**Rich communication, social motivations, and coordinated resistance against divide-and-conquer: A laboratory investigation***

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**Abstract**

This paper presents a laboratory experiment to investigate how social motivations and free-form communication (Rich Communication) can facilitate coordinated resistance against divide-and-conquer transgressions. In our experiment, a leader first decides whether to extract surplus from a *victim* and shares it with a *beneficiary*. We find that the successful joint resistance rate increases almost four-fold (from 15 to 58 percent) when moving from the more restrictive communication treatments to Rich Communication. We also find that the significant impacts of rich communication are driven more by the responders' ability to send free-form messages rather than the multiple and iterative opportunities to indicate intentions.

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## 1. Introduction

This paper presents a laboratory experiment to study how computer-mediated free-form communication can facilitate coordinated resistance against leader transgression. Since the seminal work of North and Weingast (1989), a sizable literature has emphasized that successful economic development requires mechanisms that deter the predatory behavior of the state: if political leaders can confiscate the wealth of citizens without any repercussion, no one will have the incentive to engage in costly production and investment (North, 1990; Weingast, 1995, 1997; Acemoglu et al., 2005; Greif, 2006; Acemoglu and Robinson, 2012). Scholars have argued that coordinated resistance by citizens is key to deter leader expropriation (Weingast, 1995, 1997; Acemoglu and Robinson, 2006, chapter 11). Researchers, however, have also pointed out that leaders may expropriate wealth from one group, and share it with another group to "bribe" them and secure their support (Weingast, 1995, 1997). Such divide-and-conquer strategies are difficult to defeat. Citing the former Congo ruler Mobutu as an example, Acemoglu et al. (2004) argue that divide-and-conquer tactics allow rulers to adopt socially costly policies to extract surplus, and this is an important cause of under-development.

In his pioneering work on divide-and-conquer (hereafter DAC), Weingast (1995, 1997) considers a Coordinated Resistance (hereafter CR) Game played by a leader and two responders. In the CR game, the leader first decides whether to extract surplus from one of two "responders," but shares some of this confiscated surplus with the other responder to gain her support. The two responders then simultaneously decide whether to challenge the leader. The leader's transgression is defeated if and only if both the "victim" and the "beneficiary" of the transgression incur the cost to challenge. Successful transgression increases the payoff of the leader and the beneficiary, but it lowers the total surplus available and harms the victim.

In this social dilemma, deterring the leader from practicing divide-and-conquer is difficult. It requires the beneficiary to act against her material interest, and also to successfully coordinate with the victim to challenge the leader. If the beneficiary is only concerned about her own material payoff she will never challenge the leader, so the efficient outcome of No Transgression cannot be supported as equilibrium in the one-shot CR game with standard preferences. In addition, because a beneficiary who is only concerned about her own material payoff will never challenge, allowing the victim and the beneficiary to engage in any form of non-binding "cheap talk" communication will not increase coordinated resistance against divide-and-conquer in the one-shot CR game.

As we shall discuss in detail in Section 2, however, social motivations such as concerns for fairness, the pursuit of expressive utility, or guilt aversion may motivate a beneficiary to act against her narrow material interest to challenge DAC transgression. If responders have the opportunity to send free-form messages, they can make statements that heighten the importance of social motivations to increase the prospect of successful joint resistance. Therefore, compared to restrictive communication that only allows the responders the opportunity to indicate their intended action, free-form communication (hereafter rich communication) is likely to be more effective in facilitating coordinated resistance in the CR game. Our paper reports an experiment to test this conjecture.

To focus on how rich communication and concerns beyond narrow self-interest help coordinate resistance, we abstract from repeated interaction in this study.[1] In the Rich Communication treatment, after observing the leader's decision but before deciding whether to

[1] Weingast (1995, 1997) focuses on the effects of repeated interaction in his analysis of the CR game and its applications. Cason and Mui (2014) studies experimentally the role of social preferences in the repeated CR game with and without restrictive communication, but that study does not consider rich communication.

incur the cost to challenge the leader, the two responders have the opportunity to engage in non-binding, computer-mediated and anonymous free-form communication in a private "chat room." We compare subjects' behavior in this Rich Communication treatment to behavior in the benchmark case of No Communication and various forms of restrictive communication, in which responders indicate their intended action using non-binding, binary messages.

We find that in this divide-and-conquer social dilemma, victims and beneficiaries communicate with different intensity and content: victims more quickly and vigorously engage in communication, while beneficiaries propose to acquiesce more frequently. We also find that beneficiaries are more likely to indicate an intention to challenge DAC when using rich communication, and both beneficiaries and victims are more likely to follow through on an agreement to challenge DAC when using rich communication compared to restrictive communication environments. Overall, rich communication is significantly more effective in facilitating coordinated resistance against divide-and-conquer. The successful joint resistance rate increases almost four-fold (from 15 to 58 percent) when moving from the more restrictive communication treatments to rich communication.

Our study is motivated by observations from the field suggesting that rich communication and concerns beyond narrow self-interest can be important in affecting coordinated resistance against divide-and-conquer. This observation is illustrated by the problem of land expropriation in contemporary China. In the past decade, sales of land have become the main source of revenue for local governments in China, and they also provide ample opportunities for corruption (Liu, 2010a). Land expropriation by local governments for public projects or for transfer to private developers without due compensation, often accompanied by forced demolition of property, has led to a large number of violent confrontations that have sometimes ended with death of those resisting (Chen, 2009; Amnesty International, 2012; Chang, 2012). At the risk of suffering from harassment or sometimes even arrest, legal scholars, lawyers, and activists have campaigned on behalf of the victims and advocated for legal and administrative reforms to address this growing problem (Smith, 2009; Liu, 2010a; Amnesty International, 2012).

After the death of Ye Zhongcheng in 2010, who set himself on fire to protest the demolition of his house in Jiangxi province, a local government official argued in defense that the recent rapid urbanization of China was impossible without land expropriation, and "everyone is the beneficiary of forced demolition" (Si, 2010). Nevertheless, various activists have argued that due to the suffering of the large number of victims of land expropriation, their conscience does not allow them to remain silent (Guo, 2005; Liu, 2010b). Importantly, the internet has increasingly become an important platform for victims of expropriation and forced demolition to publicize their grievances and appeal to the public for help (Liu, 2010a; Hu, 2012).

While the potential importance of rich communication in facilitating coordinated resistance is well-recognized, to our knowledge no empirical study investigates systematically how and why the content of communication may coordinate resistance against a specific act of divide-and-conquer transgression, even though the content of online discussion is often publicly observable.

This lack of research is due, in part, to the numerous challenges faced by field studies on this topic. First, individuals who choose to participate actively in online groups may already have a strong inclination to participate in collective action against state transgression. This raises the possibility that any observed impact of communication in the field may mainly be driven by a selection effect. Second, researchers usually do not know the economic, political and social incentives faced by different individuals or the actions taken by them beyond their discussion.

This makes it difficult to understand how different incentives affect the content of communication, as well as how the content of communication in turn affects behavior. Third, some messages may be fabricated. For example, the Chinese government has paid agents to participate in on-line discussions to send pro-government messages or raise questions to influence the direction of on-line discussion (Trouillaud, 2011).

The laboratory can overcome some of these difficulties. In all communication treatments in this study, both beneficiaries and victims are exogenously provided the opportunity to engage in communication. Since the identities and the actions of the victims and beneficiaries are observable, the data can reveal whether a beneficiary who gains economically from a DAC transgression communicates differently from a victim who suffers the economic loss. The analysis can also determine how communication influences actions, and whether and how rich communication between the beneficiary and the victim deters leader transgression. Although the laboratory environment is stylized, it allows for strong control that enables more direct identification of causal effects of rich communication on coordinated resistance against divide-and-conquer. Laboratory studies can generate novel insights and potentially "jump start" cumulative research efforts that can eventually lead to new understanding of how rich communication affects coordinated resistance against leader misbehavior in the field.[2]

[2] The internet offers an instructive example of this process. The phenomenon of group polarization—the observation that group discussion moves decisions to more extreme points in the same direction as the initial tendencies of the group members' individual choices—was first identified in the laboratory by experimental social psychologists (Stoner, 1961; Moscovici and Zavalloni, 1969; Isenberg, 1986), and subsequently studied in the laboratory by experimental economists (Cason and Mui, 1997). The legal scholar Cass Sunstein (2000, 2007) draws on these and other related laboratory studies to formulate the influential hypothesis that the internet may make it easier for people to limit themselves to news and information outlets that confirm to their prior views. Gentzkow and Shapiro (2011) recently test this hypothesis using field data. Exploiting the better control available in the laboratory, a small number of recent studies use the laboratory to study social conflicts, ranging from anarchy and conflict, divide-and-conquer, to riot and revolution (see Abbink (2012) for a survey).

The rest of this paper is organized as follows. Section 2 describes the CR game and discusses how rich communication and social motivations can affect behavior. Section 3 presents the experimental design and the content analysis methodology. Section 4 reports results and Section 5 concludes.

## 2. Divide-and-conquer, coordinated resistance, and rich communication

Figure 1 illustrates the laboratory CR game, which is based on a game-theoretic model of divide-and-conquer that Weingast (1995, 1997) develops in his pioneering work that captures the following ideas. First, successful transgression allows the leader to extract surplus from the responders and increases his *private* payoff, even though it reduces *total* surplus in society because some surplus is destroyed in the process. In the Figure 1 payoffs, a comparison of the leader's payoff without transgression (the bottom matrix) to the case when he successfully transgresses against both responders (the top matrix) shows that successful transgression against a responder increases the leader's payoff by 3 but reduces the responder's payoff by 6. Second, challenging is costly to the responders regardless of whether it succeeds, and the transgression will fail if and only if *both* responders incur the cost to challenge. Third, multiple equilibria exist in the top subgame when the leader transgresses against both responders. Both responders challenging the leader and both responders acquiescing are possible equilibrium responses, so this subgame is a "stag hunt" game. Fourth, the leader can either transgress against both responders, or can also use a DAC strategy. In the Figure 1 payoffs when the leader transgresses against only one responder he shares 1 of the 3 units of the expropriated surplus with the "beneficiary" responder in an attempt to gain her support.

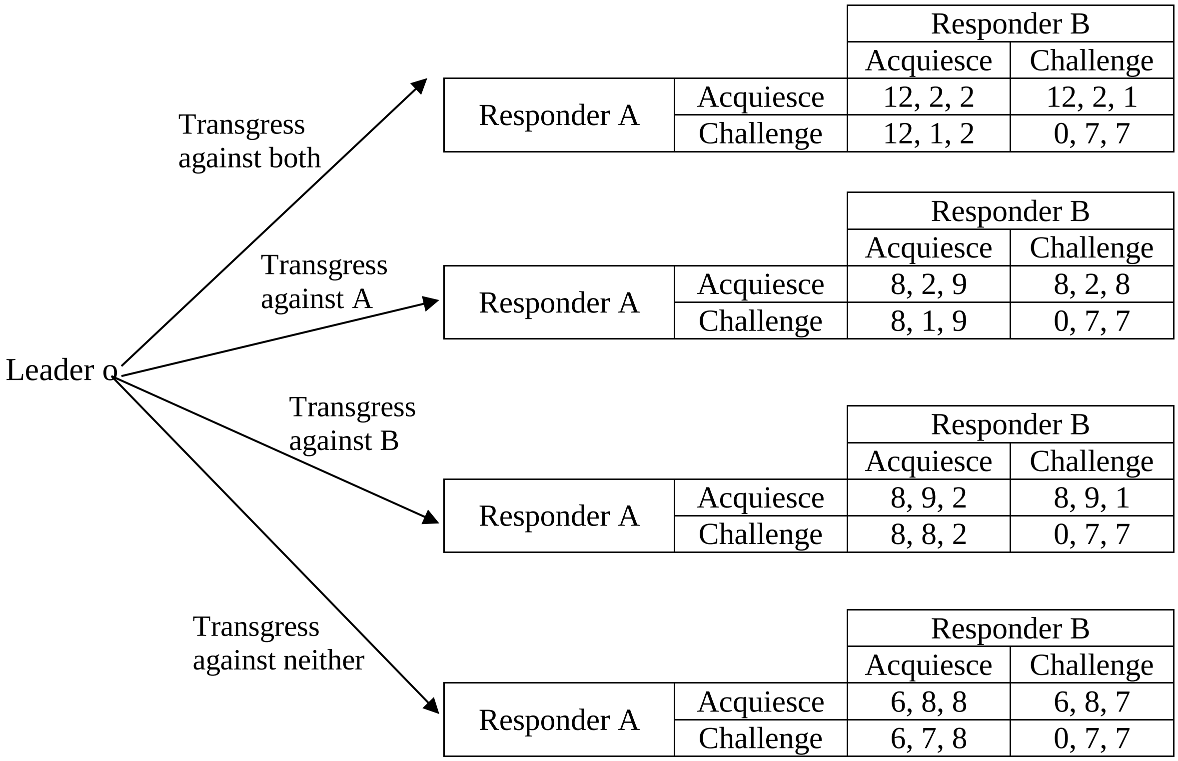


**Figure 1: The Coordinated Resistance Game (payoffs are for (Leader, Responder A, Responder B))**

When the leader transgresses against only one responder and shares some of the extracted surplus with the beneficiary in the one-shot game, a beneficiary with standard preferences will always acquiesce, so the victim of transgression will also acquiesce. Therefore, by using the DAC strategy the leader can eliminate the threat of coordinated challenge by the responders. The one-shot CR game thus has three (pure strategy) equilibria, all featuring some form of transgression.[3] In one equilibrium, the leader transgresses against both responders, with the expectation that such full-scale transgression will not be met by coordinated resistance. The other

[3] Allowing for mixed-strategy equilibrium does not change the key implications of the CR game, so we shall focus on pure-strategy equilibria.

two equilibria feature DAC transgression, in which the leader transgresses against only one responder and expects that no responder will challenge and believes that a full-scale transgression will be defeated. The CR game with standard preferences has a sharp implication: because acquiescing is the dominant strategy for the beneficiary, non-binding communication will not change the fact that No Transgression cannot be supported as an equilibrium. Therefore, communication between the responders will not change the incidence of No Transgression.

While a model based on standard preferences suggests that communication should not increase coordinated resistance in the CR game, the literature on social preferences (e.g., Camerer, 2003) suggests that some agents may have concerns beyond narrow self-interest. This implies that some beneficiaries may be willing to act against their material interest to join the victims to challenge a DAC transgression and communication can facilitate coordinated resistance and reduce transgression.[4] Some beneficiaries may be altruistic punishers (Fehr and Gächter, 2002, Gintis et al., 2005) who regard the act of transgression to be unfair and illegitimate and are willing to incur a material cost to punish and defeat the transgressing leaders.[5] Furthermore, as Hillman (2010) emphasizes, some agents derive expressive utility by "confirming pleasing attributes of being generous, cooperative, trusting and trustworthy, or ethical and moral" (Hillman 2010, p. 403). If a beneficiary is expressive and regards the act of challenging the leader's transgression as ethical, the pursuit of expressive utility may motivate him/her to challenge the transgression.

When the opportunity for free-form communication is available, a victim of DAC

[4] Cason and Mui (2007) and Rigdon and Smith (2010) study the effects of restrictive communications in the CR game and find support for this conjecture.

[5] For experimental and survey evidence of third-party enforcement of norms, see, for example, Fehr and Fischbacher (2004) and Traxler and Winter (2012), respectively. Cason and Mui (2014) presents a model of the CR game in which an agent regards a transgression as illegitimate, and hence, if the leader engages in transgression her utility as a responder is decreasing in the leader's income.

transgression can offer arguments that appeal to considerations other than narrow self-interest to influence the beneficiary's decision. The victim may highlight that the act of transgression is unfair, and argue that an ethical beneficiary should punish the leader for his transgression. The arguments provided by the victim may provide socially relevant information that affects a beneficiary's judgment regarding what constitutes fair and ethical behavior. These arguments can also make concerns for fairness and the pursuit of expressive utility highly salient, and such priming can motivate the beneficiary to coordinate resistance against DAC transgressions.[6] Free-form communication also allows a beneficiary to make statements regarding why she may be motivated to challenge the leader's transgression, and also provides the victim an opportunity to reaffirm the ethical value of a challenge by the beneficiary, and hence can be particularly conducive for the pursuit of expressive utility by the beneficiary.

Besides concerns for fairness and expressive utility, rich communication may also provide the opportunity for guilt aversion to facilitate coordinated resistance against DAC. As Battigalli and Dufwenberg (2007) has pointed out, a guilt averse person is willing to take actions against her own material interest to avoid letting down others. Charness and Dufwenberg (2006) reports a trust game experiment with rich communication that provides supporting evidence for guilt aversion.[7] In the CR game, suppose the beneficiary believes that the victim expects her to

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[6] Researchers have found that socially relevant information that provides cues about what constitutes socially desirable conduct can affect behavior. For example, see Cason and Mui (1998) on the laboratory dictator game, and Shang and Croson (2009) and Chen et al. (2010) on how providing information about others' contributions to public goods affect contribution behavior in field experiments. Andreoni and Petrie (2004) argue that their findings in a public good experiment without confidentiality suggest that subjects are of three types: those who never contribute, those who are internally motivated and always contribute, and those who are subject to social influence. For a general discussion of priming, see Bargh (2006). Chen et al. (2014) reports an economic experiment showing how priming different identities affect behavior in the prisoner's dilemma.

[7] In a trust game, the first-mover decides how much money to send to the second-mover. Capturing the idea that such "investment" is socially desirable, the amount received by the second-mover is higher than the original amount sent. The second-mover then decides how much money to send back to the first-mover. Charness and Dufwenberg (2006, 2010) report that communication in a trust game that allows the second-mover to send a written free form message increases cooperation more than another treatment with restrictive binary promises to cooperate.

challenge the leader, and the victim will hence challenge and expects to get the material payoff of 7. If the beneficiary instead acquiesces, she will cause the victim to get the lower material payoff of 1. Because "defection" from challenge to acquiesce will cause the victim to get a lower material payoff, if the beneficiary is sufficiently guilt averse she will be willing to incur the cost to challenge the leader to avoid letting down the victim.

Under rich communication, the victim can explain that she has a strong belief that the beneficiary should and would challenge the leader. Furthermore, if the victim highlights the importance of fairness and ethical considerations in in her free-form messages, the beneficiary may respond with statements that make the beneficiary believe that the victim expects her to challenge the leader. Free-form communication may thus lead the beneficiary to believe that acquiescence will let down the victim, and may motivate a guilt averse beneficiary to act against her material interest to challenge a DAC transgression.

Our discussion so far emphasizes how the victim has the incentive to engage in rich communication to make arguments that can induce the beneficiary to challenge. While a beneficiary who has concerns beyond narrow material interest may also actively participate in free-form communication, a beneficiary who has standard preferences prefers the DAC transgression to succeed. Consistent with Schelling's observation that in asymmetric games, some agents may prefer not to have communication opportunities even though communication is beneficial to others (Schelling, 1957), a beneficiary who is motivated only by her own material interest has little incentive to engage in communication. This suggests that there will be systematic qualitative and quantitative differences in the messages communicated by the victims and the beneficiaries. We expect that victims are likely to communicate more and are more likely to appeal to social motivations in order to convince the beneficiaries to coordinate resistance.

We have emphasized that rich communication may affect behavior because it offers both the victim and the beneficiary the opportunity to make specific arguments that heighten the importance of various social motivations that can help them coordinate resistance. To provide a more direct test that the free-form statements are key for allowing rich communication to affect behavior, our study also includes two restrictive communication treatments that permit the responders to communicate intended actions and to engage in iterative coordination, but remove the possibility of making free-form statements.

In the *Simultaneous Restrictive Communication* treatment, the responders can only send a single, binary message to the other responder in their group: an "intended" choice prior to committing to an actual challenge or acquiesce decision. This comparison allows us to determine whether the opportunity to send free-form messages and multi-round iterative indications of intentions will in fact facilitate coordinated resistance and reduce transgression. In the *Multi-Round Sequential Restrictive Communication* treatment, subjects can send a sequence of binary "intended" choice communications to their paired responder. A comparison of behavior in this treatment to the Rich Communication Treatment allows us to better isolate the effect of free-form communication when a dialog is possible, as subjects have roughly comparable opportunities to engage in multi-round iterative indications of intentions in both treatments.

Restrictive communication deprives the responders the opportunity to use free-form messages that make social motivations salient to affect the other responder's intention to challenge. Consequently, only those beneficiaries who have exceptionally strong social motivations are likely to indicate an intention to challenge if communication is restrictive, and we expect that beneficiaries are more likely to indicate an intention to challenge when rich communication is possible.

Finally, we can also compare how likely beneficiaries follow through with indicated intentions to challenge under different forms of communication. Unlike rich communication, restrictive communication does not allow the victim to indicate that she has a strong belief that the beneficiary should and would challenge the leader. This suggests that a guilt averse beneficiary may be less concerned about letting down the victim when communication is restrictive, and hence is less likely to follow through on an indicated intention to challenge compared to rich communication. In addition, an expressive beneficiary has the incentive to follow through on an agreement to challenge the leader, as doing so will confirm that she is trustworthy and also trusting. Restrictive communication does not allow the victim or the beneficiary to make statements to highlight the importance of being trusting and trustworthy, so it may be less powerful in inducing an expressive beneficiary to follow through on an agreement to challenge the leader. We therefore conjecture that compared to both forms of restrictive communication, beneficiaries are more likely to follow through on an agreement to challenge DAC reached through rich communication.

## 3. Experimental Design and Content Analysis Methodology

### *3.1 Experimental Design*

The experiment consists of 45 independent sessions across seven different treatments, as summarized in Table 1, conducted at Purdue and Monash Universities using 510 human subjects. All subjects were inexperienced in the sense that they participated in only one session of this study, although some had participated in other completely unrelated experiments. Sessions were conducted in all seven treatments at both universities. This design is chosen to permit important pairwise treatment comparisons to identify how different forms of communication affect behavior, and evaluate the robustness of our conclusions to alternative matching protocols.

In order to closely approximate the "one-shot" version of the game analyzed here, we employed "strangers" matching protocols that anonymously and randomly re-grouped subjects in each decision period. This permits subjects to learn about the strategic environment they face through stationary repetition, while minimizing any repeated game incentives. The Random Strangers treatments shown on the left side of Table 1 are the major treatments of the experiment. Each session in these treatments had nine participants, but two sessions were always conducted simultaneously so 18 subjects were present in the lab for each data collection period. The instructions emphasized that subjects were randomly re-grouped each period. The regrouping occurred separately within the two groups of nine subjects in the lab, although this was not mentioned in the instructions. The random strangers matching protocol means that when subjects are randomly matched to form three person groups each period, responders can be matched with another responder or leader more than once in a session.

As shown in Table 1, we conducted four treatments using this random strangers matching protocol. The *No Communication* treatment is a baseline to evaluate the impacts of alternative forms of communication. The treatment with *Simultaneous Restrictive Communication*, reported previously in Cason and Mui (2007), allowed the responders to send a restrictive, binary message to the other responder in their group: an "intended" choice (either X or Y), prior to committing to an actual challenge or acquiesce decision.[8] Only the two responders exchanging the messages, and not the leader, observe the message content. These binary messages were exchanged

[8] This treatment was labeled "Ex Post Communication" in Cason and Mui (2007). This treatment led to the most reliable increase in coordinated resistance and decrease in leader transgression among the various restrictive communication rules considered in that paper.

simultaneously; that is, a responder did not learn the other's message until after submitting her message. In all of the communications treatments, the responders first learn the transgression choice of the leader and then exchange messages for only the subgame chosen by the leader.

**Table 1: Experimental Design (510 Total Subjects)**

| | *Random Strangers* | *Perfect Strangers*[e] |
|---|---|---|
| No Communication[a,c] | 8 Sessions (72 Subjects) | 2 Sessions (48 Subjects) |
| Rich (chat) Communication[b] | 14 Sessions (126 Subjects) | 3 Sessions (72 Subjects) |
| Multi-Round Sequential Restrictive Communication[d] | 8 Sessions (72 Subjects) | |
| Simutaneous Restrictive (binary) Communication[a,c] | 8 Sessions (72 Subjects) | 2 Sessions (48 Subjects) |

[a] Random Strangers No Communication and Simultaneous Restrictive Communication data were previously reported in Cason and Mui (2007).
[b] Thirty-five periods were conducted in the Rich Communication sessions.
[c] No Communication and Simultaneous Restrictive Communication sessions were conducted for 50 periods. Only the first 35 periods are analyzed in this paper.
[d] 40 periods were conducted in the Multi-Round Sequential Restrictive Communication sessions.
[e] All Perfect Strangers sessions were conducted for 15 periods.

The data from 144 subjects in the two treatments just described provide benchmarks for evaluating other communication protocols. The remaining new data from 366 subjects in five treatments were specifically collected for this study. The use of data from treatments in earlier studies as a foundation for later studies is an important part of our research program for the study of divide-and-conquer. It allows us to use these treatments to evaluate how new and increasingly sophisticated communication environments may affect behavior in this social dilemma and obtain cumulative benefits from this research program. As we have learned from previous studies of important social dilemmas such as the prisoner's dilemma and public good games, cumulative studies involving dialogues and iterations between experiments, theory building, and field studies have significantly deepened our understanding of important issues (Ostrom, 1998; Camerer, 2003). The CR game developed in the influential work of Weingast (1995, 1997) is a rich social dilemma that has interesting endogenous role asymmetry, and provides a tractable environment for the cumulative study of the important question of divide-and-conquer.[9]

In the *Rich Communication* treatment, the two responders have the opportunity to send free-form messages through a chat window after they observe the choice made by the leader but before they make their actual choices. The leader does not observe these messages, but these messages are recorded by the experimenter. The chat window allows responders exchange multiple messages over a two-minute period. In order to measure the importance of the opportunity to send free-form messages, separately from the multiple and iterative opportunities to indicate their intended choices, in the *Multi-Round Sequential Restrictive Communication* treatment subjects can send a sequence of binary "intended" choice communications to their paired responder. One responder is chosen randomly to send the first message. This message is revealed only to the other responder, who then replies with a binary intended resistance choice, which is revealed to the first. Another round of binary intention messages is then exchanged, and this is followed by the simultaneous choice of the actual resistance decision. These two rounds of

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[9] Weingast (1995) and Weingast (1997) have 1,887 and 1,169 Google Scholar cites, respectively (July 15, 2014). While concerns about leader expropriation and under-development motivate our study, DAC is widely observed in many other settings. A defendant facing multiple plaintiffs may make different settlement offers to the plaintiffs to induce plaintiffs to settle their claims for less than they are jointly worth (Che and Spier, 2008). A firm that is negotiating contracts with several unions may offer poor terms to some and more favorable terms to others to create divergent interests among the unions (Kutalik and Biddle, 2006). An incumbent monopolist can use DAC to achieve "naked exclusion" (Rasmusen et al., 1991). Landeo and Spier (2009) and Boone et al. (2014) study experimentally how incumbent monopolist can use divide-and-conquer to achieve "naked exclusion." None of these studies, however, considers rich communication. Landeo and Spier (2012) considers a naked exclusion game between a seller, two buyers, and a potential entrant, and finds that compared to no communication, unrestrictive one way communication from the potential entrant to the buyers reduces exclusion by the seller. They, however, do not investigate whether the buyers and the entrant may communicate differently, nor do they use content analysis to study the messages of the entrants. They also do not compare rich communication to restrictive communication, while we focus on comparing rich communication to various forms of restrictive communication to determine whether the opportunity to send free-form messages is the driving force behind the effects of rich communication.

communication correspond to the median number of two messages exchanged by subjects in the Rich Communication treatment. Therefore, this treatment controls (approximately) for the multiple opportunities to indicate intentions, and the comparison with the Rich Communication treatment better isolates the impacts of the opportunity to send free-form messages.

It is possible that a responder may try to identify himself in the Rich Communication treatment, or may recognize the other responder in later periods based on how this individual chats in the random strangers matching protocol. This can imply that repeated game considerations between the responders can potentially affect behavior. To investigate whether this is a serious issue for our experiment, we added three supplementary treatments with the Perfect Strangers matching protocol, shown on the right side of Table 1. In these Perfect Strangers treatments, subjects are randomly matched to form three person groups each period, but with the restriction that a responder is matched with another responder exactly once in a session. This allows us to conduct robustness tests to investigate whether any differences in behavior (if they exist) across these treatments observed in the random strangers environment still hold in the perfect strangers environment.[10]

Each session in these perfect strangers treatments had 24 subjects—16 responders and 8 leaders. The instructions emphasized that subjects were randomly re-grouped each period, and that a responder would be matched with another responder for once and exactly once in the

[10] We also investigate this question from the other extreme. When rich communication takes place in the random strangers treatments, in 10 out of the 14 sessions the chat program did not display the participant number of the two communicating responders. This "anonymous" environment makes it more difficult for participants to use chats to identify their identity. We also conducted four sessions using the "non-anonymous" option in the chat program. In these sessions, the computer screen displayed the participant ID of both responders during the chat in each period. We found, however, that behavior in the random strangers Rich Communication treatment is qualitatively similar in the "anonymous" environment and the "non-anonymous" environment. We therefore pool the data of these 14 random strangers Rich Communication treatment together in our analysis.

session. All perfect strangers sessions were conducted for 15 periods, which is the maximum possible with 16 responders who are matched with each other responder exactly once.

The experiment instructions employed neutral terminology. For example, “Person 1” chose “earnings square” A, B, C or D—which was the transgression decision—and then “Persons 2 and 3” simultaneously selected either X or Y—which was the challenge decision. (Rich Communication instructions are in Appendix A.) Furthermore, in all sessions, if a person is designated as a Person 1, then the person remains in this same role throughout the session. Participants who are not designated as a Person 1 switch randomly between the Person 2 and Person 3 roles in different periods.

Subjects’ earnings were designated in “experimental francs.” They were paid for all periods, and their cumulative balance was converted to either Australian or U.S. dollars at exchange rates that resulted in earnings that considerably exceeded their opportunity costs. The per-person earnings typically ranged between US$25 and US$40 for the Purdue sessions and between A$30 and A$60 for the Monash sessions.[11] Exchange rates were chosen before beginning data collection based on the time required to complete pilot sessions. Sessions without communication ran more quickly—some as short at 75 minutes including instructions—while those with communication typically required 1.5 to 2.5 hours.

### *3.2 Content Analysis*

Responders can express a variety of statements in the chat rooms, and to quantify these statements formally we employ the methodology of content analysis. For this purpose we

[11] The exchange rate between U.S. and Australian dollars was approximately 1 AUD = 0.75 USD when the experiment was conducted.

employed two coders, who were undergraduate students at Purdue and Monash Universities, to review all the statements (8403 lines of messages) and classify them according to a message classification scheme developed based on pilot sessions. These coders were trained using pilot data and they coded the chat statements independently. They were unaware of the research questions addressed in this study and did not know the leaders' or responders' decisions. Each individual line of a chat was coded, and the coders judged whether each line fit into 35 specific meaning categories and subcategories. Individual chat lines could be assigned to multiple categories. Table 2 in the results section shows examples of categories.

This coding is subjective, and the coders do not always agree on the message classification. While chat communication and coding procedures have become common in the experimental literature, nearly all researchers employ the average across-coder correlation to determine whether a particular type of message meaning is reliably coded. Exceptions include Henning-Schmidt et al. (2008) and Cooper and Kühn (2014), who follow a more standard content analysis methodology to use a measure that adjusts the reliability statistic to account for the number of categories that coders can use for classification. Agreement between the coders can occur by chance, especially if there are few categories for classification. To account for this, Cohen's Kappa (Krippendorff, 2003; Cohen, 1960) is a scaled measure of agreement that takes a value of 0 when the amount of agreement is what random chance would imply, and 1 when the coders agree perfectly.[12] Kappa values between 0.41 and 0.60 are considered "Moderate" agreement, and those above 0.60 indicate "Substantial" agreement (Landis and Koch, 1977). We consider only message classifications that reach the "Moderate" agreement threshold.

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[12] The *kappa* command is available in *Stata*.

## 4. Results

The results section is organized in 3 subsections. Section 4.1 summarizes the frequency of different messages exchanged in the Rich Communication treatment, and how they differ between victims and beneficiaries. We focus on DAC transgressions throughout because nearly all transgressions are the DAC type. For example, in the 14 Rich Communication sessions the leaders chose DAC transgressions 505 times and chose to transgress against both responders only 41 times. Moreover, half of these transgressions against both responders occurred in the first 6 periods, probably because such transgressions were rarely profitable as they were nearly always met with joint resistance. Section 4.2 investigates how different forms of communication affect the intended and actual resistance rates to DAC transgressions across treatments. Section 4.3 compares the leader transgression rates and distribution of surplus across treatments.

### *4.1 Rich Communication*

For the content analysis our coders classified messages in 35 categories and subcategories. Some categories were used infrequently, and others were not reliably classified across the two coders. Table 2 presents the frequency that different types of chat statements that were frequently expressed and reliably coded for responders when they faced DAC transgressions for the Rich communication sessions, separately for the victim and beneficiary roles.[13] Beneficiary and victim subjects each exchange 2.2 to 2.6 chat messages on average per two-minute chat period respectively, so the number of messages is similar to the number we implemented exogenously in the Multi-Round Sequential Restrictive Communication treatment.

[13] Following standard practice in content analysis, when the coders disagree about the frequency with which messages fall into a particular category we use the average frequency indicated by the coders.

Our first result provides direct evidence to the conjecture that victims indeed are more active in sending free-form messages, and are more likely to appeal to social motivations than the beneficiaries to convince the beneficiaries to engage in coordinated resistance.

**Result 1:** Victims more frequently express the first message in the chat dialog, and express more messages than beneficiaries overall. Victims also more frequently appeal to the other responder to be “fair” and to harm the leader. Beneficiaries propose to acquiesce more frequently.

*Support*: Table 2 indicates that, consistent with the conjecture that victims should be more eager than beneficiaries to utilize communication to affect behavior, victims send the first message in over 62 percent of the chats. This is significantly more often than beneficiaries send the first message, and victims express 18 percent more messages overall than do beneficiaries. Victims also propose to acquiesce only 5 percent of the time, compared to 20 percent by beneficiaries, and they appeal to the other responder to be fair about twice as frequently as do beneficiaries. Victims also propose being “nasty” to the leader about 50 percent more often than to beneficiaries.[14]

These patterns provide direct statistical evidence that the asymmetric incentives faced by victims and beneficiaries lead them to communicate with *different intensity and content* in interesting and intuitive ways. Victims more quickly and vigorously engage in the chat communication. As we document below, beneficiaries indicate an intention to resist and actually do resist at higher rates in this Rich communication treatment than in other treatments, but they do so less frequently than do victims.

[14] Table 2 is based on the Random Strangers matching condition. An analysis for the Perfect Strangers condition yields similar results, so we do not present them explicitly. For the statistical comparisons we estimate the Poisson model with cluster-robust standard errors because this is advised when the data are not necessarily Poisson distributed and feature over-dispersion (Cameron and Trivedi, 2010, Ch. 17, Ch. 18). Another significant difference in Table 2 (the influence of resistance choices on the leader’s decision) is not robustly significant to an alternative model specification to account for over-dispersion, the Negative Binomial model, so we do not include it in Result 1.

**Table 2: Message Frequencies by Victims and Beneficiaries of DAC Transgressions in Rich (Chat) Communication Sessions**

| | | Average Frequency per Chat by: | | |
|---|---|---|---|---|
| Message Frequency or Count | Cohen's Kappa (Reliability) | DAC Victims | DAC Beneficiaries | *p* -value for session clustering |
| Rate of sending first message of this chat | | 0.624 | 0.376 | <0.01 |
| Total Number of messages per subject this chat | | 2.602 | 2.196 | <0.01 |
| Propose to acquiesce or inform other of intention to acquiesce | 0.843 | 0.051 | 0.209 | <0.01 |
| Propose to resist or inform other of intention to resist | 0.834 | 0.636 | 0.449 | 0.033 |
| Agree with other responder's proposal | 0.751 | 0.483 | 0.431 | 0.134 |
| Reasoning about why should choose resist or not | 0.553 | 0.616 | 0.535 | 0.092 |
| Maximizing profit (long or short run) | 0.493 | 0.039 | 0.023 | 0.124 |
| Being nice to/concern for well-being of leader | 0.660 | 0.022 | 0.037 | 0.159 |
| Being nasty to leader | 0.708 | 0.101 | 0.067 | 0.044 |
| Appeal to other responder to be fair | 0.487 | 0.178 | 0.080 | <0.01 |
| Coordination of strategies among the responders | 0.539 | 0.095 | 0.070 | 0.109 |
| Discussion of leader's decisions | 0.745 | 0.144 | 0.121 | 0.235 |
| Reference to the choice of the leader | 0.495 | 0.047 | 0.052 | 0.531 |
| Influence of responders' resistance choice on leader's decision | 0.748 | 0.083 | 0.052 | 0.011 |
| Greeting (both hello and goodbye) | 0.852 | 0.200 | 0.179 | 0.492 |
| Reference to previous rounds | 0.617 | 0.090 | 0.109 | 0.206 |
| Discussions about the experiment in general | 0.655 | 0.054 | 0.042 | 0.080 |
| Other discussion of experiment earnings | 0.428 | 0.055 | 0.050 | 0.591 |
| Other | 0.603 | 0.165 | 0.166 | 0.967 |

Note: Test for difference between victims and beneficiaries is based on a random effects poisson (count) regression of message frequencies, except for sending the first message which is based on an random effects logit model with session clustering.

### 4.2 *Intended and Actual Resistance Rates to DAC Transgression*

Before comparing the intended resistance rates across treatments, we must define how intentions are identified in the different treatments. For the Simultaneous Restrictive treatment, intended resistance is simply identified with the binary message (resist or acquiesce) expressed in the single round of communication. For the Multi-Round Sequential Restrictive treatment, we consider the intentions separately for the first round of communication and the second round of communication. For the Rich Communication treatment, we classify a responder as indicating an intention to resist if he states this in the chat for that period (classification category "propose to resist or inform the other responder of an intention to resist") or if the other responder has indicated this resist intention during the chat for that period and the subject agrees (classification category "agree with other person's proposal / confirmation of agreement"). Although coding in these categories is reliable, we distinguish between cases when both coders identify resistance intensions from cases when only one coder identifies intended resistance. As shown below the results are qualitatively similar for the two cases.

We first test the conjecture that beneficiaries are more likely to indicate an intention to challenge under rich communication than under both forms of restrictive communications.

**Result 2:** Victim intended resistance rates are never significantly different across the communication treatments, but beneficiary and joint intended resistance rates are significantly greater for rich communication compared to the restrictive forms of communication. These increases in the Rich Communication treatment are driven more by the opportunity to send free-form messages rather than the multiple and iterative opportunities to indicate intentions.

**Table 3: Intended Resistance Rates for Communication Treatments (DAC Subgames)**

| | | Multi-Round Seq. Restrictive | | Rich (Chat) | |
|---|---|---|---|---|---|
| | Simultaneous Restrictive | First Round | Second Round | Both coders identify resistance intention | Either coder identifies resistance intention |
| Victim Intentions | 76.0% (87.5%) | 77.6% | 69.2% | 67.7% (77.6%) | 77.2% (81.2%) |
| Beneficiary Intentions | 34.9% (34.1%) | 25.3% | 28.6% | 55.8% (53.5%) | 63.6% (57.1%) |
| Joint Resistance Intentions | 26.2% (29.5%) | 21.6% | 26.3% | 46.5% (49.4%) | 58.0% (53.3%) |

Note: Main entries are for Random Strangers sessions. Entries shown in parentheses are for Perfect Strangers sessions

*Support*: Table 3 displays the intended resistance rates for these three treatments. In order to test whether the intended resistance rates are significantly different, we employ one independent observation from each session in conservative Mann-Whitney tests. The victim resistance intention rates are similar across treatments, ranging from 67 to 77 percent, and are never significantly different across any treatments at the 5 percent significance level. The Restrictive Communication treatments also do not have significantly different beneficiary and joint (both responders) resistance intention rates, regardless of whether the comparison is made for the first or second round of exchanged intentions. By contrast, beneficiary and joint intended resistance rates are about twice as high in the Rich Communication treatment than in the Restrictive Communication treatments, and these differences are always significant at the 1 percent level.

The rich communication in the chat room results in numerically large and highly significant increases in the rates that beneficiaries and both responders jointly indicate an intention to resist DAC transgressions. Because the Multi-Round Sequential Restrictive Communication treatment does not significantly increase the beneficiary and joint resistance intention rates compared to the Simultaneous Restrictive Communication treatment, our results suggest that these large increases in the beneficiary and joint resistance intentions in the Rich Communication treatment are driven more by the opportunity to send free-form messages rather than the multiple and iterative opportunities to indicate intentions. Furthermore, as we document below, these large increases in resistance intention rates in the Rich Communication treatment translate into large increases in joint resistance and large decreases in leader transgression compared to the restrictive communication treatments, and hence redistribute surplus from the leaders to the responders. Despite the communication being non-binding, these results indicate that the efforts exerted by responders in communication do pay off for them.

The next result documents that the indicated intentions are significantly associated with the actual resistance rates.

**Result 3:** In all communication treatments, beneficiary and (especially) joint resistance intentions are significantly associated with greater coordination on responder joint resistance in the DAC subgames.

*Support*: We estimated a series of logit regression models of the responders' intention to resist a DAC transgression, separately for each communication treatment and for victims and beneficiaries. Detailed results are in Appendix B, and they provide statistical support for the conclusion that both victims and beneficiaries choose to resist transgressions when the beneficiary or (especially) when both responders indicate that they intend to resist. The likelihood of actual resistance for both victims and beneficiaries is nearly always statistically significantly higher when only the beneficiary or (especially) when both responders indicate an intention to resist, compared to the baseline case of no intended resistance. By contrast, the impact of the victims' intention is always smaller and is often statistically insignificant.

Results 2 and 3 suggest that even if the responders follow through on their indicated intentions to challenge at the same rates in all communication treatments, rich communication will lead to a higher successful joint resistance rate because it significantly increases the beneficiary and joint resistance intention rates. Furthermore, as discussed earlier, rich communication may be more powerful in motivating guilt averse responders or expressive responders to follow through on an agreement to challenge DAC, compared to a "similar" agreement to challenge reached through restrictive communication. The next result shows that responders are more likely to follow through on their indicated intentions to challenge under rich communication.

**Result 4:** Controlling for the type of intended resistance communicated, actual resistance rates are higher with rich communication than the restrictive communication treatments except when no responder indicates an intention to resist.

*Support*: Table 4 reports a set of logit models of the DAC challenge decision, estimated separately for different combinations of expressed challenge intentions. For the Rich Communication treatment we classify an intention as indicated if it is identified by either coder, and for the Multi-Round Sequential Restrictive we use challenge intention expressed in either round. For all models in which responders indicate any intended resistance (columns 2 through 4 and 6 through 8), resistance is significantly more likely with Rich Communication than the omitted case of the Simultaneous Restrictive treatment. The lower part of the table shows that resistance is always significantly more likely with Rich Communication than with Multi-Round Sequential Restrictive Communication for each combination of challenge intentions.

The next result combines the individual responders' actual resistance decisions to determine actual, effective joint resistance to DAC transgressions and compares joint resistance rates across treatments.

**Result 5:** Joint resistance to DAC transgression is higher with Rich Communication, compared to the No Communication baseline and the restrictive forms of communication.

*Support*: To document these performance differences we employ a simple statistical test that does not need to condition on intentions expressed, using one statistically independent observation per session. Table 5 reports the joint resistance rates to DAC transgression for each Random Strangers session, ordered from highest to lowest within treatments. Although compared to the No Communication baseline the resistance rates are slightly higher for the Simultaneous Restrictive and Multi-Round Sequential Restrictive treatments, these increases are not statistically significant. By contrast, the three- to four-fold increase in successful DAC resistance rates in the Rich Communication treatment is significantly greater than the No Communication and Restrictive Communication treatments (Mann-Whitney *p*-values<0.01 for all three pairwise comparisons; *n*=14, *m*=8). The joint resistance rate is not significantly different between the Simultaneous and Multi-Round Restrictive Communication treatments (Mann-Whitney *p*-value=0.71), indicating that it is opportunity to send free-form messages rather than merely exchange multiple messages that increases effective resistance.

### *4.3 Leader Transgressions and Surplus Distribution*

Greater responder resistance is associated with lower leader transgression, which is apparent from the scatter plot of these two measures shown in Figure 2. Each dot represents one of the 45 independent sessions. The next result indicates that the pattern of transgression rates across treatments mirrors the DAC resistance rates documented in the previous result.

**Result 6:** Transgression rates are lower and decline over time with Rich Communication, compared to the No Communication baseline and the restrictive forms of communication.

*Support*: Table 6 reports the leader transgression rates for the individual sessions and for 5-period blocks pooling across sessions within treatments. The highest transgression rates are in the No Communication baseline, and the reduction in these rates for the Simultaneous Restrictive treatment is modest and not statistically significant (Mann-Whitney *p*-value=0.19, *n*=*m*=8). Transgression rates are significantly lower relative to this baseline for the Multi-Round Sequential Restrictive (*p*-value=0.012) and Rich Communication (*p*-value<0.01) treatments. The transgression rates are not significantly different in the two Restrictive Communication treatments (*p*-value=0.115), but the Rich Communication

**Table 4: Logit Models of DAC Challenge Decision across Treatments, Separately for Different Communicated Messages (Marginal Effects Displayed)**

**Dependent Variable = 1 if Responder Challenges a DAC Transgression**

| | Victim Actual Resistance | | | | Beneficiary Actual Resistance | | | |
|---|---|---|---|---|---|---|---|---|
| | No Intended Resistance | Victim Only Intended Resistance | Beneficiary Only Intended Resistance | Both Intended Resistance | No Intended Resistance | Victim Only Intended Resistance | Beneficiary Only Intended Resistance | Both Intended Resistance |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Dummy=1 if | 0.098 | 0.420** | 0.452** | 0.109** | 0.074 | 0.189* | 0.511** | 0.233** |
| Rich Comm. | (0.080) | (0.077) | (0.101) | (0.043) | (0.054) | (0.078) | (0.088) | (0.088) |
| Dummy=1 if Seq. | -0.185** | -0.042 | -0.102 | 0.031 | (all benefic. | -0.013 | 0.173 | 0.05 |
| Restrictive Comm | (0.054) | (0.046) | (0.149) | (0.039) | acquiesced) | (0.043) | (0.093) | (0.100) |
| 1/Period | 0.559** | 0.534** | -0.189 | 0.01 | 0.274* | 0.047 | -0.017 | 0.281* |
| | (0.175) | (0.136) | (0.415) | (0.077) | (0.139) | (0.053) | (0.333) | (0.143) |
| *p* -value for Rich= Seq. Restrictive | <0.01 | <0.01 | <0.01 | 0.059 | NA | <0.01 | <0.01 | 0.042 |
| Log-Likelihood | -96.3 | -407.0 | -69.1 | -151.1 | -53.7 | -175.3 | -71.6 | -378.6 |
| Observations | 252 | 734 | 125 | 603 | 183 | 734 | 125 | 603 |

Notes: All models based on the first 35 periods only. Robust standard errors (clustering at the session level) shown in parentheses.
Omitted treatment is Simultaneous Restrictive. ** denotes significance at the one-percent level; * denotes significance at the five-percent level (all two-tailed tests).

**Table 5: Successful Joint Resistance Rates to DAC Transgressions for Individual Sessions**

| | Random Strangers Sessions | | | | Perfect Strangers Sessions | | |
|---|---|---|---|---|---|---|---|
| | No Communication | Simultanous Restrictive | Multi-Round Sequential Restrictive | Rich (chat) | No Communication | Simultanous Restrictive | Rich (chat) |
| (sessions | 0.367 | 0.372 | 0.262 | 0.889 | 0.110 | 0.238 | 0.538 |
| ordered | 0.164 | 0.351 | 0.218 | 0.833 | 0.098 | 0.094 | 0.429 |
| highest | 0.134 | 0.210 | 0.171 | 0.786 | | | 0.291 |
| to | 0.131 | 0.116 | 0.169 | 0.750 | | | |
| lowest) | 0.120 | 0.092 | 0.167 | 0.682 | | | |
| | 0.078 | 0.071 | 0.116 | 0.565 | | | |
| | 0.025 | 0.045 | 0.069 | 0.564 | | | |
| | 0.010 | 0.038 | 0.047 | 0.513 | | | |
| | | | | 0.441 | | | |
| | | | | 0.436 | | | |
| | | | | 0.429 | | | |
| | | | | 0.418 | | | |
| | | | | 0.410 | | | |
| | | | | 0.400 | | | |
| Treatment Average | 0.129 | 0.162 | 0.152 | 0.580 | 0.104 | 0.166 | 0.419 |

Note: Rates are calculated based on the first 35 periods of each session, except for the Perfect Strangers sessions which only lasted for 15 periods.

**Table 6: Leader Transgression Rates for Individual Sessions**

| | Random Strangers Sessions | | | | Perfect Strangers Sessions | | |
|---|---|---|---|---|---|---|---|
| | No Communication | Simultanous Restrictive | Multi-Round Sequential Restrictive | Rich (chat) | No Communication | Simultanous Restrictive | Rich (chat) |
| (sessions | 1.000 | 0.971 | 0.895 | 0.629 | 0.900 | 0.842 | 0.617 |
| ordered | 0.971 | 0.914 | 0.781 | 0.590 | 0.892 | 0.692 | 0.517 |
| highest | 0.924 | 0.876 | 0.743 | 0.581 | | | 0.492 |
| to | 0.914 | 0.848 | 0.638 | 0.543 | | | |
| lowest) | 0.886 | 0.810 | 0.638 | 0.429 | | | |
| | 0.857 | 0.771 | 0.610 | 0.410 | | | |
| | 0.800 | 0.619 | 0.524 | 0.410 | | | |
| | 0.619 | 0.438 | 0.419 | 0.390 | | | |
| | | | | 0.333 | | | |
| | | | | 0.219 | | | |
| | | | | 0.210 | | | |
| | | | | 0.181 | | | |
| | | | | 0.143 | | | |
| | | | | 0.133 | | | |
| Periods 1-5 | 0.808 | 0.725 | 0.683 | 0.529 | 0.813 | 0.738 | 0.658 |
| Periods 6-10 | 0.908 | 0.817 | 0.633 | 0.405 | 0.888 | 0.763 | 0.500 |
| Periods 11-15 | 0.842 | 0.842 | 0.658 | 0.381 | 0.988 | 0.800 | 0.467 |
| Periods 16-20 | 0.867 | 0.792 | 0.683 | 0.371 | | | |
| Periods 21-25 | 0.842 | 0.767 | 0.650 | 0.367 | | | |
| Periods 26-30 | 0.925 | 0.783 | 0.658 | 0.276 | | | |
| Periods 31-35 | 0.908 | 0.742 | 0.625 | 0.271 | | | |
| Treatment Average | 0.871 | 0.781 | 0.656 | 0.371 | 0.896 | 0.767 | 0.542 |

Note: Rates are calculated based on the first 35 periods of each session, except for the Perfect Strangers sessions which only lasted for 15 periods.

treatment has significantly lower transgression rates compared to the Simultaneous Restrictive and the Multi-Round Sequential Restrictive treatments (*p*-value<0.01 in both comparisons).

**Result 7:** The share of payoffs captured by the leader is ordered across treatments as follows, with all differences statistically significant: No Communication > Simultaneous Restrictive > Multi-Round Sequential Restrictive > Rich Communication.

**Figure 2: DAC Joint Resistance and Leader Transgression Across Sessions**

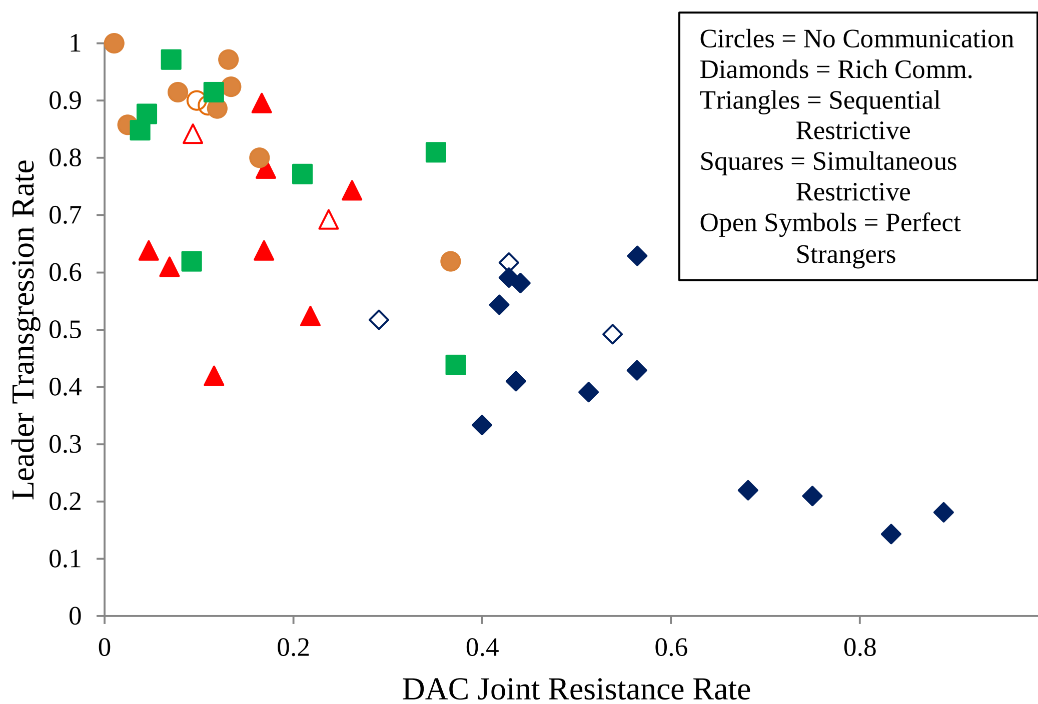


**Figure 2: DAC Joint Resistance and Leader Transgression Across Sessions**

*Support*: At the efficient no transgression/no resistance outcome, the leader receives 6 of the 22 experimental francs (27.3 percent) surplus. A successful transgression against both responders could raise his share to as high as 12/15 (80 percent). Average leader shares (across sessions) were 0.67 in No Communication, 0.59 in Simultaneous Restrictive, 0.39 in Multi-Round Sequential Restrictive, and 0.32 in Rich Communication. Based on Mann-Whitney tests, all of these pairwise differences are statistically significant (all $p$-values<0.05).

## 5. Conclusions

Using the CR game in Weingast (1995, 1997), this paper presents a laboratory experiment to investigate how rich communication may facilitate coordinated resistance against divide-and-conquer transgressions. In the context of this divide-and-conquer social dilemma, we provide novel and direct statistical evidence that agents who face asymmetric economic and social incentives communicate with different intensity and content. In the CR game, victims more quickly and vigorously engage in communication, urging the beneficiary to "be fair." On the other hand, beneficiaries propose to acquiesce more frequently.

Despite the non-binding nature of the communication and the fact that coordinated resistance requires the beneficiary to act against her material interest, the efforts exerted by the responders in rich communication do pay off. The successful joint resistance rate increases almost four-fold (from 15 to 58 percent) when moving from the Multi-Round Sequential Restrictive Communication treatment to Rich Communication. This increase in joint resistance in turn deters leader transgression, reducing the transgression rate from 66 to 37 percent.

Furthermore, our data provide support for the conjecture that rich communication is more powerful than restrictive communication in facilitating coordinated resistance against DAC transgression because it provides responders with the opportunity to make free-form statements that heighten the importance of social motivations. Compared to restrictive forms of communication, rich communication significantly increases expressions of beneficiary and joint resistance intentions. Responders are also more likely to follow-through on agreements to challenge DAC reached through rich communication than similar agreements reached in restrictive forms of communication. The joint resistance rates are also higher with rich communication than the restrictive communication treatment that allows the responders to iteratively communicate their intended actions but removes the possibility of making free-form statements. This indicates that the significant impacts of rich communication are driven more by the responders' ability to send free-form messages than the multiple and iterative opportunities to indicate intentions.

Our paper also contributes to an emerging literature in experimental economics aimed at understanding how different forms of non-binding communication affect cooperation in social dilemmas differently. In an early study, Frohlich and Oppenheimer (1998) finds that face-to-face communication is more effective than e-mail communication in promoting cooperation in the prisoner's dilemma. More recently, Brosig et al. (2003) finds that face-to-face communication increases public goods contributions more than video-conferencing, while Bochet and Putterman (2009) finds that allowing subjects to send free-form non-binding written messages increases public goods contributions more than a treatment in which subjects can only send non-binding numerical announcements. Similarly, Oprea et al. (2013) find that rich chat communication is more effective for increasing cooperation than restrictive and limited language in a continuous time public goods game.

All the above studies consider symmetric games such as the prisoner's dilemma or public good games, in which players face exactly the same incentives. Thus, when a player offers a specific argument to support why she plans to cooperate and uses the same argument to urge others to cooperate, that argument can be particularly persuasive. A richer format of communication may enable players to better exploit this "empathy effect" in a symmetric environment, and further increase cooperation.

In the CR game considered here, by contrast, a significant asymmetry exists between the victim and the beneficiary and this asymmetry is endogenously determined by the leader. The victim gains from successful coordinated resistance, but the beneficiary actually suffers a pecuniary loss from successful coordinated resistance. Despite this asymmetry, a richer format of communication still significantly increases coordinated resistance against DAC by the victim and the beneficiary, and this in turn deters transgression by the leader who does not participate in communication. Together with recent results that rich communication can also have larger impact than restrictive communication in promoting cooperation in asymmetric games such as the trust game discussed in Section 2 (Charness and Dufwenberg, 2006, 2010; also see Bicchieri et al., 2010) and the dictator game (Andreoni and Rao, 2010),[15] our results suggest that the power of rich communication can be important in both symmetric and asymmetric games.

The current study develops procedures that capture interesting qualitative and quantitative information in rich communication to facilitate comparison of its impact on coordinated resistance in this divide-and-conquer social dilemma to different forms of restrictive communication. It is not designed, however, to provide direct evidence about how specific social motivations affect behavior. Future work should address this important limitation, and study the relative importance and interactions of different social motivations in the CR game.

[15] Bicchieri et al. (2010) finds that in a trust game, chat communication that allows free discussion--including discussion about the game itself--increases the amount sent by the first-mover, but chat communication that only allows discussion on topics others than the game itself does not increases the amount sent by the first-mover. In addition, Andreoni and Rao (2010) shows that in a dictator game, allowing the recipient to ask for an allocation increases the amount of giving, while a treatment that only allows the allocator to communicate has the opposite effect.

The responders are ex ante identical in the CR game studied here, but in many situations, ex ante asymmetry may exist so that one is the natural victim while the other is the natural beneficiary. Ex ante asymmetry between the victim and the beneficiary is also an important issue in the recent debate regarding eminent domain in the United States that echoes issues raised about land confiscation in China discussed above. The taking clause of the Fifth Amendment of the United States Constitution states that "nor shall private property be taken for public use, without just compensation." In the controversial case *Kelo* vs. *City of New London* (545 U.S. 469 (2005)), in a 5-4 decision, the U. S. Supreme Court ruled that an urban development plan that "will provide appreciable benefits to the community, including, but not limited to, new jobs and increased tax revenue" serves a "public purpose" and satisfies the taking clause of the Fifth Amendment.

This ruling provides justification for government taking of properties and transferring them to private parties for development by equating "public purpose" to "public use" in the original taking clause of the Fifth Amendment. It has sparked a heated debate and led to legislation by many states to limit the government's use of eminent domain (Kerekes, 2011). In her dissenting opinion, justice O'Connor argued that "(a)ny property may now be taken for the benefit of another private party, but the fallout from this decision will not be random. The beneficiaries are likely to be those citizens with disproportionate influence and power in the political process, including large corporations and development firms. As for the victims, the government now has license to transfer property from those with fewer resources to those with more" (*Kelo* vs. *City of New London*, 545 U.S. 469 (2005)).

To investigate the impact of such asymmetry, future research can consider a modified CR game in which an exogenously designated beneficiary first decides whether to request that the leader transgress against a victim. If the leader complies, the victim then has the opportunity to engage in rich communication with a fourth player whose material payoff is not affected by the transgression. The victim can send free-form messages to persuade the "outsider" to act against her material interest to incur the cost to challenge the transgression. The outsider can now never suffer from DAC transgression, so the social motivations she faces may be different from those faced by a beneficiary in our current CR game. Careful study of this CR game with outsider-enforcement and its variations will enable us to understand whether rich communication can still facilitate coordinated resistance in such environments.

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## Appendix A: Experiment Instructions (Rich Communication)

This is an experiment in the economics of multi-person strategic decision making. The Australian Research Council has provided funds for this research. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. The currency used in the experiment is francs. Your francs will be converted to Australian Dollars at a rate of 8 francs to one dollar. At the end of today's session, you will be paid in private and in cash.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

The experiment consists of 35 separate decision making periods. The 18 participants in today's experiment will be randomly split each period between three equal-sized groups, designated as **Person 1**, **Person 2** and **Person 3** groups. If you are designated as a Person 1, then you remain in this same role throughout the experiment. Participants who are not designated as a Person 1 switch randomly between the Person 2 and Person 3 roles in different decision making periods.

At the beginning of each decision making period you will be randomly re-grouped with two other participants to form a three-person group, with one person of each type in each group. The groupings change every period, since you will be randomly re-grouped in each and every period.

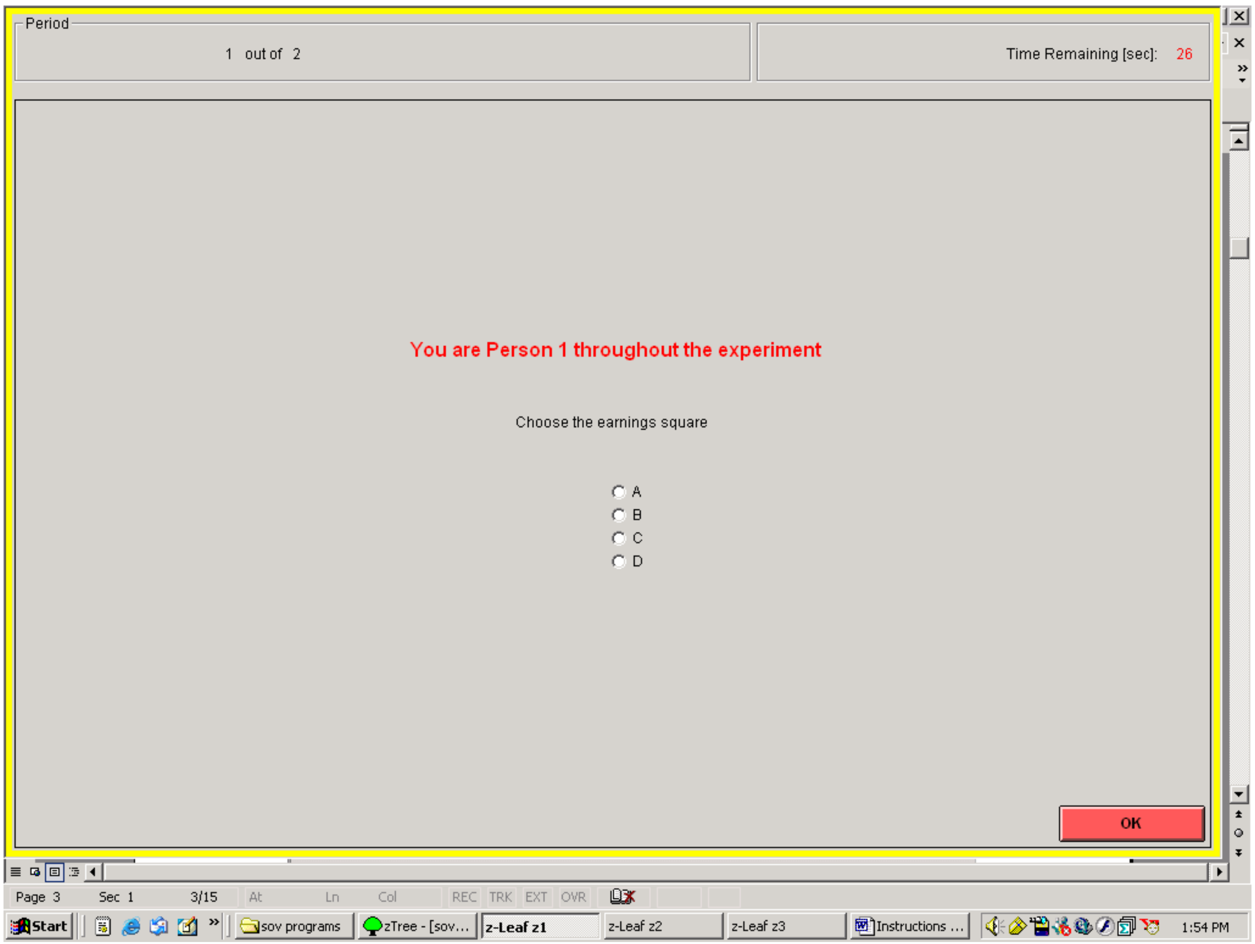
Your Choice

During each period, you and all other participants will make one choice. Earnings tables are provided on separate papers, which tell you the earnings you receive given the choices that you and others in your group make.  If you are **Person 1** then you choose the earnings square, either **A**, **B**, **C** or **D**. You make this choice before the other two people in your group make their choice, on a decision screen as shown in Figure 1 on the next page.

After learning which earnings square the Person 1 chose, then **Persons 2 and 3** make their choices. However, after learning Person 1's earnings square choice but before making their actual choice, Persons 2 and 3 have an opportunity to privately communicate with each other for 90 seconds in a chat window. (After period 5 this chat period will be reduced to 60 seconds.)

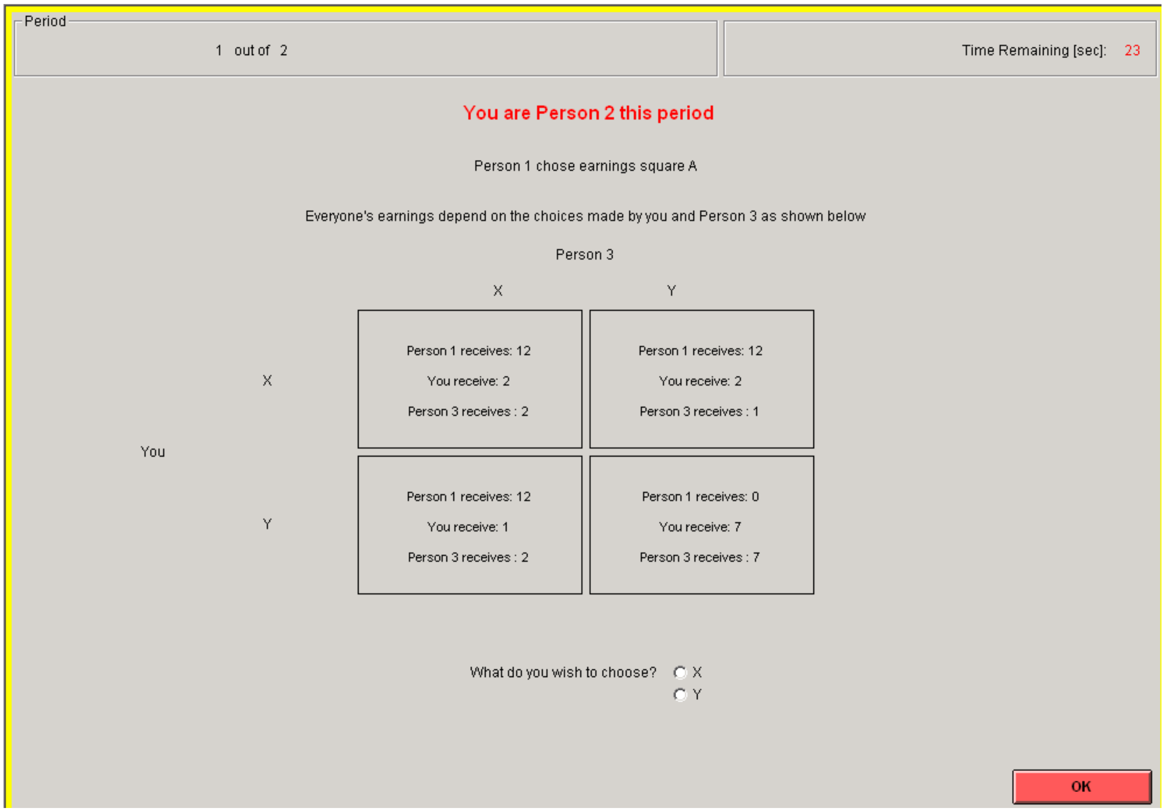
Although we will record the messages that you send, only you and the one other person (either Person 2 or 3 depending on whether you are Person 3 or 2) will see them. Person 1 will not observe your chat messages.

Note, in sending messages back and forth between you and the other person we request that you follow two simple rules: (1) Be civil to each other and use no profanity and (2) Do not identify yourself.




**Decision Screen for Person 1**

After the chat period is over, Persons 2 and 3 then make their actual choice simultaneously; for example, if you are Person 2 then you do not learn the actual choice of Person 3 until after you make your choice. Both Persons 2 and 3 may choose either **X** or **Y.**

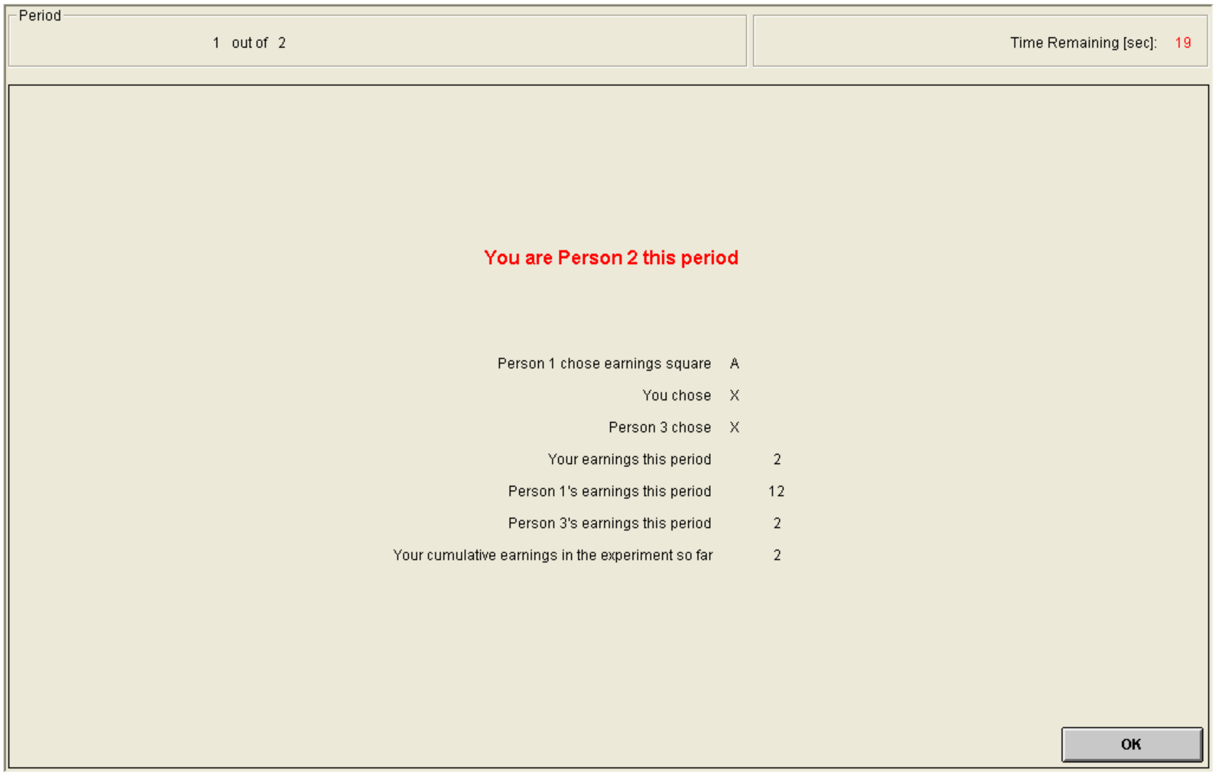



**Decision Screen for Person 2 (Person 3's is very similar)**

Your earnings from the choices each period are found in the box determined by you and the other two people that you are grouped with for the current decision making period. If both Persons 2 and 3 choose **X**, then earnings are paid as shown in the box in the upper left on the screen. If both Persons 2 and 3 choose **Y**, then earnings are paid as shown in the box in the lower right on the screen. The other two boxes indicate earnings when one chooses **X** and the other chooses **Y**. To illustrate with a random example: if Person 1 chooses earnings square **A**, Person 2 chooses **X** and Person 3 chooses **Y**, then Person 1 earns 12, Person 2 earns 2, and Person 3 earns 1. You can find these amounts by looking at the appropriate square and box in your page of earnings tables.

<u>The End of the Period</u>

After everyone has made choices for the current period you will be automatically switched to the outcome screen, as shown on the next page. This screen displays your choice as well as the choices of the people you are grouped with for the current decision making period. It also shows your earnings for this period and your earnings for the experiment so far.




**Example Outcome Screen (Shown for Person 2)**

Once the outcome screen is displayed you should record your choice and the choice of the others in your group on your Personal Record Sheet. Also record your current and cumulative earnings. Then click on the *continue* button on the lower right of your screen. Remember, at the start of the next period all participants are randomly re-grouped, and you are randomly re-grouped each and every period of the experiment.

We will now pass out a questionnaire to make sure that all participants understand how to read the earnings tables and understand other important features of these instructions. Please fill it out now. Raise your hand when you are finished and we will collect it. If there are any mistakes on any questionnaire, I will summarize the relevant part of the instructions again. Do not put your name on the questionnaire.

# Earnings Tables – Person 1

**Earnings Square A:**

| | | Person 3's Choice: X | Person 3's Choice: Y |
|---|---|---|---|
| Person 2's Choice: | X | Person 1 receives 12<br>Person 2 receives 2<br>Person 3 receives 2 | Person 1 receives 12<br>Person 2 receives 2<br>Person 3 receives 1 |
| | Y | Person 1 receives 12<br>Person 2 receives 1<br>Person 3 receives 2 | Person 1 receives 0<br>Person 2 receives 7<br>Person 3 receives 7 |

**Earnings Square B:**

| | | Person 3's Choice: X | Person 3's Choice: Y |
|---|---|---|---|
| Person 2's Choice: | X | Person 1 receives 8<br>Person 2 receives 2<br>Person 3 receives 9 | Person 1 receives 8<br>Person 2 receives 2<br>Person 3 receives 8 |
| | Y | Person 1 receives 8<br>Person 2 receives 1<br>Person 3 receives 9 | Person 1 receives 0<br>Person 2 receives 7<br>Person 3 receives 7 |

**Earnings Square C:**

| | | Person 3's Choice: X | Person 3's Choice: Y |
|---|---|---|---|
| Person 2's Choice: | X | Person 1 receives 8<br>Person 2 receives 9<br>Person 3 receives 2 | Person 1 receives 8<br>Person 2 receives 9<br>Person 3 receives 1 |
| | Y | Person 1 receives 8<br>Person 2 receives 8<br>Person 3 receives 2 | Person 1 receives 0<br>Person 2 receives 7<br>Person 3 receives 7 |

**Earnings Square D:**

| | | Person 3's Choice: X | Person 3's Choice: Y |
|---|---|---|---|
| Person 2's Choice: | X | Person 1 receives 6<br>Person 2 receives 8<br>Person 3 receives 8 | Person 1 receives 6<br>Person 2 receives 8<br>Person 3 receives 7 |
| | Y | Person 1 receives 6<br>Person 2 receives 7<br>Person 3 receives 8 | Person 1 receives 0<br>Person 2 receives 7<br>Person 3 receives 7 |

**Appendix B: Logit Models of DAC Challenge Decision Based on Communicated Messages**

**(Marginal Effects Displayed)**

**Dependent Variable = 1 if Responder Challenges a DAC Transgression**

| | Simultaneous Restrictive | | Multi-Round First Round | | Simultaneous Restrictive Second Round | | Rich (Either Coder finds resistance) | |
|---|---|---|---|---|---|---|---|---|
| Message Combinations: | Victim Challenge | Beneficiary Challenge | Victim Challenge | Beneficiary Challenge | Victim Challenge | Beneficiary Challenge | Victim Challenge | Beneficiary Challenge |
| Only Victim Indicates Resistance | 0.101* (0.051) | -0.017 (0.065) | 0.016 (0.019) | 0.012 (0.028) | 0.119** (0.022) | 0.068 (0.053) | 0.134** (0.050) | 0.035 (0.085) |
| Only Beneficiary Indicates Resistance | 0.245** (0.052) | 0.205† (0.107) | 0.081 (0.077) | 0.374** (0.013) | 0.130† (0.068) | 0.442** (0.151) | 0.174** (0.037) | 0.376** (0.046) |
| Both Responders Indicate Resistance | 0.643** (0.074) | 0.440** (0.125) | 0.727** (0.031) | 0.600** (0.078) | 0.825** (0.031) | 0.673** (0.158) | 0.549** (0.055) | 0.600** (0.051) |
| 1/period | 0.438** (0.169) | 0.142 (0.090) | 0.266** (0.054) | 0.108 (0.139) | 0.259** (0.099) | 0.137 (0.161) | 0.353* (0.144) | 0.289* (0.126) |
| Log likelihood | -324.1 | -220.4 | -227.1 | -141.1 | -180.6 | -121.8 | -161.2 | -268.3 |
| Observations | 625 | 625 | 510 | 510 | 510 | 510 | 505 | 505 |

Notes: All models are based on the first 35 periods only. Robust standard errors (clustering at the session level) shown in parentheses. ** denotes significance at the one-percent level; * denotes significance at the five-percent level; † denotes significance at the ten-percent level (all two-tailed tests).

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**Supplementary Appendix to**

# Rich Communication, Social Preferences, and Coordinated Resistance against Divide-and-Conquer: A Laboratory Investigation (2013)

**by Timothy N. Cason and Vai-Lam Mui**

In the text, before proceeding to discussing our experimental design, we first discuss how rich communication may affect the behavior of victims and beneficiaries. As background for this discussion, we informally sketch in the text a model developed in Cason and Mui (2013) that was designed to study how incomplete information about social preferences and non-binding restrictive communication (in the form of a binary message) affect behavior in the repeated CR game. We then informally explain how the model can be used to demonstrate that the presence of heterogeneous social preferences transforms the subgame following a DAC transgression (the DAC subgame) into a game of incomplete information. We also state that it can be shown that an informative equilibrium exists in the CR game with social preferences and non-binding restrictive communication, in which restrictive communication can help coordinate resistance between the victim and the (*SP*-type) beneficiary.

This appendix sketches the model that we discussed informally in the text. Detailed discussion of the model and proofs of results are reported in the Technical Appendix of Cason and Mui (2013) that is available at http://users.monash.edu.au/~vlmui/CR_app.pdf.

Consider a model in which all agents are of two types. With probability *p* an agent has standard preferences, and with probability *(1-p)* the agent has social preferences. An agent's type is her private information. Cox et al. (2007) assume that in a (two-player) sequential move game, when a second-mover with social preferences makes her decision after observing the action chosen by the first-mover, the second-mover's marginal rate of substitution between her income and the income of the first-mover depends on her emotional state toward the first-mover. Following this approach, and for simplicity we assume that the only emotional reaction that can be triggered in the CR game is the negative reaction toward a transgressing leader by the responders. Qualitatively, our main results hold for any social preferences models in which a social preference type beneficiary prefers that DAC be defeated.[1]

If agent *i* is a Social Preferences type (hereafter the *SP*-type) and a responder, she regards a DAC transgression by the leader as undesirable, modeled with the utility function

$$U_i\left(y_L, y_i, y_j\right) = \begin{cases} \frac{1}{\alpha}\left[y_i^{\alpha} + \theta y_L^{\alpha})\right], & \theta \in (-1,0) \text{ if } a_L \in \{TAB, TA, TB\} \\ & \theta = 0 \text{ if } a_L = NT \end{cases} \quad (1)$$

Here, $y_i$ is agent *i*'s income, $y_L$ is the leader's income, $y_j$ is the income of the other responder, $\theta$ is the (conditional) emotional state variable, and $\alpha \le 1$ (and $\alpha \ne 0$) is an elasticity of substitution parameter. TAB denotes transgression against both responders, NT denotes No Transgression, and TA and TB denote divide-and-conquer transgression against A and B, respectively. If an agent is a Standard type (hereafter the *S*-type), then regardless of whether she is a leader or a responder, she has a utility function

$$U_i\left(y_i\right) = \frac{1}{\alpha} y_i^{\alpha}. \quad (2)$$

Because the only emotional reaction we focus on is the negative reaction by a responder towards a transgressing leader, an *SP*-type leader will also have a utility function of $U_i\left(y_i\right) = \frac{1}{\alpha} y_i^{\alpha}$.

**Result 1**: If $|\theta| > \left(9^{\alpha} - 7^{\alpha}\right)/8^{\alpha}$ and $p < \left(7^{\alpha} - 2^{\alpha}\right)/\left(7^{\alpha} - 1\right)$, then each of the three following strategy profiles constitutes a Bayesian Nash Equilibrium in the DAC subgame with social preferences:

(i) Both the *S*-type victim and the *SP*-type victim acquiesce, and both the *S*-type beneficiary and the *SP*-type beneficiary acquiesce.

[1] Note that given the chosen parameter values, introducing simple inequity aversion, such as that captured in Fehr and Schmidt's (1999) well-known model, does not affect the beneficiaries' dominant strategy to acquiesce. A beneficiary challenging a transgression reduces the disutility from earning more than the transgression victim. But he also reduces his material payoff and increases his disutility from earning more than the leader when the resistance succeeds. Therefore, acquiescing remains a dominant strategy for the beneficiary. Furthermore, one can show that this implies that a leader with inequity aversion still prefers DAC transgression to no transgression. Therefore, incorporating inequity aversion does not change the conclusion that "no transgression against any responder" cannot be supported as part of an equilibrium. Inequity aversion could change the set of equilibria for other payoff parameters, however, such as the lower leader payoffs used in Weingast's (1997) original version of the game.

(ii) Both the *S*-type victim and the *SP*-type victim challenge. The *S*-type beneficiary always acquiesces, and the *SP*-type beneficiary challenges.

(iii) The *S*-type victim challenges with a probability $\beta = \frac{(1-p)(9^\alpha + \theta 8^\alpha - 7^\alpha) + p(9^\alpha - 8^\alpha)}{p(7^\alpha - 8^\alpha - \theta 8^\alpha)} \in (0,1)$, and the *SP*-type victim always challenges. The *S*-type beneficiary always acquiesces, and the *SP*-type beneficiary challenges with a probability $\gamma = \frac{2^\alpha - 1}{(1-p)(7^\alpha - 1)} \in (0,1)$.

Result 1 shows that when social preferences are sufficiently strong and that there is a sufficiently high probability that a beneficiary is an *SP*-type, then social preferences transform the DAC subgame into a stag-hunt game for the responders, with multiple (and Pareto-ranked) equilibria. The model also implies that victims will challenge more than beneficiaries, which is consistent with the empirical findings in Cason and Mui (2007). Although joint resistance can be supported as an equilibrium, incomplete information about the types of other responders and multiple equilibria can prevent joint resistance from occurring. We refer the interested reader to pp. 8-25 of the Technical Appendix of Cason and Mui (2013) that is available at http://users.monash.edu.au/~vlmui/CR_app.pdf for detailed analysis of the one-shot CR game with incomplete information about social preferences that contains the proof of Result 1 and the discussion of other results.

Now consider the effect of non-binding restrictive communication between the responders in the one-shot CR game. In the one-shot CR game with social preferences and with communication, the timing of events is as follows:

1. Nature chooses the type of each player.
2. The leader, L, chooses his action $a_L \in A_L = \{TAB, TA, TB, NT\}$ .
3. At the *responder communication stage*, responders A and B observe the leader's action, and then simultaneously choose a message $m_i \in M_i = \{AC, CH\}, i = A, B$.
4. Observing the message sent by the other responder, a responder updates her belief about the type of the other responder.

5. At the *responder action stage*, each responder chooses her action $a_i \in A_i = \{AC, CH\}, i = A, B$ , as a function of the observed message profile $(m_A, m_B) \in M_A \times M_B$ sent by the responders.

6. Payoffs are realized for the leader and the two responders.

In this game, the players' strategies constitute a Perfect Bayesian equilibrium if:

(E1) Given the responders' strategies, L's chosen action maximizes his expected utility.

(E2) At the responder communication stage, for any responder, given the leader's chosen action and the other responder's strategy, each type of this responder's chosen message maximizes her expected utility.

(E3) Having observed the message sent by the other responder, a responder updates her belief about the type of the other responder based on the other responder's strategy according to Bayes' rule.

(E4) At the responder action stage, for any responder and for any observed message profile, each type of this responder's action maximizes her expected utility given the leader's chosen action and the other responder's strategy.

Note that (E1) reflects the assumption that an *S*-type leader and an *SP*-type leader will behave the same in this model.

**Result 2**: If $-\theta > \frac{9^{\alpha} - 7^{\alpha}}{8^{\alpha}}$ and $p < \left(\frac{3}{4}\right)^{\alpha}$, then the following strategy profiles constitute a Perfect Bayesian equilibrium in the CR game with social preferences:

(i) The leader chooses NT. (ii) If the leader chooses TA, then both the *SP*-type and the *S*-type of responder A (who is the victim) will choose the message CH, while the *SP*-type of responder B (who is the beneficiary) will choose the message CH, and the *S*-type of responder B will choose the message AC. Both types of A will choose the action CH iff the observed message profile is $(m_A, m_B) = (CH, CH)$. The *SP*-type of B will choose the action CH iff the message profile is $(m_A, m_B) = (CH, CH)$, and the *S*-type of B will choose the action AC for any message profile $(m_A, m_B)$. (iii) if the leader chooses TB, then A (who is now the beneficiary) and B (who is now the victim) will adopt strategies that are mirror images of the strategies just described when the leader chooses TA. (iv) if the leader chooses TAB, then regardless of their type, both responders will choose the message CH, and will choose the action CH iff the observed message profile is $(m_A, m_B) = (CH, CH)$. (v) if the leader chooses NT, then regardless of their type, both responders will choose the message AC, and will choose the action AC for any observed message profile $(m_A, m_B)$.

As common in cheap talk games, a babbling equilibrium always exists, but Result 2 shows that an informative equilibrium also exists. In this equilibrium, both types of victim will indicate Challenge and will challenge if and only if both the victim and the beneficiary have indicated Challenge in the communication stage. An *SP*-type beneficiary will indicate Challenge, and will challenge if and only if both the victim and the beneficiary have indicated Challenge in their messages. An *S*-type beneficiary will indicate Acquiesce, and will acquiesce regardless of the messages sent by the victim and beneficiary. These strategies constitute an equilibrium because an *SP*-type beneficiary prefers that a DAC transgression be defeated and has the incentive to send a message of CH to indicate that she is an *SP*-type so as to induce coordinated resistance with the victim. On the other hand, an *S*-type beneficiary prefers that a DAC transgression succeeds, and has no incentive to deviate to send a message of Challenge. Communication can help coordinate resistance against DAC in this environment. We refer the interested reader to pp. 64-77 of the Technical Appendix of Cason and Mui (2013) that is available at http://users.monash.edu.au/~vlmui/CR_app.pdf for detailed analysis of the one-shot CR game with incomplete information about social preferences and restrictive communication that contains the proof of Result 2 and the discussion of other results.

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