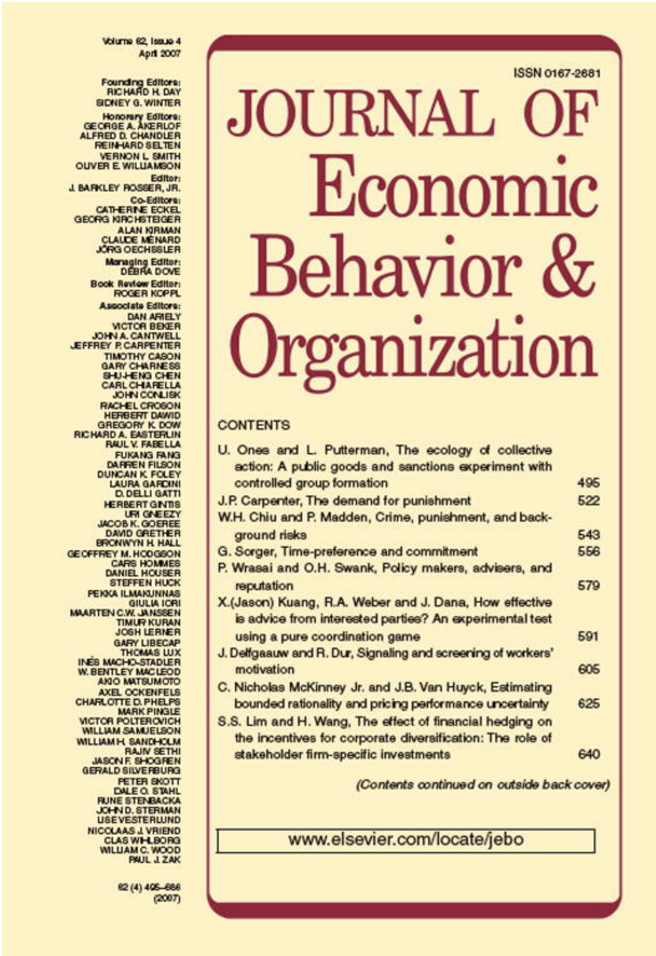

Volume 62, Issue 4
April 2007



62 (4) 405–686
(2007)

ISSN 0167-2681

# JOURNAL OF Economic Behavior & Organization

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Journal of Economic Behavior & Organization
Vol. 62 (2007) 591–604

JOURNAL OF
Economic Behavior
& Organization

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# How effective is advice from interested parties? An experimental test using a pure coordination game

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Received 27 September 2004; accepted 30 March 2005
Available online 14 February 2006

**Abstract**

This study investigates whether the effectiveness of non-binding advice in coordination is influenced by knowledge of the adviser's motive. Using pure coordination games in which a non-playing adviser makes a recommendation of which strategy to play, we find that if the advice appears to be "self-interested" (i.e., the adviser has a monetary stake in the advice being followed), it is less effective than if the same advice is given by a neutral independent party with no economic interest in the game. The implications of our results for the effectiveness of advice in real-world economic and organizational situations are discussed.


*JEL classification:* C72; C92; D21; D70

*Keywords:* Coordination games; Advice; Equilibrium selection

## 1. Introduction

Coordination problems, in which players must attempt to match the actions of others, are important in much economic activity. As a result, coordination games are a useful tool for modeling and studying economic and organizational phenomena. In such games, coordination is often difficult due to multiple equilibria and strategic uncertainty since players find it difficult to anticipate which equilibrium others will attempt to implement (Schelling, 1960; Van Huyck et al., 1990; Ochs, 1995).

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0167-2681/$ – see front matter 
doi:10.1016/j.jebo.2005.03.010

One potential solution to coordination problems is to give common-knowledge advice to players regarding what action to take (Brandts and MacLeod, 1995). However, standard economic theory predicts that such advice will be effective only if it is aligned with players' self-interests (Harsanyi and Selten, 1988). Hence, the effectiveness of non-binding advice in coordinating behavior, particularly when it conflicts with other equilibrium selection criteria such as payoff-dominance and risk-dominance, is an empirical issue.

Aside from its interest for game theorists, the effectiveness of non-binding advice is also important for understanding the role and influence of leadership in firms. Milgrom and Roberts (1992) and Foss (2001) argue that a key role of organizational leaders is to ensure coordination among employees. Thus, the effectiveness of leadership is largely dependent on the extent to which the leader's guidance actually impacts which equilibrium arises within an organization.

Previous studies find that non-binding advice has considerable influence on behavior in coordination games. Specifically, when advice leads away from a payoff-dominant equilibrium and there are no other conflicting selection criteria, a significant proportion of players (up to half) follow it (Van Huyck et al., 1992; Brandts and MacLeod, 1995). In this prior research, the advice is often provided as a message from the experimenter with no explicit description of the experimenter's motivation for providing the advice. However, this research does not explore the impact of advice in more naturally occurring settings where a non-participating adviser's wealth is influenced by the combined actions of the players receiving the advice and, in particular, when the adviser's interest is inconsistent with players' interests.

Such instances are common in real organizations. For example, a coordination problem may arise within a division of a firm when employees have to choose among technologies possessing network externalities (e.g., operating systems and communication technologies). Suppose a manager can recommend which technology employees should adopt. How effective will such a recommendation be, particularly when it is counter to what employees generally perceive as being the best choice?

While previous research has explored the effect of such recommendations when employees are *unaware* of the reasons behind recommendations, we argue that in real organizations the reasons are usually known and salient (or at least employees believe they know the reasons). For instance, the manager may obtain a kickback from one alternative's manufacturer or may have a preference for a different kind of technology than the employees (e.g., one that allows easier monitoring of communication). If the preferences of the person giving the advice influence its effectiveness as a coordinating mechanism, then ignoring the role of such preferences makes it difficult to generalize existing experimental results to situations outside the laboratory.

We investigate the influence on behavior of a recommendation to play a payoff-dominated equilibrium in a pure coordination game. We first replicate previous results (e.g., Van Huyck et al., 1992; Brandts and MacLeod, 1995) with a treatment in which the advice is from the experimenter (with no mention of motivation for the recommendation). We then focus on whether the influence of advice is affected by the adviser's motivation. To do so, we explore how the effectiveness of advice differs between a treatment in which "interested" advice comes from an adviser with an explicit stake in the final outcome of the game and a treatment in which "uninterested" advice comes from a third party with no stake in the game. Our experimental results show that players' perceptions of the adviser's motive significantly influence the effectiveness of advice; advice that appears to be motivated by self-interest is less effective than if the same advice is given by a neutral party who has no economic interest in the game.

The remainder of this paper is organized as follows: Section 2 reviews related literature and sets forth our hypotheses, Section 3 presents the design of our experiments, Section 4 discusses the main experimental results using only first round choices, Section 5 reports dynamic results and Section 6 summarizes and concludes.

## 2. Background and hypotheses

A number of previous experimental studies examined the effect of non-binding messages and advice on players' behavior in coordination games. Most of these studies used games in which payoff-dominance and risk-dominance select different equilibria (as in the "stag hunt" or "weak link" games), and the advice was usually to implement the payoff-dominant, risk-dominated equilibrium. Therefore, a player's willingness to follow the advice reflects her belief in the effectiveness of the advice in distinguishing between these two selection principles. For example, Charness (2000) and Weber et al. (2001) found that non-binding messages to play the payoff-dominant equilibrium significantly increased the frequency with which players selected the corresponding strategy. Offerman et al. (2001) found that when players were given advice to choose a cooperative but risky strategy in an overlapping-generations coordination game, about 30–46 percent of the players followed the advice. Similarly, in Chaudhuri et al.'s (2001) multi-generational minimum-effort coordination game, in which a predecessor gives advice to a successor, the advice to choose the option corresponding to the Pareto-optimal equilibrium was followed by approximately 43 percent of the players. To summarize, these studies show that if payoff-dominance conflicts with risk-dominance, advice pointing to an equilibrium selected by the former principle will be followed by a significant proportion of players, but not by all of them (and will not ensure coordination on the efficient equilibrium).[1]

Two studies explored the effectiveness of advice in a context similar to ours.[2] Van Huyck et al. (1992) used a pure coordination game in which concerns about risk do not have any offsetting (and therefore confounding) effect to that of payoff-dominance. Specifically, they used a game similar to the one in Table 1. This game has three Nash equilibria (along the diagonal), one of which ($a$, $a$), is payoff-dominant. Van Huyck et al. found that when the experimenter recommended that players play strategy $b$, which corresponds to a payoff-dominated equilibrium, 48 percent of the players followed the advice. Using a different game, Brandts and MacLeod obtained a similar result (31 percent of subjects followed a recommendation to play a payoff-dominated equilibrium). Taken together, the results of prior research indicate that when non-binding advice conflicts with payoff-dominance and there are no other selection principles involved, it is followed by a significant proportion of players (up to one-half).



1 Relatedly, Brandts and MacLeod show that recommendations from the experimenter to play imperfect Nash equilibria are not followed, and subjects instead play strategies consistent with perfection.

2 Schotter and Sopher (2003, in press a,b) and Celen et al. (2004) investigated the effect of advice on the formation of social conventions in a variety of intergenerational games. They found that previous players' advice significantly impacts subsequent players' behavior and that such advice can facilitate coordination in games such as the battle-of-sexes game. In this work, the adviser has an interest, much as in our experiments. However, this work differs from ours in two important ways. First, in the work by Schotter and Sopher and Celen et al. the adviser, prior to giving advice, plays the game in the same role as the advisee while in our experiment the adviser and advisee are in totally different roles (and the adviser does not make any strategic choice in the game). This distinction is important since our work focuses on the effectiveness of "outside" advice while their work mainly focuses on the effectiveness of "peer" or "parent" advice. Second, in most of their experiments the adviser shares common interest with the advisee because the adviser's payoff is positively related to the advisee's payoff. In our study, the adviser either has no explicit interest in the game or has interest that is in conflict with the advisee.

Table 1
Game 1

| Player X's choice | Player Y's choice | | |
|---|---|---|---|
| | *a* | *b* | *c* |
| *a* | 6, 6 | 0, 0 | 0, 0 |
| *b* | 0, 0 | 5, 5 | 0, 0 |
| *c* | 0, 0 | 0, 0 | 4, 4 |

In our study, we first replicate the above previous results. We use Game 1, in which the three pure strategy combinations (*a*, *a*), (*b*, *b*) and (*c*, *c*) are all Nash equilibria, but only (*a*, *a*) is payoff-dominant. We compare a treatment without advice (1NA) with one in which there is advice to play *b* from the experimenter (1A).

Payoff-dominance suggests that in Game 1 without advice players will choose *a* (Farrell, 1988; Harsanyi and Selten, 1988). Thus, our first hypothesis is the following:

**H1.** In Game 1 without advice (treatment 1NA), subjects will choose strategy *a*.

If players receive advice from the experimenter to play strategy *b,* standard equilibrium refinements predict that players will realize that this advice is collectively irrational since it results in an inferior payoff ((*b*, *b*) is a payoff-dominated equilibrium) and will therefore deem this advice strategically irrelevant, ignore it, and coordinate on the payoff-dominant equilibrium (Harsanyi and Selten, 1988; Sugden, 1995). However, in light of previous results showing the partial effectiveness of such a recommendation (e.g., Van Huyck et al., 1992; Brandts and MacLeod, 1995), we hypothesize that

**H2.** In Game 1 with advice to play *b* from the experimenter (treatment 1A), a significant proportion of subjects will choose strategy *b*.

While previous research demonstrates that non-binding advice can influence behavior in a coordination game, our focus is on exploring the effectiveness of such advice while varying the perceived motivation for the advice. To explore this issue, we conducted experiments using Game 2 (shown in Table 2), a modified version of Game 1. In Game 2, there is a third player (Player Z) who does not make any choice, but instead receives a payoff determined by the choices of Players X and Y (Player Z's payoff is the third number in each cell). The only outcome in which Player Z receives a positive payoff is (*b*, *b*), which is a payoff-dominated Nash equilibrium for Players X and Y. As long as it is common knowledge that Players X and Y do not care at all about Player Z, payoff-dominance selects the same equilibrium (*a*, *a*), as in Game 1.

The main focus of our study is on how advice from an interested party (Player Z) differs in effectiveness from advice from an uninterested party. To do so, we vary the source of a recom-

Table 2
Game 2

| Player X's choice | Player Y's choice | | |
|---|---|---|---|
| | *a* | *b* | *c* |
| *a* | 6, 6, 0 | 0, 0, 0 | 0, 0, 0 |
| *b* | 0, 0, 0 | 5, 5, 5 | 0, 0, 0 |
| *c* | 0, 0, 0 | 0, 0, 0 | 4, 4, 0 |

mendation to Players X and Y to play *b* in Game 2. We wish to explore how a recommendation to play strategy *b* affects the propensity of Players X and Y to do so and how the source of the recommendation influences its effectiveness. Therefore, we conduct three treatments: one without advice (2NA), one with advice from the "interested" party (2AI) and one with advice from an "uninterested" party (2AU).

To create a base rate for behavior without any recommendation, we conduct a treatment using Game 2 with no advice. Traditional game theory assumes that the presence of Player Z should be irrelevant (payoff-dominance should still select (*a*, *a*)). On the other hand, social concerns may impact behavior in Game 2. For instance, Players X and Y may be influenced by concerns for fairness (see Camerer, 2003) or social welfare (see Ledyard, 1995), especially when the cost for them to reach a fair and social welfare-maximizing outcome is not high.[3] Therefore, we expect subjects to treat such social concerns (which select the (*b*, *b*) equilibrium) as a potential coordinating device.

**H3.** In Game 2 without advice (treatment 2NA), a significant proportion of Players X and Y will choose *b*.

When there is a recommendation to choose *b* (treatments 2AI and 2AU), we predict that its effectiveness will be "motivation dependent". That is, whether the advice is followed will depend on what players know about the adviser's motive. More precisely, we believe that the strength of the recommendation will be undermined when the recommendation is explicitly consistent with the adviser's known self-interest.[4]

We conducted two different treatments with advice using Game 2. In one treatment (2AI), Player Z gives advice to Players X and Y to play *b*.[5] We anticipate that such advice from an "interested" party will have a negligible incremental coordinating effect (above the frequency of *b* choices in the absence of any advice). Thus, our next hypothesis is that

**H4.** In Game 2 with advice from Player Z (treatment 2AI), Player Z's advice to play *b* will produce no change in Players X's and Y's behavior relative to the benchmark case in which Game 2 is played with no advice (treatment 2NA).

We also compare behavior in treatment 2AI to that in treatment 2AU, in which the advice to play *b* comes from a neutral independent party with no interest in the game (a subject in a previous experiment). When advice is given by someone who has no stake in the advice being followed, we anticipate that it will be more effective than when it comes from an interested party. That is, advice from "uninterested" parties will have a stronger influence on behavior. This allows a test of our main research question[6]:

[3] We do not distinguish whether any change in behavior from Game 1 to Game 2 is due to fairness concerns or social welfare concerns (or to how costly it is for Players X and Y to coordinate on (*b*, *b*) instead of (*a*, *a*)). While the relative impact of these selection principles would be worth studying, doing so extends beyond our primary focus, which is on the differential impact of different kinds of advice ("interested" versus "uninterested"). The "without advice" condition (i.e., 2NA) is simply used as a benchmark against which the effect of advice (conditions 2AI and 2AU) is examined. Therefore, we do not distinguish between the different principles of equilibrium selection involved in treatment 2NA but instead simply use it as a baseline condition to compare the effectiveness of advice.

[4] This is somewhat related to "reactive devaluation" in social psychology, which occurs when an outcome becomes less attractive by having another party (in a bargaining situation) indicate the outcome is favorable (see Ross, 1995).

[5] We allowed Player Z to freely choose any advice to give (*a*, *b* or *c*), but expected that a large majority would recommend *b*.

[6] In a sense, H4 is "stronger" than H5 in that H4 posits that there will be no change in behavior from 2NA to 2AI, while H5 simply posits that the change from 2NA to 2AI will be smaller than the change from 2NA to 2AU.

**H5.** In Game 2, the advice to play *b* will be more effective if it is given by a neutral independent party (treatment 2AU) than if it is given by Player Z (treatment 2AI).

## 3. Experimental design

In our experiment, pairs of subjects played either Game 1 or Game 2 twice. There were five conditions:

(1) In treatment 1NA, two subjects played Game 1 with no recommendation.
(2) In treatment 1A, two subjects played Game 1, but received a recommendation (from the experimenter) to play strategy *b*.
(3) In treatment 2NA, two subjects played Game 2, producing a payoff for a passive third subject, with no recommendation.
(4) In treatment 2AI, two subjects played Game 2, producing a payoff for a passive third subject, with a recommendation of what strategy to play from the third subject.
(5) In treatment 2AU, two subjects played Game 2, producing a payoff for a passive third subject, with a recommendation of what strategy to play from an independent party outside the experiment.

The independent-party recommendation for treatment 2AU was collected in the following manner. A few days before running the 2AU sessions, we asked six people who showed up for an unrelated cancelled experiment to give advice to players in an experiment that we would run in the future.[7] They received a fixed amount (US$ 6, which included a US$ 5 show-up fee) for making this recommendation. In their instructions, we explained Game 2 and gave them a short quiz to ensure that they fully understood the game. We then told them that we would like to ask an independent party to give advice to future participants in the role of Players X and Y. They then each indicated their choice of advice (*a*, *b* or *c*) by circling it at the bottom of the instruction sheet. Among the six subjects, four recommended choosing *b*, and two recommended choosing *a*. To maintain comparability with treatment 2AI (in which every Player Z recommended *b*), the analysis below considers only sessions in which we handed out the sheets of the four recommenders who recommended *b*.[8]

We ran the experiments in five two-round sequences: 1NA–1A, 1A–1NA, 2NA–2AI, 2AI–2NA and 2AU–2NA, in which subjects played two games with randomly drawn opponents each time (subjects could not be matched with the same person twice).[9]

Our subjects were undergraduate students in various fields at the University of Pittsburgh and Carnegie Mellon University. Table 3 presents the combinations of conditions by sequence and

[7] These people were told they would be eliminated from the list of potential participants for this experiment.

[8] In two other sessions, excluded from the remaining analysis, we used only the recommendations to play *a*. This was done primarily to avoid the concern that we deceived subjects by not sampling from all of the possible recommendations. The impact of the *a* recommendations, while not useful for a comparison with the *b* recommendations generated by Player Z in treatment 2AI, is nonetheless worth mentioning. We expected such recommendations to be quite effective since they were consistent with players' self-interests. In fact, 95 percent of the players followed the advice.

[9] We originally planned to run all the treatments in two-round sequences (holding group size constant, this means eight possible combinations). After running five of the eight sequences, however, we detected a significant order effect (see Section 5) that prevents us from pooling data across sequences. Therefore, since the cost of conducting additional sequences was non-negligible and such sessions would generate a lot of (second round) data we would not use in our primary analysis, we did not run the other three sequences.

Table 3
Experimental sessions

| Sequence of conditions | University of Pittsburgh | | Carnegie Mellon University | |
|---|---|---|---|---|
| | Date | # of subjects (# Player X or Y) | Date | # of subjects (# Player X or Y) |
| 1NA–1A | 11-20-02 | 10 (10) | 3-12-03 | 10 (10) |
| 1A–1NA | 9-25-02 | 10 (10) | 3-7-03 | 8 (8) |
| 2NA–2AI | 2-14-03 | 12 (8) | 3-18-03 | 15 (10) |
| 2AI–2NA | 10-15-02 | 18 (12) | 3-4-03 and 6-12-03 | 30 (20) |
| 2AU–2NA | 4-22-03 | 18 (12) | 4-25-03 and 6-11-03 | 30 (20) |



population.[10] Experimental instructions and procedures were constant across conditions, except for the necessary variations in the specific treatments.

In every session, the experimental instructions consisted of two parts. The first part consisted of general instructions that explained how to interpret generic payoff tables (for either Game 1 or Game 2, depending on the condition for that session). Subjects were told that each point in the payoff table corresponded to US$ 0.50. These general instructions were distributed and read aloud to all subjects. Subjects' questions were answered, and a short quiz was given to ensure that they understood how to read and interpret payoff tables of the form presented in Tables 1 and 2 (but with generic payoffs).

After the general instructions and quiz, each subject randomly drew a participant number that consisted of a letter (X or Y, as well as Z in Game 2) and a number. The letter gave the role that the subject would play in the game and the number was used for grouping. For example, X3, Y3 and Z3 were in the same group. The process of role assignment and grouping was strictly anonymous, so throughout the experiment a subject did not know whom he or she played with or what role any other subject had.

The second part of the instructions consisted of treatment-specific instructions that were presented to subjects immediately before each of the two rounds. In the specific instructions, subjects were shown the payoff table for the game they would play (Game 1 in 1NA and 1A and Game 2 in 2NA, 2AI and 2AU). After presenting the game, the instructions included a statement highlighting the strategic aspect of coordination games ("Players X and Y will receive points only if they both make *the same* choice").

Then, in 1A and 2AI, subjects read (and the experimenter read aloud) the following paragraph about advice:

> To assist you in figuring out what choice to make [the experimenter/Player Z], will give both players advice as to which option to choose. Both Players X and Y will receive exactly *the same* advice, so following this advice can be helpful for making the same choice as the other player. The advice is not a requirement. However, since Players X and Y cannot receive any points unless they make the same choice, the advice might help to figure out what choice to make. Note that if you believe the other player in your group will follow the advice, then you will receive points only if you also follow the advice.

[10] Subjects' affiliations produced no significant difference in results, so we pool data from the two populations.

In 2AU, subjects read the following statement about the advice:

> To assist Players X and Y in figuring out what choice to make, we asked a neutral independent party to give Players X and Y advice as to which option to choose. This neutral independent party understood the game very clearly, and did not know the identities of the players in today's experiment. This neutral independent party was a student similar to yourselves who was recruited in the same way that you were. He/she was given a sheet that described the game in detail, and answered questions to make sure he/she understood the game. He/she then gave advice about Players X's and Y's choices.
>
> Both Players X and Y will receive exactly *the same* advice, so following this advice can be helpful for making the same choice as the other player. The advice is not a requirement. However, since Players X and Y cannot receive any points unless they make the same choice, the advice might help to figure out what choice to make. Note that, if you are Players X or Y, and if you believe the other player in your group will follow the advice, then you will receive points only if you also follow the advice.

Following the treatment-specific instructions, subjects were asked if they had any questions.

In conditions 1A, 2AI and 2AU, Players X and Y received advice before playing the game. In condition 1A, players were shown a sheet indicating that they should play action *b*. In condition 2AI, Player Z circled a recommendation on an "Advice Sheet". The experimenter then collected this sheet and showed it privately to Players X and Y. In condition 2AU, the experimenter privately showed Players X and Y a copy of the exact instruction sheet collected from one of the recommenders.[11] In all three cases, subjects in the role of Players X and Y knew that they were observing the same advice sheet as the other strategic player with whom they were matched.

After completing the instructions (and providing Players X and Y with advice in conditions 1A, 2AI and 2AU), subjects played the game. When playing the game, subjects in the role of Players X and Y indicated their choices by circling them on a "Record Sheet".[12] The experimenter then collected these sheets.

After the first round (game) was completed, subjects were informed that they would play a second game and received new participant numbers and new condition-specific instructions describing the second condition. Subjects received no feedback about the result of the first round when they entered into the second round. (As Table 3 indicates, the only thing that varied between the two rounds within a session was the presence or absence of advice, not the game.) The second round then proceeded in the same way as the first.

After conducting both rounds, we matched Players X's and Y's choices for every group and determined all players' payoffs. The participation fee (US$ 6) and the money converted from the accumulated points were paid to the subject privately in cash as they exited the experiment.

## 4. Results

Comparing conditions by position (first or second game) within a session, the results of Game 2 exhibit a significant order effect (see Table 4). Hence, our main analysis only uses data from the



[11] The experimental instructions for recommenders in 2AU are available on the JEBO website.

[12] To ensure anonymity, whenever a subset of the participants was making a choice (such as when Players X and Y chose actions in Game 2 or when Player Z chose advice in 2AI), we also had all other participants make a choice (usually a hypothetical choice) by similarly writing on a piece of paper.

Table 4
Choices in the two rounds of each sequence

| Sequence | First round | | Second round | |
|---|---|---|---|---|
| 1NA–1A ($n=20$) | 1NA | *a*: 20 (100%)<br>*b*: 0 (0%)<br>*c*: 0 (0%) | 1A | *a*: 8 (40%)<br>*b*: 12 (60%)<br>*c*: 0 (0%) |
| 1A-1NA ($n=18$) | 1A | *a*: 9 (50%)<br>*b*: 9 (50%)<br>*c*: 0 (0%) | 1NA | *a*: 17 (94%)<br>*b*: 1 (6%)<br>*c*: 0 (0%) |
| 2NA-2AI ($n=18$) | 2NA | *a*: 7 (39%)<br>*b*: 11 (61%)<br>*c*: 0 (0%) | 2AI | *a*: 3 (17%)<br>*b*: 15 (83%)<br>*c*: 0 (0%) |
| 2AI-2NA ($n=32$) | 2AI | *a*: 12 (38%)<br>*b*: 20 (63%)<br>*c*: 0 (0%) | 2NA | *a*: 18 (56%)<br>*b*: 14 (44%)<br>*c*: 0 (0%) |
| 2AU-2NA ($n=32$) | 2AU | *a*: 6 (19%)<br>*b*: 26 (81%)<br>*c*: 0 (0%) | 2NA | *a*: 11 (34%)<br>*b*: 21 (66%)<br>*c*: 0 (0%) |

Entry is the number (percentage) of subjects choosing *a*, *b* or *c*.

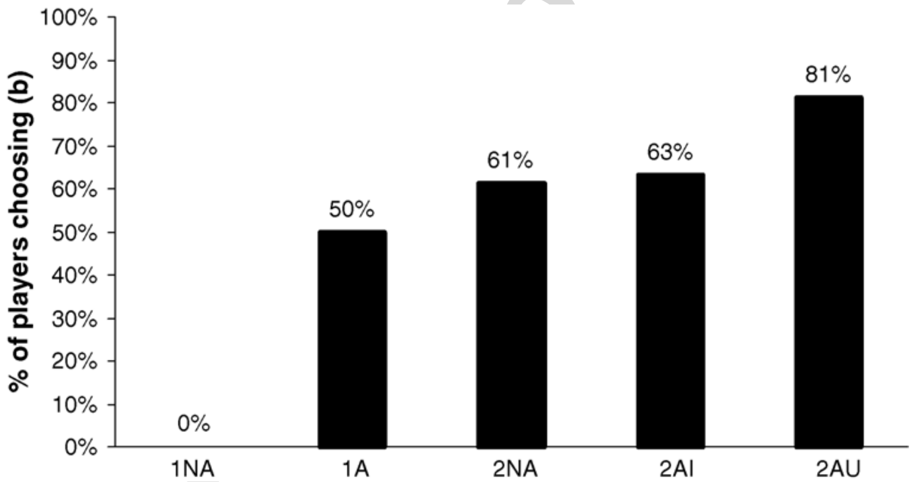


Fig. 1. First round *b* choices by condition.

first round of each sequence, and this essentially makes each condition a one-shot game.[13] We discuss the second round data in Section 5.

We first explore behavior in Game 1 (1NA and 1A). As Fig. 1 indicates, our results closely replicate those of Van Huyck et al. (1992). When there is no advice (1NA), every subject chooses *a*. However, when advice is given by the experimenter to play *b* (1A), half of the choices are

[13] Of course, in many comparable real-world organizational settings, a history of repeated interaction may influence the effectiveness of advice. Such influences are likely to be "history dependent", meaning that what happens initially may be expected to happen subsequently, and this belief is self-reinforcing. Therefore, to demonstrate the effectiveness of advice in a situation that has been uninfluenced by history and to lay a foundation for what might happen with repetition, we look only at one-shot data. That is, one-shot data are more suitable for testing our main hypotheses while controlling for confounds possibly resulting from repetition.

consistent with this advice. This change is statistically significant (Fisher's Exact, one-tailed, $p < 0.001$).[14] Thus, H1 and H2 are clearly supported, meaning we replicate previous work.

To test H3, which predicts that fairness or social welfare concerns will influence behavior in Game 2, we compare the frequency of *b* choices in conditions 1NA and 2NA. The frequencies of *b* choices for these two conditions are, respectively, 0 and 61 percent, which are significantly different (Fisher's Exact, one-tailed, $p < 0.001$). Therefore, social concerns clearly compete with payoff-dominance and influence Players X's and Y's choices in Game 2.

We are most interested in the effect of Player Z's advice to play *b* in Game 2 since this constitutes advice from an "interested" party. (Not surprisingly, every subject in the role of Player Z recommended *b*.) We saw that advice from the experimenter to play *b* in Game 1 had a significant effect on behavior (i.e., the frequency of *b* choices increased from 0 percent in 1NA to 50 percent in 1A). H4 predicts that interested advice from Player Z will not have any effect on the behavior of Players X and Y in Game 2. Comparing condition 2NA with 2AI shows that the change in behavior was very small (61 percent versus 63 percent) and not statistically significant (Fisher's Exact, one-tailed, $p = 0.45$). Player Z's recommendation appears to have virtually no impact on behavior in Game 2, providing support for H4.

In condition 2AU (uninterested advice), 81 percent of subjects followed the recommendation to play *b*, which is higher than both the 63 percent who did so in condition 2AI (interested advice) and the 61 percent who choose *b* in condition 2NA (no advice). The difference between 2AU and 2NA is statistically significant (Fisher's Exact, one-tailed, $p = 0.06$), indicating that "uninterested" advice in condition 2AU significantly influenced choices (recall that the difference between conditions 2NA and 2AI is not significant).

The difference between the proportions of *b* choices in conditions 2AI and 2AU is also statistically significant (Fisher's Exact, one-tailed, $p = 0.05$).[15] Treatments 2AI and 2AU differ only in the source of the recommendation, i.e., whether it comes from an interested or uninterested adviser. Therefore, the fact that the effect of uninterested advice (2AU) is 10 times as big as the effect of interested advice (2AI) provides clear support for H5.[16]

To summarize, we first replicate previous work demonstrating the effect of a recommendation from the experimenter to implement a payoff-dominated equilibrium. Half of our subjects play the advised action even though none play that action in the absence of advice. In a modified game in which a third party earns a positive payoff only if the payoff-dominated equilibrium (*b*, *b*) is reached, the advice to play *b* from the "interested" third party has no effect on behavior. However, when the same advice comes from someone with no monetary interest in the (*b*, *b*) equilibrium, significantly more players follow it.



[14] Because the sample sizes in many of our comparisons are relatively small, we employ Overall's Strengthened Fisher's Exact Test (see Rosenthal and Rosnow, 1991).

[15] A logistic regression also reveals that *b* choices are significantly more likely under the "uninterested" advice than under the "interested" advice ($p = 0.05$, one-tailed).

[16] The percentage of the three-player groups achieving (*b*, *b*) coordination (and the average earnings per subject) are 33 percent (US$ 7.06) in 2NA, 31 percent (US$ 6.91) in 2AI and 75 percent (US$ 8.13) in 2AU. That is, the uninterested advice also produces the highest efficiency. The difference in the percentage of (*b*, *b*) coordination is not statistically significant between 2NA and 2AI ($p = 0.68$, two-tailed), but is significant between 2NA and 2AU ($p = 0.04$, two-tailed), and between 2AI and 2AU ($p = 0.02$, two-tailed). Given the idiosyncrasy of random matching, such comparisons would be more meaningful with a larger sample. However, the fact that we get significant differences in spite of the relatively small samples provides further support for our results.

Table 5
Logistic regression test for order effects for Game 2

| Variable | Coefficient | Standard error | $p$-Value (two-tailed) |
|---|---|---|---|
| Constant | 0.452 | 0.483 | 0.350 |
| Condition (2NA = 0; 2AI = 1) | 0.059 | 0.606 | 0.923 |
| Round (first round = 0; second round = 1) | −0.703 | 0.601 | 0.242 |
| Condition × round | 1.802 | 0.946 | 0.057 |
| $N = 100$; pseudo $R^2 = 0.105$ | | | |

Dependent variable: choice ($a = 0$; $b = 1$).

The above results directly address our main research question: the impact of advice is clearly affected by its source and the source's motivation for making the recommendation. Therefore, in the real-world, where the source and motivation for advice frequently vary and the occurrence of "interested" advice is common, the effectiveness of advice is likely to vary across situations. In particular, when advice is perceived to be motivated by self-interest, it is likely to be far less effective than if it is uninterested.

## 5. Second round data

We ran the experiments in two-round sequences. In each sequence, subjects played two conditions (with versus without advice) of either Game 1 or Game 2, with a different opponent each time. As shown in Table 4, there is a significant order effect for 2NA and 2AI, and therefore we did not pool first and second round data for the analysis. Here, we describe some of the order effects.

There appear to be two order effects in Game 2. First, when 2NA was the first game in a sequence 61 percent of subjects choose *b*, but this percentage dropped to 44 percent when 2NA was played after 2AI. Second, when 2AI was played after 2NA, the percentage of *b* choices increased from 63 percent (when 2AI was played as the first game in the sequence) to 83 percent. Subjects' behavior appears to be affected by prior experience with a different condition. This is confirmed in Table 5, which reveals a significant condition–round interaction for Game 2.[17] Since our primary focus in this paper is not on such order effects but rather on the influence of different kinds of recommendations, *ceteris paribus*, we do not further explore the possible causes or implications of such effects.

## 6. Conclusion

In this paper, we investigate the effectiveness of non-binding advice to play a payoff-dominated strategy in a pure coordination game. We find that the motivation of the adviser significantly influences the extent to which players follow the advice. When advice comes from a party that does not receive a monetary payoff as the result of the advice being followed (at a cost to those following the advice), it is more likely to be effective than when it comes from someone who receives such a payoff. The results support our prediction that players make causal inferences about the motive that underlies received advice and use these inferences to determine the validity of the advice (for both themselves and other players).

[17] There is no significant order effect for Game 1.

Our results are important for understanding the role advice plays in coordinating behavior. Most research studying the effect of non-binding advice in coordination games ignores the possible differential impacts of the source of the message and the (perceived) motivation behind it. Advice in previous experiments usually takes the form of a recommendation from an uninterested party. In the world outside the laboratory, however, people rarely receive recommendations that come from an uninvolved party with unknown motivations. Instead, communication to players in a naturally occurring setting usually comes from people with a vested interest in obtaining certain outcomes and avoiding others. In many cases, people making strategic decisions are aware of the motivation behind the recommendation, and when they are not, they likely develop perceived reasons for why it was made. As we demonstrate, such motivations are important in determining what actions people will take and should be considered when analyzing the likely impact of advice in real-world contexts.[18]

Our study also contributes to management literature and practice. In organizational contexts, the leader often needs to give subordinates strategic directions to coordinate their actions. Rather than blindly follow those directions, the subordinates might ask questions such as "what's in it for the boss?" or "why did she make that recommendation?" Thus, the effectiveness of leadership may be weakened if the leader's directives are perceived to be motivated primarily by personal gain.

While there are many potential applications of our results, the main point of our work is simple. The effectiveness of advice can depend significantly on the motivation of the source.

## Acknowledgements

Thanks to George Loewenstein, John Duffy, Colin Camerer, Kristy Towry, workshop participants at the University of Pittsburgh, and participants at the 2003 ESA International Meetings and 2005 AAA Management Accounting Research Conference for helpful comments and suggestions. This research was funded by a Carnegie Mellon Berkman Faculty Development grant (to Weber) and by a Jacob G. Birnberg Recognition Fund grant (to Kuang).

## Appendix A. Instructions for recommenders in 2AU

Thank you for your participation. The following activity should take about 5–10 min.

In the next couple of weeks, we will invite some students to play a simple game. In the game, they will be randomly divided into groups of three, and each person will be randomly assigned to a role. The role will be Player X, Player Y or Player Z. Both the grouping and the role assignment will be anonymous, meaning that no one will know which of the other people they are playing with at any time, and no one will know any other person's role at any time.



[18] To give a concrete example, in financial markets, the effectiveness of an analyst's investment recommendation depends on the extent to which investors (playing a form of coordination game) follow that recommendation, and investors' reaction may be influenced by their perceptions of the analyst's incentive for making that recommendation. After the recent breakout of corporate frauds and scandals, the credibility of financial consultants has dropped because investors' trust in them (and their belief in others' trust in them) dramatically declined due to the perceived "selfish" motives underlying investment recommendations. Our study provides empirical evidence that one way of restoring investors' faith is to increase the independence of those "advisers" by restricting them from entering into common interest with the company that they evaluate.

They will play a game like the one pictured below. In the game, Players X and Y will each separately and independently choose one of three options: (*a*), (*b*) or (*c*). Both players will make their choices at the same time without knowing the other's choice. Player Z will NOT make any choice.

All three players will accumulate points based on the combined choices that Players X and Y make. The numbers inside each cell of the following table correspond to the points that each player receives for a particular combination of Players X's and Y's choices. Player X's points are in the lower left corner of the cell, Player Y's points are in the upper right corner and Player Z's points are in the lower right corner. At the end of the experiment, the points that each player accumulates will be converted to money at the rate of 50 cents per point.

| Player X's choice | Player Y's choice | | | | | |
|---|---|---|---|---|---|---|
| | *a* | | *b* | | *c* | |
| *a* | X: 6 | X: 6<br>Z: 0 | X: 0 | Y: 0<br>Z: 0 | X: 0 | Y: 0<br>Z: 0 |
| *b* | X: 0 | Y: 0<br>Z: 0 | X: 5 | Y: 5<br>Z: 5 | X: 0 | Y: 0<br>Z: 0 |
| *c* | X: 0 | Y: 0<br>Z: 0 | X: 0 | Y: 0<br>Z: 0 | X: 4 | Y: 4<br>Z: 0 |

For example, if Player X chooses (*b*) and Player Y chooses (*a*), then we should look in the middle left cell for the points that each player receives. Here, Player X receives 0 points, Player Y receives 0 points and Player Z receives 0 points. To give you another example: if Player X chooses (*c*) and Player Y chooses (*c*), then the points that each player receives are in the bottom right cell: Player X receives 4 points, Player Y receives 4 points and Player Z receives 0 points.

To make sure that you understand the game, please answer the following two questions:

1. If Player X chooses (*b*) and Player Y chooses (*c*), then: Player X receives _____ points; Player Y receives _____ points; Player Z receives _____ points.
2. If Player X chooses (*b*) and Player Y chooses (*b*), then: Player X receives _____ points; Player Y receives _____ points; Player Z receives _____ points.

Are there any questions about the game before we proceed?Note that in this game Players X and Y will receive points only if they both make *the same* choice. Since Players X and Y will make their choices at the same time without knowing the other's choice, they will need to choose based on what they believe the other player will choose. The points that Player Z can receive will depend on the combined choices that Players X and Y make.

To assist Players X and Y in figuring out what choice to make, we would like a neutral independent party to give them advice as to which option to choose. *You will provide the advice* in this experiment. Therefore, your role will be to provide advice to both Players X and Y on what choice to make when playing the game. Both Players X and Y will receive exactly *the same* advice when they play the game in the experiment in the next few weeks (they will receive a copy of this exact sheet). Following this advice can be helpful for making the same choice as the other player. The advice is not a requirement. However, since Players X and Y cannot receive any points unless they make the same choice, the advice might help them to figure out what choice to make. Note that, for Players X and Y, if one player believes the other player in his/her group will follow the advice, then he/she will receive points only if he/she also follows the advice.

When we conduct the experiment in the future, the experimenter will show the advice to Players X and Y. After that, Players X and Y will have a moment to think about their choice, and then will make a choice of (*a*), (*b*) or (*c*).

You will be the neutral independent party who gives advice to Players X and Y. Your advice is:

| | | | |
|---|---|---|---|
| Players X and Y should both choose. (Please circle one) | *a* | *b* | *c* |



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