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Compromise and coordination: An experimental study ☆

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ABSTRACT

This study experimentally examines the role of a compromise option in a repeated battle-of-the-sexes game. In a random matching environment, we find that compromise serves as an effective focal point and facilitates coordination, but fails to improve efficiency. However, in a fixed-partnership environment, compromise deters subjects from learning to play alternation, which is a more efficient, but arguably more complex strategy. As a result, compromise hurts efficiency by allowing subjects to coordinate on the less efficient outcome. In a follow-up experiment, we find that many compromisers switch to alternation after playing the repeated game multiple times. These results suggest that subjects teach and learn to use the alternation strategy from each other.

1. Introduction

Coordination problems are prevalent in economics and coordination is especially difficult to achieve in the presence of conflicts of interest. When such conflicts cannot be resolved using the available options, some people may seek compromise options, while others may try to find alternative methods of resolving the conflict. For example, a new couple who have differing food preferences may choose to go to a restaurant that is not necessarily one of their favorites, but is perfectly acceptable for a first date. However, over time, they may decide to alternate between their respective favorite restaurants. A further example is that of firms bidding for a government contract. If the government contract is offered only once, settling on a low bid that grants each firm an equal chance of winning may be acceptable. However, when the government has a long-term demand from these firms, they can instead coordinate a price conspiracy by taking turns to be the lowest bidder.[1]

A compromise option naturally serves as a focal point (Schelling (1960)) for coordination.[2] First, it alleviates conflicts of interest. By coordinating on a compromise option, people can effectively avoid coordination failures, and no one risks living

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[1] See Armentano (1994) for a discussion on the infamous "phase of the moon" conspiracy used by General Electric, Westinghouse, Allis-Chalmers, and I-T-E in the 1960s. We thank Glen Waddell and the 2018 PhD class at the University of Oregon for suggesting this example.

[2] See Crawford and Haller (1990), Mehta et al. (1994), and Crawford et al. (2008) for studies on focal points in coordination games.

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with their least favorite options. Second, it features more equal payoffs across parties. Hence, it is potentially favored by fair-minded players. The focality of a compromise option is found to be very effective in short-term interactions. Recently, Jackson and Xing (2014) conduct an experiment using a variant of a battle-of-the-sexes game, featuring two equilibria with highly asymmetric payoffs, and another equilibrium with symmetric payoffs, but with a slightly lower total payoff. They find that most subjects choose to play the one with a symmetric, but inefficient outcome in a one-shot interaction, even though there are variations across cultures. In a more recent laboratory experiment using a one-shot battle-of-the-sexes game with a third option, Bett et al. (2016) find that subjects tend to choose a symmetric, but strictly dominated option to avoid coordination failure.

While a compromise option may serve as an effective coordination device in the short run, how its presence may affect people's decisions in the long run remains unknown. Coordination games with repeated interactions are different to those with one-shot interactions, because in the former case, people can rely on past interactions as their coordination device.[3] Therefore, the effect of a compromise option in such settings naturally becomes more complicated. Would such an option retain its focality in the event of repeated interactions? Would it help or hinder coordination? Would people achieve a higher or lower long-run payoff? To the best of our knowledge, few studies have investigated these questions. Therefore, this study serves as an attempt to fill this gap in the literature.

We employ a two-by-two experimental design: 1) Subjects repeatedly play 30 rounds of either a standard 2×2 battle-of-the-sexes game, or a 3×3 variant of the game with an additional compromise option, which is similar to that studied in Jackson and Xing (2014). There are two highly asymmetric pure-strategy Nash equilibria, and one symmetric, but less efficient pure-strategy Nash equilibrium. 2) At the beginning of the experiment, subjects are permanently assigned to either a group of six, in which the members are randomly matched in pairs in each round (random matching), or to a group of two (fixed matching), in which the same persons are matched in each round. Comparing the two games allows us to investigate how the compromise option affects subjects' behavior. Comparing the two matching settings enables us to understand the role of compromise in a stranger environment and in a fixed-partnership environment, respectively.

First, for the random matching setting, we find that most groups fail to coordinate better than chance in the 2×2 game. In contrast, most groups choose to coordinate on the compromise option in the 3×3 game. This result demonstrates that the compromise option serves as a focal point in repeated interactions if people cannot form stable partnerships. However, we do not find significant improvement in terms of the average payoff when the compromise option is available, because those who fail to compromise earn a relatively low payoff, which offsets the payoff advantage gained by the compromisers.

Second, under the fixed matching setting, we find that most groups learn to coordinate on a pattern of alternation between the two asymmetric pure Nash equilibria in the 2×2 game. This result confirms both the theoretical and experimental literature on alternating behavior in repeated games (see Bhaskar, 2000; Lau and Mui, 2008, 2012; Kuzmics et al., 2014; Cason et al., 2013; Duffy et al., 2017; Romero and Zhang, 2018; Arifovic and Ledyard, 2018; Sibly and Tisdell, 2018, among others).[4,5] On the other hand, we observe a mix of alternation and coordinating on the compromise option in the 3×3 game. There is no significant difference between the coordination rates across the two games. However, the payoff earned by the subjects in the 3×3 game is significantly lower than that in the 2×2 game because coordinating on the compromise option is less efficient than alternation. To summarize, when people are in stable partnerships, a compromise option may disturb their learning process toward adopting the more efficient strategy of alternation. Compromisers seem to be short-sighted, in that they tend to compromise too early and give up long-term gains.

To further understand the rationale behind the main findings in the fixed matching settings, we run another experiment to investigate the behavior pattern when subjects have a chance to learn over a longer time span. In this follow-up experiment, subjects play the 30-round 3×3 game (refereed to as a "supergame") four times, with four different partners. We find that, across supergames, the alternation strategy becomes more prevalent, crowding out the compromise strategy. As a result, the average payoff increases over supergames. Moreover, we find that when a subject has experience with alternation, she always chooses alternation in subsequent supergames, even if she meets someone who only has experience in compromising. We further examine those who only have experience in compromising in early supergames, but manage to alternate in later supergames. We find that some learn alternation from their opponents, because they initially always choose the compromise option, but then alternate after they observe their opponents alternating in a new supergame. The remaining subjects discover the alternation strategy themselves (they initiate alternation for a few rounds), but eventually compromise in a supergame, because it is a safer strategy. Then, when they meet someone who is willing to take the lead in alternating, they follow immediately. Therefore, the evidence suggests that teaching and learning and a reduction in strategic uncertainty over supergames explain why subjects increasingly choose alternation after playing the game repeatedly. These findings provide new experimental evidence on strategic teaching, complementing that in the literature; see Terracol and Vaksmann (2009), Hyndman et al. (2009, 2012) and Cason et al. (2013).

[3] See Crawford and Haller (1990), Blume and Gneezy (2000), and Lau and Mui (2008), among others, for studies on how past behaviors affect future actions.

[4] Although most of these studies examine repeated coordination games, Cason et al. (2013) and Sibly and Tisdell (2018) use repeated games in which the efficient outcomes are not stage-game Nash equilibria.

[5] Note that Arifovic and Ledyard (2018) adopt an interesting perspective in which they use simulations to show that individual evolutionary learning (IEL) explains human behavior well in repeated 2×2 battle-of-the-sexes games. See also Mäs and Nax (2016) for a behavioral study of evolutionary coordination games.

	X	Y
X	250,50	0,0
Y	0,0	50,250

A: 2×2 **game**

	X	Y	Z
X	250,50	0,0	0,0
Y	0,0	50,250	0,0
Z	0,0	0,0	100,100

B: 3×3 **game**

Fig. 1. Payoff structures.

Table 1
Treatments overview.

	Random matching	Fixed matching
2×2 game	R-2	F-2
3×3 game	R-3	F-3

Notes: Each cell displays the abbreviation of each treatment.

The remainder of this paper is organized as follows. Section 2 introduces the experimental design, procedures, and hypotheses. Section 3 provides the results. Section 4 presents the design and the results for the follow-up experiment. Section 5 explores the theoretical foundations and several alternative explanations for the hypotheses and the findings. Section 6 concludes.

2. Experimental design, procedures, and hypotheses

2.1. Treatment design

In the experiment, we implement the payoff matrices shown in Fig. 1, where the payoffs are presented in an experimental currency. Fig. 1A presents the payoffs for a 2×2 battle-of-the-sexes game, and Fig. 1B presents those for a 3×3 battle-of-the-sexes game with a compromise option. In both games, we keep the payoffs under actions X and Y constant. Both players always receive a zero payoff if they choose differently. The row player prefers coordinating on (X, X), and the column player prefers coordinating on (Y, Y). For the 3×3 game, an additional action Z is added to the 2×2 game, and the players receive an equal payoff of 100 if they both choose Z. Note that (Z, Z) is the only outcome that yields the same payoff for both players; however, the total payoff of (Z, Z) is lower than those of (X, X) and (Y, Y). Thus, we call this option a "compromise," as it yields a fair outcome, but with an efficiency loss.

To investigate the effect of the compromise option, we first vary the game that the subjects play in the experiment. Subjects are presented with either the game in Fig. 1A or the game in Fig. 1B. Before two players are matched to play one of the games, they are informed about their preferences. One of them is selected as the row player, and the other is chosen as the column player. The role of each subject is kept fixed throughout the experiment.

Then, we investigate the relationship between a partnership and the effect of the compromise option by varying the matching protocols. In a repeated play of 30 rounds, subjects are either in a random matching or in a fixed matching condition. In the random matching condition, subjects are assigned to a fixed group of six, where half are chosen as row players, and the other half are chosen as column players. In each round, the row and column players from the same group are matched randomly into pairs to play one of the games. Thus, subjects cannot form long-term partnerships with any of the players in their matching group because they cannot identify one another. In the fixed matching condition, subjects are divided into groups of two. Here, one is chosen to be either the row player or the column player. In contrast to the random matching condition, subjects in this condition naturally form a long-term partnership, and can rely on past interactions to build future strategies. At the end of each round, each subject receives feedback about the action of her opponent and her own payoff. In order to minimize group effect, subjects are not provided with the decisions of the remainder of the group in the random matching condition.

Each subject participates in only one of the treatments: the 2×2 or the 3×3 game, under either random matching or fixed matching. This gives us a 2×2 between-subject design. Table 1 summarizes the treatments.

At the end of the experiment, we elicit subjects' risk attitudes using a simple task, as in Eckel and Grossman (2008), and add an option to capture risk-seeking behavior. In this method, a subject chooses between six coin-flip gambles that vary in their degree of risk and expected value. Gamble 1 will be chosen by risk-seeking subjects, gamble 2 by risk-neutral subjects, and gambles 3–6 by risk-averse subjects, with increasing levels of risk aversion. Overall, a higher number in the gamble choice task indicates a higher level of risk aversion. The details of the risk-elicitation task are provided in Appendix A.

2.2. Procedures

The experiment was conducted at the Shanghai University of Finance and Economics. Chinese subjects were recruited from the subject pool of the Economics Lab. We ran nine sessions in total, and randomized the treatments at the session level. In each session, we ran two treatments, and for each treatment, we ran four or five sessions. We obtained 10 or 11 independent matching groups under random matching, and 20 or 21 matching groups under fixed matching. In total, 208

Table 2
Summary of subjects.

Treatments	No. of subjects	No. of groups	No. of sessions
R-2	60	10	4
R-3	66	11	5
F-2	42	21	4
F-3	40	20	5
Total	208	62	9

subjects were recruited, most of whom were undergraduate students from various fields of studies. Table 2 presents the number of subjects, number of independent matching groups and number of sessions in each treatment.

The experiment was computerized using z-Tree and was conducted in Chinese.[6] Upon arrival, subjects were randomly assigned a card indicating their table number, and were seated in the corresponding cubicle. Prior to the start of the experiment, subjects read and signed a consent letter agreeing to their participation. All instructions were displayed on their computer screens. Control questions were conducted to check their understanding of the instructions. The same experimenters were always present during the experimental sessions.

After finishing the experiment, subjects received their earnings in cash privately. The average earnings were CNY 45 (equivalent to about USD 7), and each session lasted between 40 and 60 minutes.

2.3. Hypotheses

We test three hypotheses in the experiment. First, we expect that under random matching, the compromise option will serve as an effective focal point for coordination, as found in the one-shot experiments in the literature, such as those of Jackson and Xing (2014) and Bett et al. (2016). In addition, reducing coordination failures should help to improve efficiency, because only coordination yields a positive payoff.

Hypothesis 1. Under random matching, the compromise option improves coordination and efficiency.

Second, we expect that under fixed matching, subjects are able to learn an efficient strategy in the 2×2 game that leads to alternation between the two pure Nash equilibria.[7] We further expect that whenever the compromise option is available, it may deter subjects from learning the more sophisticated strategy of alternation, given that the compromise option is simpler and that it results in instant coordination success. We provide a theoretical foundation for the above two conjectures in Section 5.1 by drawing insights from the literature on optimal learning initiated by Crawford and Haller (1990).

Note that alternation between the two pure Nash equilibria in the 2×2 game yields an average payoff of 150, whereas the compromise option in the 3×3 game gives each subject 100 in each round. Therefore, although introducing the compromise option may not change the rate of coordination (some subjects may switch from coordinating on alternation to coordinating on compromise), it can reduce the payoff for each subject.

Hypothesis 2. Under fixed matching, the compromise option does not reduce the rate of coordination, but it does reduce efficiency.

Third, we compare the two matching protocols. In contrast to fixed matching, random matching effectively resembles a stranger environment in which subjects cannot form long-run partnerships and, consequently, are unable to learn more sophisticated strategies (e.g., alternation, in the case of fixed matching). Therefore, we expect that subjects can coordinate more successfully on better equilibria and earn a higher payoff under fixed matching than they can under random matching.

Hypothesis 3. In both games, fixed matching weakly improves efficiency.

3. Results

3.1. Behavior in the 2×2 battle-of-the-sexes game

In the 2×2 battle-of-the-sexes game with a random matching treatment (R-2), each subject meets one of the other subjects in the matching group in every new round to play the game. In the stage game, there are two asymmetric pure-

[6] The English translations are provided in Appendix A.

[7] See Bhaskar (2000) and Kuzmics et al. (2014) for a theoretical foundation for an efficient strategy in symmetric coordination games with conflicts of interest. In addition, the turn taking strategy can be supported in subgame perfect equilibria as shown in Lau and Mui (2008) and Lau and Mui (2012).

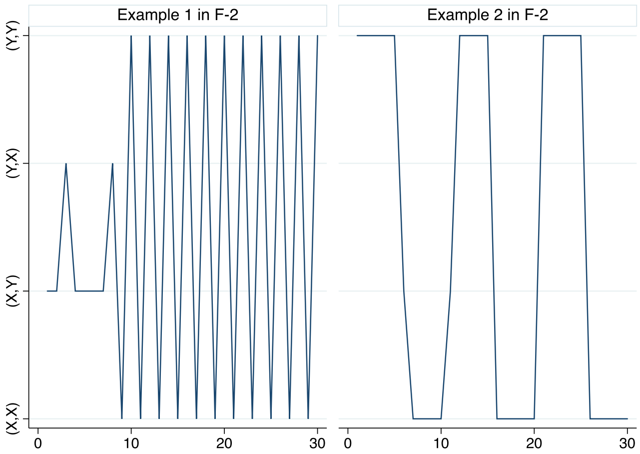

Fig. 2. Examples of behavior patterns in F-2. The x-axis shows the round number. The y-axis is the outcome distribution, in the order of (X, X), (X, Y), (Y, X), and (Y, Y), from bottom to top.

strategy Nash equilibria with reversed payoffs, (X, X) and (Y, Y). Most of the 10 matching groups fail to converge to any of the two asymmetric Nash equilibria, or to any other coordination pattern.[8]

This result is not surprising, because subjects have no obvious ways to coordinate on one of the two asymmetric equilibria. In a one-shot battle-of-the-sexes game, standard theory predicts that subjects will use a mixed strategy. In the mixed-strategy equilibrium, subjects choose the action corresponding to their favorite outcomes with a frequency of 0.83, and the other action with a rate of 0.17.[9] However, in our experiment, subjects choose the former action with a rate of 0.65, which is well below the prediction (sign-rank test, $p < 0.01$). Moreover, this rate is well above half (sign-rank test, $p < 0.01$), suggesting that the subjects are not using a naive randomizing strategy.

This result serves as a benchmark for our experiment. It shows that without the possibility of forming long-run partnerships or having the compromise option, subjects cannot coordinate better than chance in a battle-of-the-sexes game.

Result 1. *In R-2, subjects use a mixed strategy because there are no other effective ways of achieving coordination success.*

The battle-of-the-sexes game with a fixed matching treatment (F-2) exhibits a very different behavior pattern to that in R-2. Most of the pairs (16 out of 21) use an alternation strategy to maximize both their coordination rates and their total payoffs.[10] In an alternation strategy, two opponents with different preferences alternate between each of their favorite outcomes. Two examples of such strategies are shown in Fig. 2. In the left panel of Fig. 2, after about 10 rounds, the two players alternate between their favorite outcomes every round. In contrast, in the right panel of Fig. 2, after about five rounds, two players begin alternating between their favorite outcomes every few rounds. These examples suggest that subjects are not only able to use an alternation strategy, but can use it in a more complex manner. These results confirm the experimental findings of alternation strategies in a repeated battle-of-the-sexes game (e.g., Cason et al., 2013; Duffy et al., 2017).

The alternation strategy has two main advantages: First, it yields the highest total payoff that can be achieved in a repeated-game setting. Second, it gives each player an equal payoff once the alternating pattern is established. Therefore, this treatment shows how a long-run partnership solves the coordination problem.

Result 2. *In F-2, subjects use an alternation strategy to achieve coordination success.*

3.2. Behavior in the 3×3 *game with the compromise option*

In the treatment of the 3×3 battle-of-the-sexes game with the compromise option and under random matching (R-3), the stage game has two asymmetric pure-strategy equilibria, (X, X) and (Y, Y), and one symmetric pure-strategy Nash

[8] The coordination rate over time in each matching group is shown in Fig. 9 in Appendix B. As shown, only group 2 exhibits a pattern of coordinating better over time. This might be caused by the relatively small group size (six subjects in each group), which makes it easier for subjects to converge to one of the two asymmetric equilibria.

[9] $0.83 = \frac{250}{250+50}$, $0.17 = \frac{50}{250+50}$.

[10] Among the other five pairs, three fail to coordinate, and two converge to one of the asymmetric equilibria. Group-level data can be found in Fig. 11 in Appendix B.

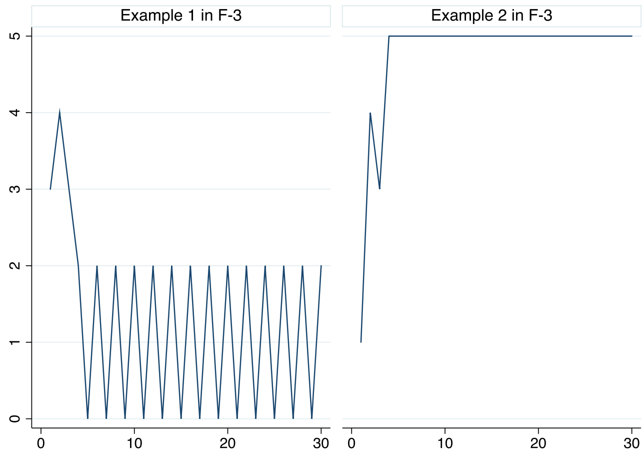

Fig. 3. Examples of behavior patterns in F-3. The x-axis shows the round number. The y-axis is the outcome distribution, and the number 0–5 indicate (X, X), (X, Y) or (Y, X), (Y, Y), (X, Z) or (Z, X), (Y, Z) or (Z, Y), and (Z, Z), respectively.

equilibrium, (Z, Z). Of the 11 matching groups, nine converge to playing the symmetric equilibrium, but the remaining two groups fail to do so.[11]

This result suggests that subjects rely on the compromise option to solve the coordination problem otherwise presented in the 2×2 battle-of-the-sexes game. They quickly learn to use the compromise option exclusively, and abandon using the other two actions. This provides clear evidence that the symmetric equilibrium stands out as the focal point among the three equilibria. This finding confirms and strengthens the experimental findings of Jackson and Xing (2014) and Bett et al. (2016), who find similar results for a one-shot setup only.

Result 3. *In R-3, subjects use the compromise option to achieve coordination success.*

In the treatment of the 3×3 game with the compromise option and under fixed matching (F-3), there exists a behavior pattern quite distinct from that in R-3. Although many of the pairs (9 out of 20) use a similar alternation strategy to that in F-2, a significant number of pairs (7 out of 20) converge to the symmetric equilibrium.[12]

This result is intriguing. Subjects fall into two distinct behavior patterns. As shown in the left panel of Fig. 3, in the alternating pattern, subjects play the game as if the compromise option is not presented. However, as displayed in the right panel of Fig. 3, in the compromise pattern, subjects play the game in a similar manner to R-3.

Compared with R-3, the focality of the compromise option is diminished in F-3. However, compared with F-2, the focality persists in F-3 and partially crowds out the use of the alternation strategy.

Given that subjects fall into two categories, based on their choice of strategy, it is natural to ask which strategy yields the higher payoff. Subjects earn 130 or 92 when using the alternation or the compromise strategy, respectively (Mann–Whitney test, $p < 0.001$, using group-level data as per observation).[13] That is, alternation yields a higher return than that of compromise.

Result 4. *In F-3, subjects use either the alternation strategy or the compromise strategy to achieve coordination success.*

3.3. The effect of the compromise option on coordination

In this section, we conduct an analysis at the treatment level. First, we investigate the effect of the compromise option on coordination. Fig. 4 shows the average coordination rate in each treatment. The overall coordination rate is 0.53 in treatment R-2, but is much higher in the other three treatments (0.75 in R-3, 0.80 in F-2, and 0.80 in F-3). Mann–Whitney tests show that the coordination rate in R-2 is significantly lower than those of the other three treatments ($p < 0.05$); furthermore, the latter three are not statistically different.

How often do subjects use the compromise option? As is shown in Table 3, under random matching, subjects use the compromise option 83% of the time overall, with a rate of 88% in the final 15 rounds. This suggests that, on most occasions, subjects learn to use the compromise option to avoid coordination failure. Under fixed matching, subjects use the

[11] The compromise rate over time in each matching group is shown in Fig. 10 in Appendix B. Only group 7 and group 16 fail to exhibit a pattern of converging to compromise over time. Sign-rank tests report that the compromise rates in the final 15 rounds for these nine groups are not statistically different from 0.95 at the 10% level.

[12] Of the other four pairs, three fail to converge to any pattern, and one group converges to a non-equilibrium outcome (X, Y).

[13] The average payoffs are higher for both types in the final 20 rounds (i.e., 146 and 98, respectively).

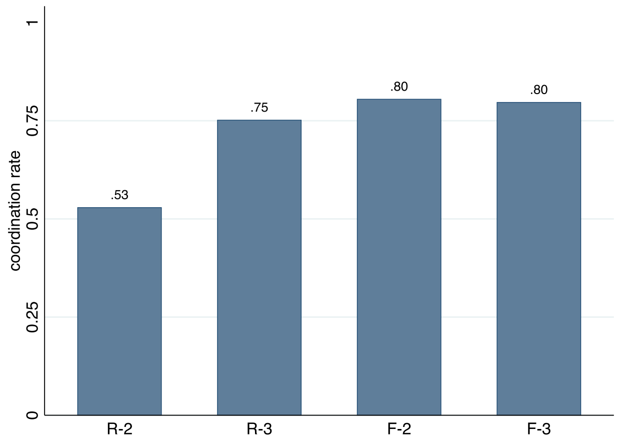

Fig. 4. All-rounds average coordination rate by treatment.

Table 3
Choice distribution in each treatment.

Treatment	Rounds 1-30			Rounds 16-30		
	Favorite	Preferred	Compromise	Favorite	Preferred	Compromise
R-2	0.65	0.35	–	0.63	0.37	–
R-3	0.12	0.04	0.83	0.09	0.03	0.88
F-2	0.56	0.44	–	0.54	0.45	–
F-3	0.32	0.25	0.43	0.34	0.27	0.39

Notes: Here, "favorite" is the action of one's favorite equilibrium, "preferred" is the action of one's least attractive equilibrium, and "compromise" is the action of the symmetric equilibrium. Each cell displays the rate of each action.

compromise option 43% of the time overall, and 39% of the time in the final 15 rounds. Although this option is not used as frequently as it is in random matching, it remains the most attractive option among the three. In treatments with the 2×2 game, subjects tend to alternate between actions X and Y, resulting in a balanced choice distribution.

Does it take longer to establish an alternating pattern in F-3 than it does in F-2? Based on the pairs who eventually use the alternation strategy, we find that, on average, it takes 4.25 rounds for an alternating pattern to be established in F-2, but 6.44 rounds in F-3 ($p = 0.127$, two sided Mann–Whitney test). Therefore, the presence of the compromise option weakly increases the number of rounds it takes for subjects to converge to alternation, although the difference is not significant.

Result 5. *Under random matching, the compromise option serves as a focal point and facilitates coordination. Under fixed matching, the compromise option partially crowds out the use of the alternation strategy and induces the use of compromise as a coordination strategy.*

Overall, the effect of the compromise option depends on the matching protocol. Under random matching, it is evident that the compromise option largely improves coordination. The mechanism is that the compromise option stands out among other actions and becomes the focal point. By choosing to compromise, the coordination problem is largely resolved. This supports Hypothesis 1 in terms of coordination. In contrast, under fixed matching, the compromise option partially crowds out the use of the alternation strategy. However, coordination failure still exists in some groups. As a result, the overall coordination remains intact. This supports Hypothesis 2 in terms of coordination.

3.4. The effect of the compromise option on efficiency

In this section, we investigate the effect of the compromise option on efficiency. In both games, maximal efficiency is achieved at one of the asymmetric equilibria, and is a constant. Therefore, we can measure efficiency simply as the average payoffs of the subjects in all treatments.[14]

Fig. 5 shows the "all-rounds" average individual payoffs in each treatment. Under random matching, subjects in R-2 earn 79.3, on average, while subjects in R-3 earn 76.0, on average (Mann–Whitney test, $p = 0.832$). Under fixed matching, subjects in F-2 receive a significantly higher payoff than subjects in F-3 do (120.7 vs. 101.4, Mann–Whitney test, $p < 0.05$). These results suggest that the effect of compromise on efficiency is neutral at best: although it has no effect under random matching, it reduces efficiency under fixed matching.

[14] We can also measure efficiency as the average payoff divided by the maximal payoff.

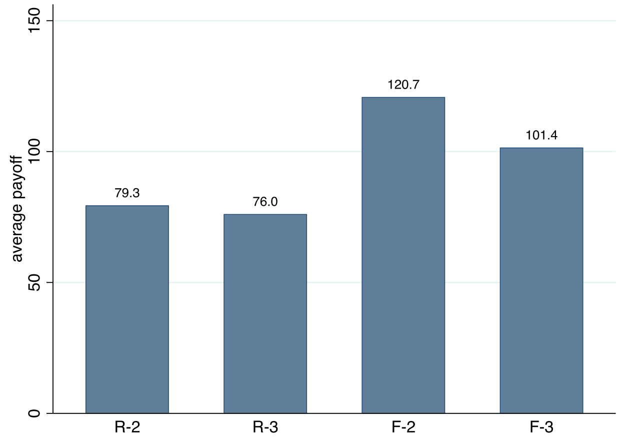

Fig. 5. All-rounds average payoff by treatment.

Table 4
Payoff by type of strategy in each treatment.

Treatment	Rounds 16-30			
	Alternation	Compromise	Asymmetric	None
R-2	–	–	127 ($n = 1$)	81 ($n = 9$)
R-3	–	95 ($n = 9$)	–	32 ($n = 2$)
F-2	145 ($n = 16$)	–	105 ($n = 2$)	60 ($n = 3$)
F-3	147 ($n = 9$)	99 ($n = 7$)	–	53 ($n = 4$)

Notes: Each cell displays the average payoff of the corresponding strategy; the number of matching groups or pairs who use the strategy are shown in the parentheses.

What is the mechanism underlying such a neutral (or even negative) effect? Because the subjects in each treatment adopt different strategies over time, we examine the average payoff for each type of strategy. According to the group-level analysis in Sections 3.1 and 3.2, we group strategies into three categories. First, when using "alternation" strategy, a group or a pair of subjects alternate between achieving each of their favorite outcomes. Second, when using the "compromise" strategy, a group or a pair of subjects choose the compromise option and achieve the symmetric outcome. Third, when using the "asymmetric" strategy, a group or a pair of subjects converge to one of the asymmetric equilibria. Finally, "none" denotes a group or a pair of subjects that fail to converge to any of these successful strategies.[15]

Table 4 provides the average payoffs by type of strategy in each treatment. Because we focus on the payoffs once a strategy has been used and is stable, we use only the data in rounds 16–30. As shown in Table 4, the earnings under each type of strategy tend to be similar across treatments. For example, subjects earn slightly less than 150 if they use the "alternation" strategy, but earn slightly less than 100 if they use the "compromise" strategy. The payoffs are below 150 (the mean of 50 and 250) for subjects playing the "asymmetric" strategy, because they sometimes deviate from the pattern. Finally, the earnings are much lower for subjects who fail to use any of the successful strategies to coordinate.

Under random matching, we can see from Table 4 that although the compromise option allows groups of subjects to use the "compromise" strategy, the payoff gains are not large (from 81 under "none" in R-2 to 95 under "compromise" in R-3). Moreover, subjects who fail to use the "compromise" strategy in R-3 earn much less than subjects in R-2 do. As a result, there is no difference between the overall payoffs across the two treatments. Under fixed matching, the compromise option in F-3 results in about half of the groups who would otherwise have used the "alternation" strategy in F-2 now using the "compromise" strategy. This also leads to a significant reduction in the payoff (from 147 to 99).

Result 6. *Under random matching, the compromise option has no overall effect on subjects' average payoff. Under fixed matching, the compromise option reduces subjects' average payoff.*

In summary, Result 6 does not support Hypothesis 1, which predicts a positive role of the compromise option in terms of increasing subjects' payoffs. However, it does support Hypothesis 2 in terms of efficiency.

Finally, we find that when playing the same game, subjects always earn more under fixed matching than they do under random matching: in the 2×2 game, 120.7 vs. 79.3, respectively (Mann–Whitney test, $p < 0.01$). In the 3×3 game, subjects earn 76.0 under random matching and 101.4 under fixed matching (Mann–Whitney test, $p < 0.05$). This result indicates

[15] We say a strategy is unsuccessful if in the final 10 rounds, a group or a pair of subjects fail to match their actions more than 20% of the time.

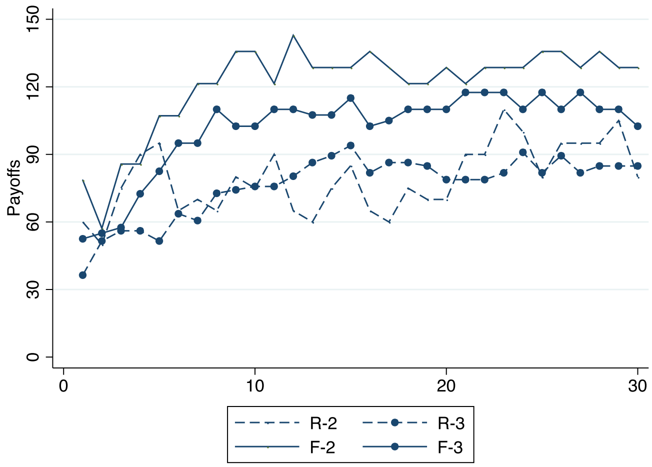

Fig. 6. Average payoffs over rounds.

that a fixed partnership helps subjects develop an efficient strategy more quickly. We discuss the pace of learning in greater detail in the next section.

Result 7. *Subjects earn more under fixed matching than they do under random matching.*

Thus, Result 7 supports Hypothesis 3.

3.5. Learning

Although both games are simple, subjects may have to learn how to use the best strategies given others' strategies and how their strategies are dependent on the past. In this section, we briefly investigate whether there is a learning effect.

Fig. 6 shows the average payoffs over rounds in each treatment. This is the best measure for learning, because subjects are expected to earn more if they learn to use better strategies over time. As shown, subjects indeed earn more over time in all treatments. Moreover, the increasing pattern is particularly strong in treatments F-2 and F-3, suggesting that subjects tend to learn more quickly under fixed matching than they do under random matching. This is intuitive as fixed matching allows subjects to learn the strategies of their partners in each round. In the first few rounds, there is no obvious payoff difference across treatments. Then, F-2 yields a higher earning pattern than F-3, and F-2 and F-3 both yield higher earning patterns than those of R-2 and R-3. This explains, from a dynamic viewpoint, why fixed matching yields higher payoffs in both games.

Result 8. *There is clear evidence of learning, and the pace of learning is faster under fixed matching than it is under random matching.*

Result 8 provides further support for Hypothesis 3. The ability to learn under fixed matching helps subjects achieve higher payoffs.

Next, we compare the pace of learning for subjects who use the various strategies in treatment F-3.[16] Here, we compare the mean number of rounds taken to converge to using either the alternation or the compromise strategy. The results show that it takes longer for the alternators to learn their strategy than it does for the compromisers to learn theirs (6.44 rounds vs. 3.86 rounds, $p < 0.1$, two-sided Mann–Whitney test). This suggests that alternation is the more complex of the two strategies.

4. Follow-up experiment

The alternation strategy payoff-dominates the compromise option. Nevertheless, a significant number of subjects coordinate on the compromise option rather than alternation when the compromise option is available under fixed matching. This contrasts with the prevalent use of alternation when the compromise is not available. In this section, we examine this finding by implementing a follow-up experiment, where we investigate the behavioral pattern when subjects play the 30-round 3×3 game repeatedly. We refer to the 30-round 3×3 game as a "supergame."

[16] In F-3, subjects use two types of strategies; in the other treatments, subjects use at most one type of strategy.

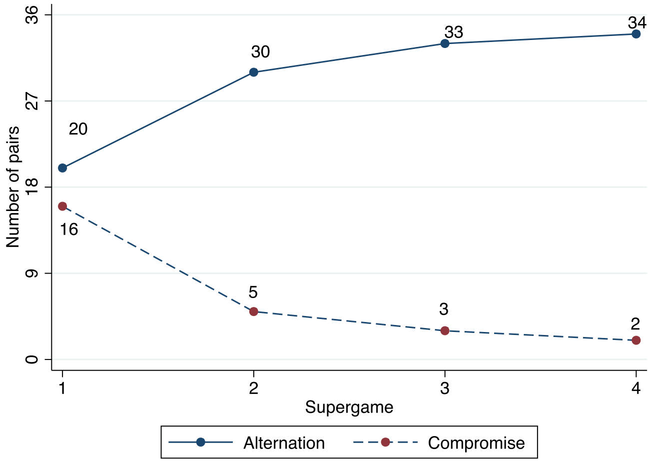

Fig. 7. Number of pairs choosing each strategy in each supergame.

4.1. Experimental design and procedures

In this experiment, we implement the 3×3 game in Fig. 1B. In each supergame, subjects play the 3×3 game repeatedly with the same partner for 30 rounds; this is the same game as the F-3 treatment in the main experiment. After finishing one supergame, subjects are rematched with a new partner to play the supergame again. In total, each subject plays the supergame four times, each time with a different partner. Within a supergame, after each round, subjects learn the strategy (of his/her partner) and payoffs in that round. At the end of a supergame, the subjects learn their own and their partners' strategies and payoffs over all 30 rounds.

The follow-up experiment was also conducted at the Shanghai University of Finance and Economics. A total of 72 subjects participated in one of the three sessions. Subjects who had participated in the main experiment were excluded. In each session, we recruited 24 subjects. Each subject was assigned randomly to a matching group of eight people, yielding nice independent matching groups. Subjects earned on average CNY 105 (equivalent to about USD 15). Each session lasted between 70 and 90 minutes.

4.2. Behavioral patterns across supergames

First, we investigate whether subjects use different strategies after playing the supergame multiple times. Fig. 7 shows the number of pairs that converge to "alternation" or "compromise," by supergame. As shown, of the 36 pairs, about half converge to "alternation" and half play "compromise" in the first supergame. However, after gaining experience, more pairs converge to "alternation" over time, thus reducing the number of those choosing "compromise."[17] This result clearly shows that subjects learn to play "alternation" over multiple supergames.[18]

Next, we examine how the average payoffs change as subjects gain experience by playing supergames. Fig. 8 shows that the average payoffs per supergame vary significantly across supergames (66.3 vs. 116.3, $p = 0.01$; 116.3 vs. 129.3, $p = 0.04$; 129.3 vs. 137.5, $p = 0.06$; two-sided Mann–Whitney tests at the matching group level). Thus, subjects earn more when they have more experience playing the supergames, which is consistent with the previous finding that increasing numbers of subjects choose alternation over time.

Result 9. *Subjects learn to alternate over supergames, which yields a higher average payoff over supergames.*

4.3. Teaching and learning

Next, we investigate why subjects alternate more often across supergames. To do so, we first examine how the strategy profile of a new pair is influenced by each subject's strategy in the previous supergame. We use the data from supergames 2–4, because these subjects have experience playing the 3×3 game. We find that when at least one player has alternated in a previous supergame, they always choose alternation in the subsequent supergame. When both subjects compromise in the previous supergame, they might choose "compromise" (10 out of 14), "alternation" (3 out of 14), or "coordination failure" (1 out of 14).

[17] In the second supergame, one pair of subjects fails to converge to either of the equilibrium strategies; thus, we exclude this pair in Fig. 7.

[18] In addition, at the matching group level, we find that the number of subjects choosing "alternation" weakly increases when subjects have more experience, whereas the number choosing "compromise" weakly decreases with experience; see Fig. 13 in Appendix B.

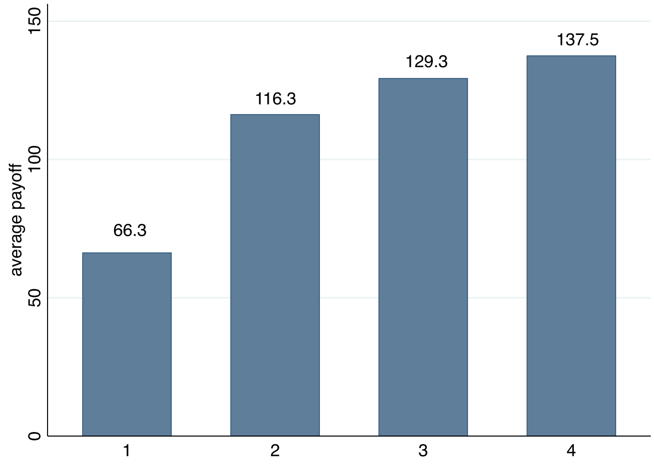

Fig. 8. Average payoff in each supergame.

Table 5
Behavior pattern of initial compromisers.

Behavior	No. of subjects
a. Learn alternation from opponents and alternate	24
b. Know alternation, but compromise once (and then alternate)	4
c. Learn alternation from opponents, but compromise	2
d. Do not know the alternation strategy (and never alternate)	2
Total	32

The above result suggests that the alternators may lead or teach compromisers to alternate in a new supergame. In order to investigate whether alternation does increase as a result of teaching, we examine whether the past compromisers already know how to alternate, or whether they learn to alternate from their opponents. If a compromiser tries to alternate by herself, but eventually compromises in a supergame, we can infer that she understands the alternation strategy, but chooses to compromise, owing to strategic uncertainty. In contrast, if a compromiser never tries to alternate (even for a few rounds) by herself, but starts to alternate when her opponent takes the lead, we can infer that this compromiser learns the alternation strategy from her opponent. Table 5 shows the behavior patterns of all initial compromisers (subjects who compromised in the first supergame). Of the 32 initial compromisers, 28 switch to alternation in one of the subsequent supergames. Of the 28 switchers, 24 learn to alternate from their opponents (a), and the remaining four try to alternate by themselves, but then choose to compromise in early supergames, owing to strategic uncertainty. These subjects eventually meet someone who is willing to take the lead in alternating, after which they follow (b). Finally, four compromisers never establish an alternation pattern in any supergame (c and d), although two try to alternate for a few rounds, but fail and never meet someone who is willing to take the lead and alternate (c). Overall, these observations provide evidence that at least two channels can explain why many compromisers switch to alternation across supergames: (1) some learn to alternate from their new opponents; and (2) some fail to alternate, owing to strategic uncertainty in earlier supergames, but then meet someone who is willing to take the lead, helping them to believe that alternation is possible.[19]

Why are teaching and learning effective in boosting alternation? One plausible explanation is that alternation is more complex than compromise, because it requires that two subjects alternate between two outcomes, rather than choosing the same action every round. Hence, this arguably requires a higher cognitive load than that of compromise. For example, Luhan et al. (2017) find that in bargaining games, many subjects tend to settle on equal and inefficient payoffs if it is more complex to achieve equal and efficient payoffs.

Result 10. *Teaching and learning and a reduction in strategic uncertainty can explain why many compromisers switch to alternation across supergames.*

The follow-up experiment contributes to the literature on strategic teaching. Early works, including Ellison (1997), Fudenberg and Levine (1998) (Chapter 8), and Camerer et al. (2002), argue that sophisticated players may choose to forego immediate payoffs by taking certain actions that manipulate their opponents' future choices, thus achieving their preferred long-run outcomes. Such behavior is called strategic teaching. Terracol and Vaksmann (2009) experimentally study a coordination game with multiple Pareto-unrankable pure Nash equilibria. They find that under a fixed partnership, players who

[19] In our experimental survey, many subjects said they had learnt the alternation strategy from their opponents, while others stated that they had worked out the alternation strategy by themselves, but chose to compromise because it seemed to be a safer strategy. This also supports our finding.

gain more from their favorite equilibrium are more likely to teach their opponents to coordinate on that equilibrium. Hence, teaching serves the purpose of equilibrium selection. Hyndman et al. (2009) also consider how strategic teaching helps to select a Nash equilibrium, but in the context of coordination games with Pareto-rankable equilibria. They find that subjects teach their opponents to play the Pareto-efficient equilibrium when teaching incentives are strong. Hyndman et al. (2012) examine games with a unique Nash equilibrium, showing that teaching plays an important role in the convergence to the Nash equilibrium. Interestingly, both Hyndman et al. (2009) and Hyndman et al. (2012) find that teachers could conceivably stop teaching shortly after they realize that their students are slow learners. This matches our finding that some subjects stop alternating and choose to compromise when their opponents keep compromising. Cason et al. (2013) study an assignment game with a unique dominant strategy equilibrium, but where alternating between two non-equilibrium outcomes can lead to higher payoffs for both players. They find that successful alternating often involves fast learning, and that players with experience in alternating are more likely to be the teacher than inexperienced players are. Similarly to Cason et al. (2013), we find that experience is important, because alternators from previous supergames tend to teach previous compromisers to alternate in a new supergame. In summary, although existing empirical works document the role of teaching in equilibrium selection, convergence to equilibrium play, and selecting an efficient strategy, our experiment presents new evidence on strategic teaching in selecting a complex and efficient strategy over a simple and inefficient strategy in a novel game.

5. Discussions

In this section, we first provide an optimal learning theoretical foundation for Hypothesis 2. Then, we briefly discuss whether risk attitudes play a role.

5.1. Theoretical support for Hypothesis 2

Hypothesis 2 is based on the conjecture that subjects learn to alternate in F-2, whereas the compromise option disrupts the learning process toward alternation and leads to lower efficiency in F-3. We show in this section that these conjectures have a solid theoretical grounding provided by the literature on optimal learning. Optimal learning is first studied by Crawford and Haller (1990) for repeated symmetric pure coordination games without a common-knowledge description. This is later extended by Blume (2000) to the context with partial language. Optimal learning provides a description of play in which players can achieve coordination as fast as possible by utilizing the asymmetries that arise after symmetry is broken by the history of play. Hence, if the players are sufficiently sophisticated and the optimal learning rule is unique, it should become focal. Perhaps the game experimentally investigated by Blume and Gneezy (2000) provides the best illustration of the idea. Consider three identical locations, evenly arranged on a circle. Two players both receive a payoff of 1 if they simultaneously and anonymously choose the same location. Otherwise, they get nothing. Suppose the two players play this game for two rounds. If they happen to coordinate in the first round, they should choose the same location in the second round, because this is the optimal choice. If they miscoordinate in the first round, then the location that neither of them chooses becomes uniquely distinguishable and the players should learn to play it in the second round because it guarantees coordination. Blume and Gneezy (2010) further study how cognitive ability influences optimal learning. Bhaskar (2000) extends this idea to symmetric games with conflicts of interest, such as the battle-of-the-sexes game and the hawk-dove game, and shows that the so called "egalitarian" convention is efficient, providing the fastest way for players to break symmetry and achieve alternation. Kuzmics et al. (2014) extend Bhaskar (2000) to allocation games.[20] They provide a formal theory arguing that conventions or meta-norms in such games should satisfy two criteria: Pareto optimality and simplicity. Note that these two criteria are satisfied by the "egalitarian" convention of Bhaskar (2000). In addition, Al'os-Ferrer and Kuzmics (2013) provide a framework for studying focal points in one-shot normal form games that is based on the symmetry structure of the games.

Although the games we consider here are not symmetric, we believe that the same idea of optimal learning can be applied. To see this, let us first consider the 2×2 battle-of the-sexes game. For ease of exposition, we consider that two players play this game repeatedly for an infinite number of rounds, but that the main intuition carries naturally to the finitely repeated version.

Assume that the two players have an identical discount factor $a \in (0, 1)$, and that they adopt the following strategy: In the first round, player 1 plays X with probability s, and Y with probability $1 - s$, and player 2 plays X with probability $1 - s$, and Y with probability s, where $s \in [0, 1]$. If both players choose X, then in the next round, both choose Y, and they subsequently alternate; if both choose Y, then in the next round, both choose X, and they subsequently alternate. Otherwise, they restart the same process in the next round. This strategy is very similar to the "egalitarian" convention considered in Bhaskar (2000), with the exception that the two players may put different weights on the two actions, given that they have different preferences over them.

Let W denote both players' repeated-game payoffs (although the game is asymmetric, following the above described strategy yields the same expected payoffs for both players in the infinite repeated game) and player 1's payoffs in the repeated game can be reduced to a one-stage game with the following payoff matrix (Table 6):

[20] When there are only two players, an allocation game is equivalent to a battle-of-the-sexes game.

Table 6
Repeated game payoffs for the 2 × 2 game.

	$1-s$	s
s	$\frac{250+50a}{1-a^2}$	aW
$1-s$	aW	$\frac{50+250a}{1-a^2}$

The optimal s is chosen to maximize:

$$W = s(1-s)\left(\frac{250+50a}{1-a^2} + \frac{50+250a}{1-a^2}\right) + (s^2 + (1-s)^2)aW = \frac{s(1-s)\frac{300}{1-a}}{1-a(s^2+(1-s)^2)}.$$

The unique solution to the maximization problem is $s = 0.5$, which is independent of the value of a. Hence, although the two players have a conflict of interest, randomizing between X and Y with equal probability guarantees the highest expected payoffs for them because it is the fastest way for them to achieve alternation. This optimal strategy provides the first theoretical support for Hypothesis 2 that subjects learn to alternate in the 2×2 game; the result of F-2 confirms the theory.

Next, we examine the 3×3 battle-of-the-sexes game with the compromise option. We again consider the infinitely repeated version of the game, and assume that the two players have an identical discount factor $a \in (0, 1)$. We discuss the additional nuances associated with the finitely repeated version at the end.

Consider the following strategy. In the first round, player 1 plays X with probability s_1, Y with probability s_2, and Z with probability $1 - s_1 - s_2$; player 2 plays X with probability s_2, Y with probability s_1, and Z with probability $1 - s_1 - s_2$, where $s_1, s_2 \in [0, 1]$ and $s_1 + s_2 \leq 1$. If both players choose X, then in the next round, both choose Y, and they subsequently alternate; if both choose Y, then in the next round, both choose X, and they subsequently alternate. Otherwise, they restart the same process in the next round. Although the compromise option provides a chance for instant coordination, alternation is the efficient convention and players may wish to coordinate on it as soon as possible. If both players choose either X or Y in a round, then alternation becomes viable. However, if they choose otherwise, there is no obvious way to establish the alternating pattern. Even though they know they will be better off starting alternation immediately from the next round, their conflicts of interest prevent them from finding a way to start the pattern, because player 1 would prefer alternation starting from (X, X), and player 2 would prefer alternation starting from (Y, Y). Therefore, restarting the process is the best way to obtain alternation.

Player 1's payoffs in the repeated game can be reduced to a one-stage game with the following payoff matrix (Table 7):

Table 7
Repeated game payoffs for the 3 × 3 game.

	s_2	s_1	$1-s_1-s_2$
s_1	$\frac{250+50a}{1-a^2}$	aW	aW
s_2	aW	$\frac{50+250a}{1-a^2}$	aW
$1-s_1-s_2$	aW	aW	$100+aW$

The optimal s_1 and s_2 are chosen to maximize:

$$W = s_1 s_2\left(\frac{250+50a}{1-a^2} + \frac{50+250a}{1-a^2}\right) + (1-s_1-s_2)^2 100 + (1-2s_1 s_2)aW = \frac{s_1 s_2 \frac{300}{1-a} + (1-s_1-s_2)^2 100}{1-a(1-2s_1 s_2)}.$$

Simple calculation yields that there exists a threshold $\tilde{a} \in (0, 1)$, such that when $a < \tilde{a}$, $s_1^* = s_2^* = 0$; when $a > \tilde{a}$, $s_1^* = s_2^* = 0.5$. Impatient players will keep compromising because the compromise option yields instant coordination. Sufficiently patient players are willing to endure some initial failures of miscoordination in order to achieve alternation in the long run. Hence, alternation and compromise coexist if there exist subjects above and below the threshold. This provides additional theoretical support for Hypothesis 2; the results in F-3 confirm the coexistence of alternation and compromise.

The result shares some similarities with the 3×3 pure coordination game studied in Crawford and Haller (1990) (p. 586). In their game, coordination on X or Y yields both players a payoff of 1, and coordination on Z yields both players a payoff $b < 1$. Miscoordination results in a payoff of zero. They show that when players are impatient, they will settle on Z; when they are patient, they randomize between X and Y so as to achieve coordination as quickly as possible.

The finitely repeated version of the game involves a heavier calculation than infinitely repeated game do, because the number of remaining rounds changes as the game proceeds. One potential difference between the two repeated games is that $\tilde{a}$ should increase in the number of rounds in the finite game. This is because when the number of remaining rounds decreases, even very patient players, who would have preferred to establish the alternation pattern in earlier rounds, but failed to do so, would tend to settle on compromise.

5.2. Risk attitudes

Risk attitude could be another reason why some pairs converge to compromise in F-3. If at least one of the subjects in a pair is very risk averse, she might want to avoid alternating, because there is a risk of not receiving her own favorite outcome in future periods.

To assess whether risk attitude affects subjects' decisions, we compare the choices made in the risk-elicitation part of the experiment, by subjects who alternate and those who compromise in treatment F-3. We find that the compromisers are slightly more risk-averse than the alternators are, on average (4.36 vs. 3.78, $p = 0.28$, two sided Mann–Whitney test). However, the difference is not significant. Hence, we do not find strong support for risk attitudes playing a role in F-3.

6. Conclusion

In this study, we investigate how a compromise option affects play in a battle-of-the-sexes game under random matching (repeated one-shot game) and under fixed matching (repeated games), as well as when the fixed-matching repeated-game (supergame) is played repeatedly with different partners. Experimentally, we find that the effectiveness of the compromise option depends crucially on the matching protocol. Under random matching, the inclusion of the compromise option affects play significantly, because most subjects tend to use the compromise option in order to avoid coordination failure that otherwise exist without such an option. In contrast, under fixed matching, the compromise option partially crowds out subjects from using the alternation strategy and leads to a lower payoff, because many subjects use compromise to coordinate. Finally, when the supergame is played multiple times, subjects learn to adopt the alternation strategy more often across supergames.

This study serves as an attempt to understand the role of focal points in repeated interactions. In contrast to short-term interactions, players can rely on additional mechanisms to achieve coordination in repeated interactions. Nevertheless, the role of focal points is unclear. Our findings provide evidence that the compromise option retains its salience in repeated games, owing to its symmetry and simplicity, but is less salient than that in one-shot games. However, the salience of the compromise option wears off when subjects gain experience by repeatedly playing supergames. Our results raise an important question on whether other types of focal points can retain their focality in repeated games.

A potential extension of this study suggested by an anonymous referee, is to investigate how our findings depend on the payoff of the compromise option, relative to the payoff of the alternation strategy. One conjecture is that the compromise option becomes more attractive when its relative payoff increases, because subjects will find it more profitable to compromise. However, subjects' incentives to teach each other to use the alternation strategy may decrease, which would result in a slower upward trend in the use of alternation, and in the average payoff across supergames.

Appendix A. Experimental instructions

In this appendix, we provide the experimental instructions that are translated from the original Chinese version.

Instructions (All treatments)

Welcome to this experiment on decision-making. Please read the following instructions carefully. During the experiment, do not communicate with other participants in any means. If you have any question at any time, please raise your hand, and an experimenter will come and assist you privately. This experiment will last about one hour.

This experiment is divided into two parts. In Part I, you are going to take part in an experiment in this room together with other participants. Each participant seats behind a private computer, and no one can ever know the identity of another. In Part II, you are going to conduct your decision-making independently with other participants. All decisions are made on the computer screen.

It is an anonymous experiment. Experimenters and other participants cannot link your name to your desk number, and thus will not know the identity of you or of other participants who made the specific decisions. During Part I, your earnings are denoted in points. Your earnings depend on your own choices and the choices of other participants. At the end of the experiment, your earnings will be converted to RMB at the rate: 100 points = ¥ 1. During Part II, your earnings are denoted directly in RMB currency Yuan. In addition, you receive 10 RMB show-up fee. This show-up fee is added to your earnings from Part I and Part II. Your total earnings will be paid to you in cash privately.

Part I (Treatment R-3)

In this experiment, you will stay in a group of six people. In each round, you will be randomly matched with one person in the room. The two of you are going to play a game. Each person will make a choice between A, B and C. If you and the other person make a different choice, you will both receive 0 points. If you and the other person both choose A, you will receive 250 points and the other person will receive 50 points. If you both choose B, then you will receive 50 points and the other person will receive 250 points. If you both choose C, both of you will receive 100 points.

The possible decisions and payoffs are also shown in the following matrix. In each cell of the matrix, the first number shows the amount of points for you, and the second number shows the amount of points for the other person.

You will play this game for 30 rounds in total. In these 30 rounds, you will be matched within your matching group of six people. You will not be matched with someone with the same preferences as you. Therefore, you will be only matched with 3 different participants in this group. In each round, you will be re-matched to one of the 3 participants. In each

Table 8
Options in the Risk-elicitation task.

Option 1	Head: 17	Tail: 0
Option 2	Head: 15	Tail: 3
Option 3	Head: 13	Tail: 4
Option 4	Head: 11	Tail: 5
Option 5	Head: 9	Tail: 6
Option 6	Head: 7	Tail: 7

round, the chance of meeting any of the three participants is one third. At the end of each round, you will learn the choice of your partner in this round. Your earnings in this experiment equal the sum of the points you earn in all of the 30 rounds plus the show-up fee. Your earnings will be converted to RMB at the rate: 100 point = ¥ 1.

Quiz (Treatment R-3)

1. In each round, what is your payoff if you choose A and the other person chooses C?
2. In one round, what is your payoff if both you and the other person choose B? How about the payoff of the other person?
3. How many rounds are you going to play in this experiment?
4. Which of the following statements below is true? a. I will play with the same person in all the rounds. b. I will never play with the same person for more than one round. c. I might play with the same person for more than one round.
5. Suppose you are now in round 10, which statement below is true? a. I will play with the same person in the next round. b. I might play with a different person in the next round. c. I will definitely play with a different person in the next round.

Part I (Follow-up experiment)

In this experiment, you will be matched with other people in the room. The two of you are going to play a game. Each person will make a choice between A, B and C. If you and the other person make a different choice, you will both receive 0 points. If you and the other person both choose A, you will receive 250 points and the other person will receive 50 points. If you both choose B, then you will receive 50 points and the other person will receive 250 points. If you both choose C, both of you will receive 100 points.

The possible decisions and payoffs are also shown in the following matrix. In each cell of the matrix, the first number shows the amount of points for you (in red), and the second number shows the amount of points for the other participant (in blue).

Once you are matched with someone, you will play this game with this person for one block. Each block consists of 30 rounds of the game. That is, you will play the game with the same person repeatedly for 30 rounds. At the end of each round, you will learn the choice of your partner in this round. After the first block is finished, you will learn the choices of you and your partner in the entire 30 rounds. Then, you will be re-matched with another person to play the next block, which also consists of 30 rounds of the game. In total, there are 4 blocks in this part. In each block, you will be matched with a different person to play this game repeatedly for 30 rounds.

In this part, your earnings equal the total earnings of two randomly selected blocks. The earnings of each block equal the sum of the point you earn in the 30 rounds of that block. At the end of the experiment, your earnings will be converted to RMB at the rate: 100 points = ¥ 1.

Quiz (Follow-up experiment)

1. In each round, what is your payoff if you choose A and the other person chooses C?
2. In one round, what is your payoff if both you and the other person choose B? How about the payoff of the other person?
3. How many rounds are you going to play in this experiment?
4. Which of the following statements below is true? a. I will play with the same person in all the rounds. b. I will play with the same person in one block. c. I will never play with the same person for more than one round.
5. Suppose you are now in round 60, which statement below is true? a. I will play with the same person in the next round. b. I might play with a different person in the next round. c. I will definitely play with a different person in the next round.

Part II (All treatments)

In Table 8, we present six different options. You are asked to select one of the options. Your earnings will depend on the outcome of a fair coin toss generated by the computer. Every option shows the amount in points you earn in case a head shows up or a tail shows up. The chance of head or tail is 50% respectively. When you have made your choices, the computer will randomly decide the result of the coin toss. Please indicate which one of the six options you prefer.

Appendix B. Supplemental figures

In this appendix, we provide the supplemental figures that are useful for understanding the experimental results (Figs. 9–13).

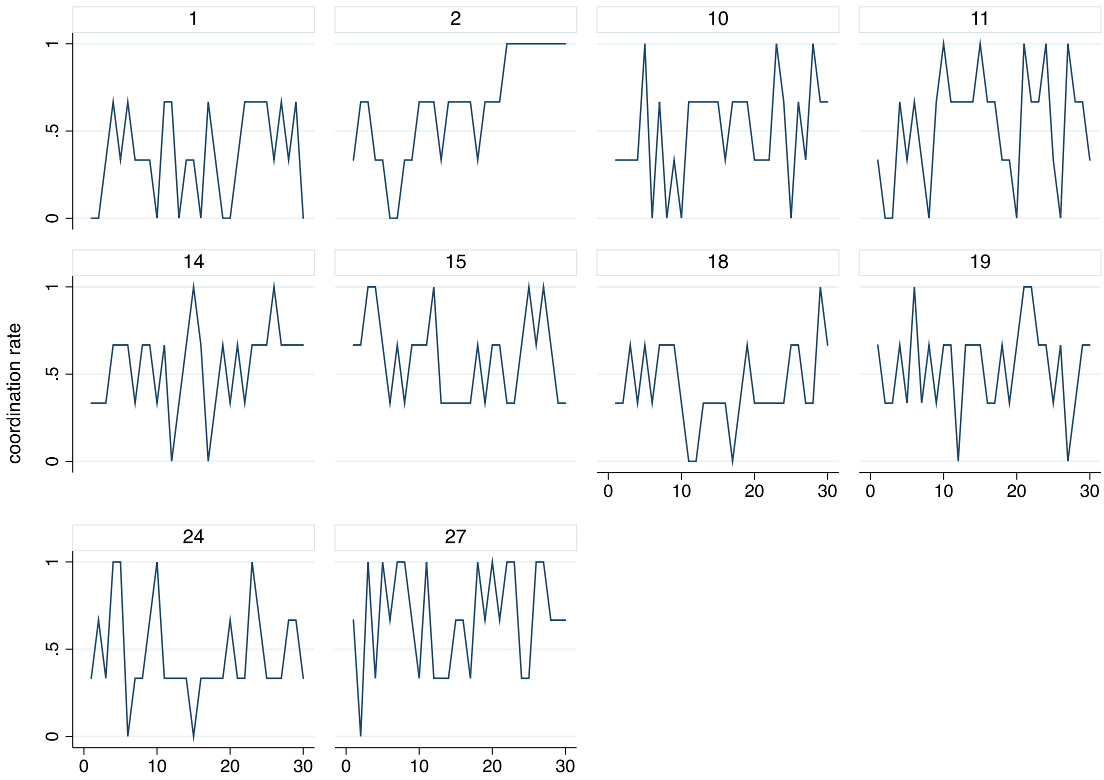

Fig. 9. Group-Level Data, R-2. Coordination rate over time. *Notes: X-axis is round number. Y-axis shows the coordination rate.*

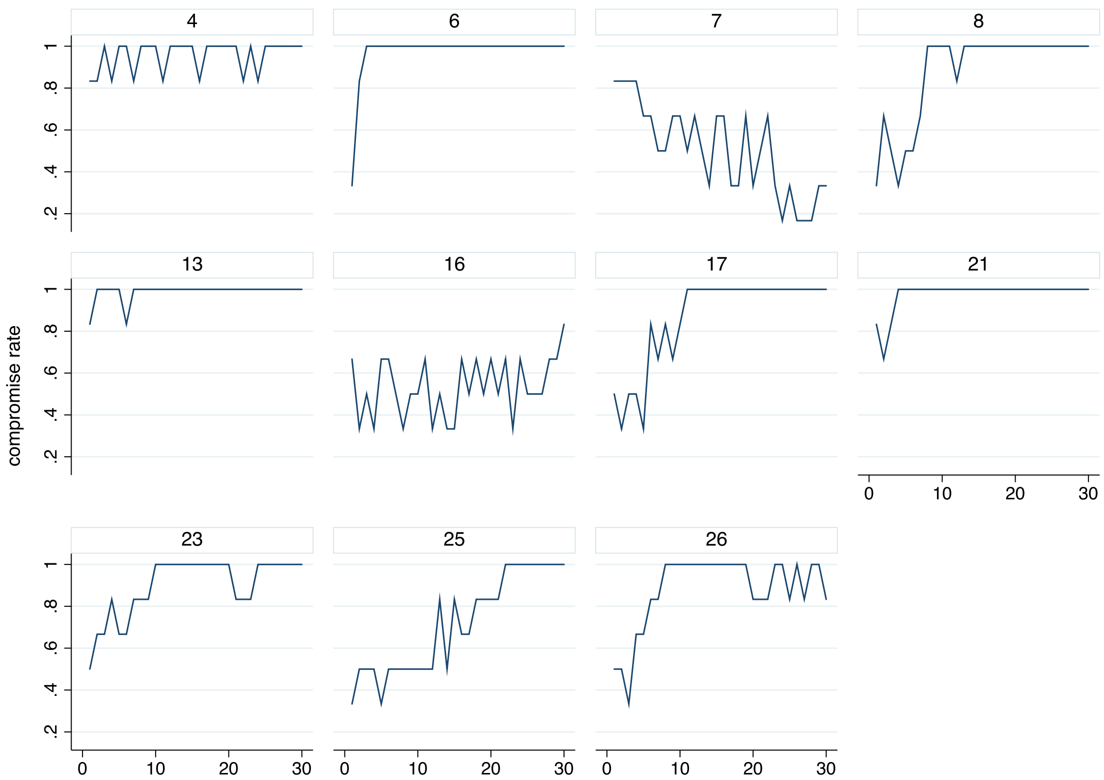

Fig. 10. Group-Level Data, R-3. Compromise rate over time. *Notes: X-axis is round number. Y-axis shows the rate of choice Z.*

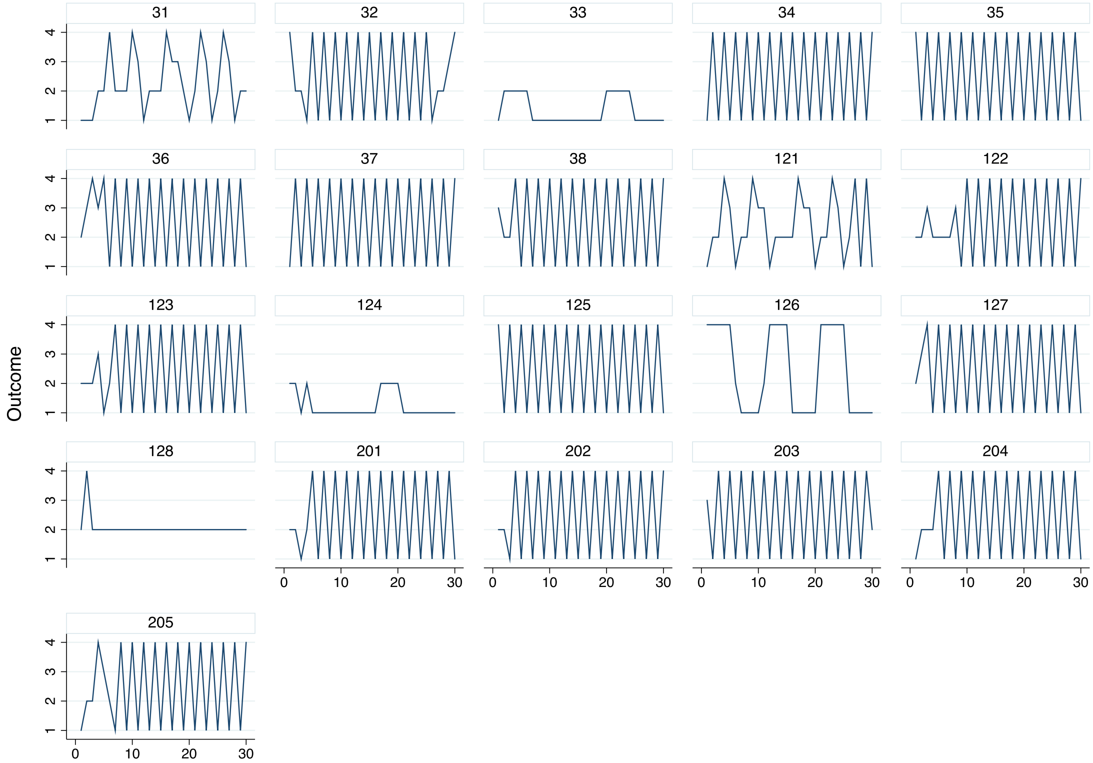

Fig. 11. Group-Level Data, F-2. Outcome distribution over time. *Notes: X-axis is round number. Number 1-4 in y-axis indicates outcome* (X,X), (X,Y), (Y,X), (Y,Y), *respectively.*

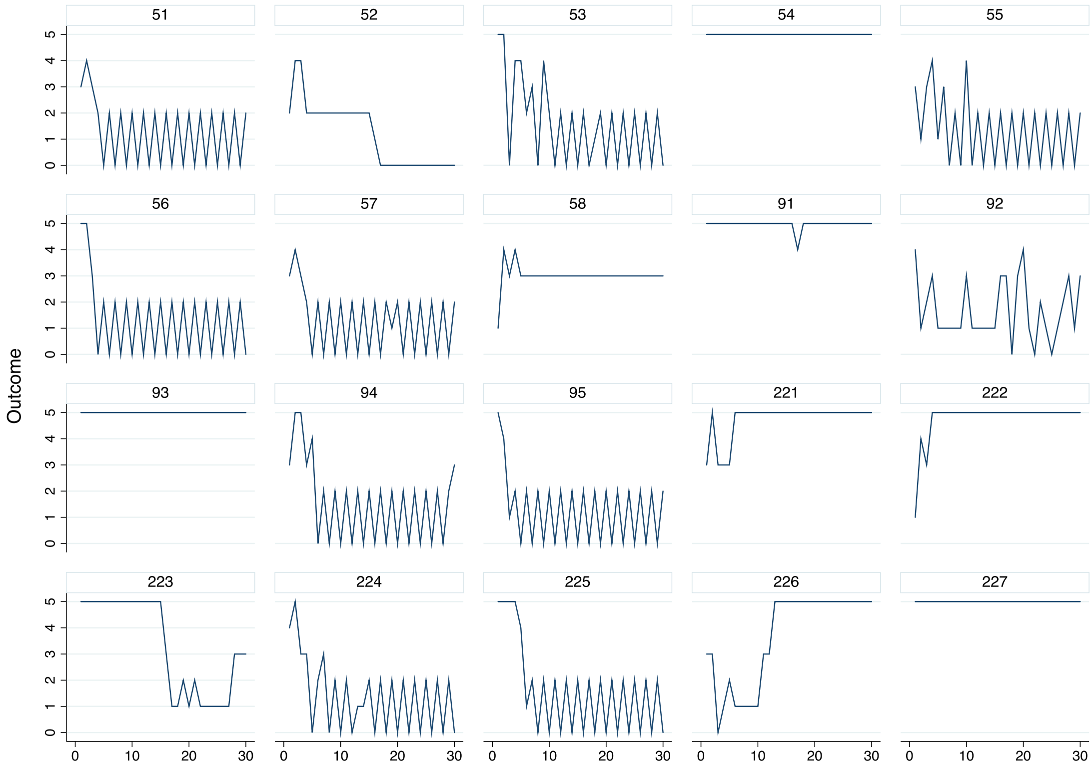

Fig. 12. Group-Level Data, F-3. Outcome distribution over time. *Notes: X-axis is round number. Number 0-5 in y-axis indicates outcome* (X,X), (X,Y) *or* (Y,X), (Y,Y), (X,Z) *or* (Z,X), (Y,Z) *or* (Z,Y), (Z,Z), *respectively.*

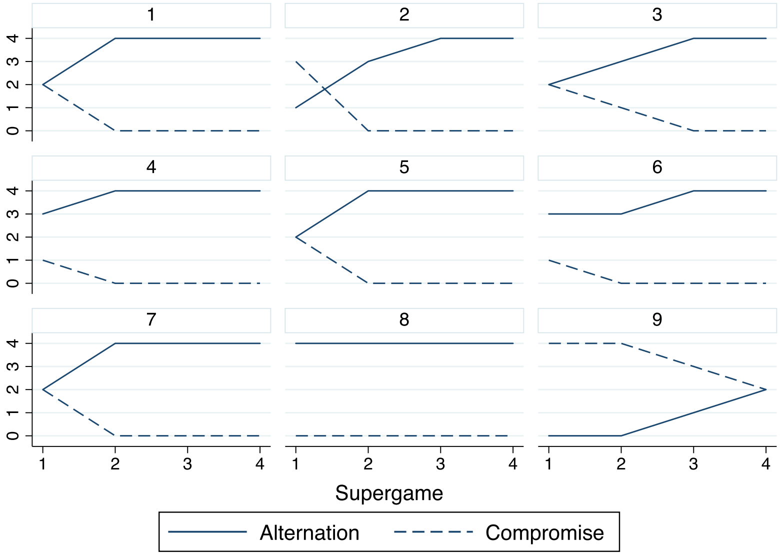

Fig. 13. Group-Level Data, Follow-up experiment. Number of each strategy ("alternation" and "compromise") in each supergame.

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