randomly selected two sessions from each setting to develop a coding scheme with 11 categories. Each chat room discussion was coded by two individuals independently according to these categories. The unit of observation for coding was all messages in a given round in each conflict (i.e., between the two contestants and the third party, if applicable). If a unit of observation was deemed to contain the relevant category of content, it was coded as 1 for that category and 0 otherwise. Each unit was coded under as many or few categories as the coders deemed appropriate. The coders also knew the experimental instructions provided to subjects so that they understood the strategic environment the subjects faced. The analysis focuses on those categories in which the coders had a moderate or substantial agreement, as measured by Cohen's Kappa (Cohen 1960). This measure takes a value of 0 when the agreement is consistent with random chance and 1 when the coders agree perfectly. The categories with bold letters in Table A2 indicate a strong degree of consistency (Cohen's Kappa > .6) while those in italics do not even have a moderate degree of consistency (<.3).

Table A1: Categories for coding messages and observed frequency in chat communication across settings and treatments (First round communication in parentheses)

Cat	Description	Multiple Prizes Setting Prize = 1000 points in each round			One Prize Setting Prize = 50,000 points in one round		
		Direct Comm.	Comm. with Mediator	Mediator with Pun.	Direct Comm.	Comm. with Mediator	Mediator with Pun.
1	**One Participant A does not communicate**	.014 (.071)	.164 (.143)	.093 (.213)	.030 (.076)	.05 (0)	.108 (.077)
2	**Mediator does not communicate**	---	.071 (.143)	.243 (.392)	---	.121 (.143)	.123 (.192)
3	The participants A agree on minimal investments	.321 (.5)	.379 (.429)	.393 (.607)	.377 (.5)	.478 (.464)	.315 (.577)
4	The participants A agree on a different behavior	.064 (0)	.064 (.142)	.007 (.036)	.015 (.038)	.15 (.32)	.185 (.192)
5	**The participants A agree on taking turns in winning**	.278 (.393)	.171 (.286)	.164 (.25)	.046 (.115)	.007 (0)	.069 (.077)
6	**Mediator threatens withdrawal of points**	---	---	.043 (.143)	---	---	.031 (.077)
7	The participants criticize / insult each other	0 (0)	.057 (.071)	.057 (0)	.008 (0)	.014 (0)	.038 (0)
8	*The participants discuss the rules of the experiment.*	.035 (0)	.128 (.071)	.121 (.036)	.115 (.038)	.214 (.036)	.231 (.115)
9	*One participant A signals a strong desire to win .*	0 (0)	0 (0)	0 (0)	.015 (0)	0 (0)	.008 (.038)
10	*The discussion focuses on past behavior*	.071 (0)	.128 (.071)	.236 (071)	.069 (.038)	.071 (.071)	.115 (.038)
11	*Discussion focuses on future earnings.*	.385 (.5)	.486 (.679)	.314 (.536)	.4 (.346)	.393 (.464)	.423 (.538)

Bold Letters denotes categories with Cohen's Kappa reliability above 0.6. *Italics* denote codes with Cohen's Kappa reliability below 0.3.

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