The Courtesy Game

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Abstract In this paper, we study the role of courtesy in the solution of asymmetric social dilemmas. To this end, we introduce a novel game, the Courtesy Game, and show with the help of a laboratory experiment that an efficient equilibrium in the form of turn-taking, i.e., alternate play of the weakly dominant and weakly dominated strategies of the stage game, only emerges in a partner matching and in a few groups in which certain players take the lead. One conclusion from this result is that a 'courtesy equilibrium' does not arise spontaneously but requires explicit rules of conduct.

Keywords: Courtesy Game, Social Dilemma, Social Preferences, Turn-Taking, Experiment

JEL classification: C73, C91, D91

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Amongst them all growes not a fayrer flowre,
Then is the bloosme of comely courtesie,
Which though it on a lowly stalke doe bowre,
Yet brancheth forth in braue nobilitie,
And spreds it selfe through all ciuilitie:
Of which though present age doe plenteous seeme,
Yet being matcht with plaine Antiquitie,
Ye will them all but fayned showes esteeme,
Which carry colours faire, that feeble eies misdeeme.

Edmund Spenser 1596, The Faerie Queene,
Book VI, Proem, Stanza 4

1 Introduction

According to the Cambridge Dictionary, *courtesy* is a particular kind of "polite behavior, or a polite action or remark".[1] Since the early Middle Ages, rules of conduct have been compiled in so-called 'courtesy books' (for an overview see, e.g., Ashley and Clark, 2001). English poet Edmund Spenser, from whom the above quote originates, dedicated Book VI of his famous epic poem *The Faerie Queene* to the virtue of courtesy (Spenser, 1596). For courtesy to be more than just intrinsically motivated gentleness but a social virtue, it requires the skill to choose the appropriate action for the situation: "Spenser portrays courtesy as a true moral virtue. It derives not only from gentleness, a natural inclination *to seek what is best for others*, but also from the *conscious and voluntary choice of an action that best meets the needs* of a particular situation." (Culp, 1971, p. 37, emphasis added). In this paper, we examine the role of courtesy in solving symmetric social dilemmas with asymmetric pure strategy equilibria.

In the modern language of behavioral economics, courtesy could be defined as a social preference, or more precisely a combination of *altruism* and *efficiency preferences* (for a critical overview of the literature on social preferences in experimental games, see List, 2009). Altruistic behavior is a prominent explanation of the results of, e.g., the dictator game and the public goods game (Levitt and List, 2007). Andreoni and Miller (2002) have shown that "altruism is rational" (p. 737), i.e., the behavior of participants in laboratory experiments is compatible with maximizing a continuous, convex, and monotonic utility function. In the context of reforms, it has been shown that participants in experiments are willing to forgo their own payoff (and accept disadvantageous inequality) if this increases the overall payoff of the group (Messer et al., 2010; Paetzel et al., 2014), which clearly indicates ef-

[1] `https://dictionary.cambridge.org/dictionary/english/courtesy`.

ficiency preferences. Accordingly, courtesy, i.e., the combination of altruism with efficiency preferences, could make an empirically relevant contribution to solving social dilemmas.

However, the question arises, which in our view has not yet been sufficiently examined: whether courteous behavior can develop *spontaneously* or whether external clues in the form of rules of conduct are needed. In everyday life, we are constantly confronted with the question of appropriate behavior, be it when eating at a buffet, entering buildings through doors or at a bottleneck in traffic. Others are just as hungry or in just as much of a hurry as we are, but it is pretty obvious that we cannot reach for the same chicken thigh, walk through the door or pass the road narrowing at the same time. In Spenser's sense, deliberate waiting to let the other person go first would be a courteous strategy for resolving the situation. However, waiting not only has the disadvantage of losing valuable time, but also carries a risk: an inefficient *courtesy dilemma* can arise in which both wait and nobody gets a turn. Rules of conduct therefore define or provide guidance on what needs to be done by whom to achieve an efficient result. At the conference buffet, the keynote speakers are the first to help themselves; at the entrance door, the man lets the woman and the younger lets the older go first; and at the road narrowing a traffic sign determines which side may drive first.

Our initial assumption for this research project is that without such rules of conduct, courteous behavior does not arise spontaneously, primarily because of the looming courtesy dilemma, so on grounds of risk aversion, but also because many people are inequality-averse or even envious (e.g., using a representative sample of the German population, Kerschbamer and Müller, 2020, showed that 64.8% of the respondents were inequality-averse and 3.5% were envious), or only seek their own profit (e.g., 22.7% of the participants in Andreoni and Miller, 2002 were purely self-interested and 33% in Fischbacher et al., 2001). Moreover, in addition to risk attitudes, social preferences, and beliefs that tend to influence the willingness to *cooperate*, there are various factors that can influence *coordination*, e.g., communication, sequential decision-making and leadership, and focal points (c.f., Van Dijk and De Dreu, 2021).

In this paper, we focus on the leadership factor. Diekmann and Przepiorka (2016) have experimentally shown that in the repeated volunteer's dilemma[2] with a partner matching, an efficient turn-taking equilibrium develops in a large number of groups, i.e., one player must lead and the other players must

[2]In the volunteer's dilemma, the cooperation of a single member of a group is sufficient to provide a public good, otherwise all $n \geq 2$ group members go away empty-handed. Thus, there are n Pareto-efficient Nash equilibria in which exactly one group member, the volunteer, provides the good and bears the costs alone.

then follow in turn. Cappelen et al. (2016) have demonstrated in a laboratory experiment on the voluntary provision of public goods that leadership can increase the average contribution to the public good as long as the leader is only moderately compensated. Experimentally investigating the relationship between leadership, beliefs, and voluntary contributions to public goods, Gächter and Renner (2018) found that leaders have a major influence on the beliefs and contributions of followers. In a study by Cason et al. (2013) on the assignment game[3] that is closely related to ours, certain players did not only initiate turn-taking in their groups but also tried to extend this kind of cooperation to other groups (which is why the authors called these players 'teachers' instead of leaders).

To systematically pursue the question of whether there are courteous players who show leadership and, together with the followers, are able to establish an efficient courtesy equilibrium, we introduce a new symmetrical 2×2 game, the Courtesy Game (hereinafter CG). The stage game has a 'discourteous' weakly dominant strategy and a 'courteous' strategy. The symmetric Nash equilibrium is inefficient, while the two asymmetric Nash equilibria are Pareto efficient. However, the courtesy dilemma arises when both players choose the courteous strategy. We investigate how the repetition of the game and the matching protocol affect the individual strategy choice and the group outcome. One solution to the courtesy dilemma would be for both players to take turns playing both strategies. Turn-taking in repeated social dilemma games has been discussed at length in the literature (for overviews see, e.g. Helbing et al., 2005; Kaplan and Ruffle, 2012; Cason et al., 2013; Kaplan et al., 2018). We thus contribute to this established field of research by analyzing the role of a particular social preference, courtesy, and of leadership for the resolution of social dilemmas in a new game, the CG.

Our main result is that in the partner matching, some leaders actually initiate turn-taking and are followed by other players. However, the number of groups that succeed in doing so is relatively low overall, even in comparison to the total stranger treatment. In addition, the courtesy dilemma also occurs more frequently in the partner treatment, so that there is no significant gain in efficiency. Accordingly, we consider the chances of spontaneous courtesy contributing to the solution of social dilemmas to be rather low and consider explicit rules of conduct to be necessary.

In the next section, we introduce the CG and compare it to related symmetric two-player games with asymmetric equlibrium outcomes. In Section

[3]In the repeated assignment game, which will be explained in more detail below, the two players can maximize their payoff by deviating from the dominant strategy of the stage game and taking turns at a disadvantage.

3, we present the experiment and derive conjectures for the results. Section 4 presents the results. The paper ends with conclusions in Section 5. There, we also relate our results to the literature, discuss possible weaknesses and point out future research needs.

2 The Courtesy Game and Related Games

In this section, we introduce the CG and compare it to similar games, viz., the assignment game, the volunteer's dilemma, and the chicken game (also know as the hawk-dove game). According to Dawes (1975, p. 89), social dilemma games are characterized by the fact that (i) there is a dominant uncooperative strategy and (ii) it would be efficient if all players cooperated. As we will see in the following subsection, the CG is different because mutual cooperation would lead to a Pareto-dominated outcome, the courtesy dilemma. We compare the CG with the assignment game studied by Cason et al. (2013) which, like the CG, has two asymmetric efficient strategy profiles, but which are Nash equilibria only in the CG. In the two-person volunteer's dilemma, on the other hand, there is no dominant strategy but two efficient asymmetric Nash equilibria (Diekmann, 1985; Diekmann and Przepiorka, 2016). There is no dominant strategy in the chicken game either, and mutual cooperation (by braking or keeping in lane) would be just as Pareto-efficient as the two asymmetric Nash equilibria.

2.1 The Courtesy Game

Consider the everyday situation where two cars meet at a street narrow (see Figure 1). We assume that both drivers $i \in \{A, B\}$ are in a hurry. Arrival on time at the destination yields each driver a utility of a. A courteous driver, who waits in front of the narrow and gives way to the other driver, has a disutility of $-w < 0$ due to later arrival. When both drivers simultaneously try to go through the narrow, they have to slow down, causing them a disutility of $-s < 0$. We assume that the drivers are indifferent between the costs of delays c caused by courtesy and slow drive, i.e., $c = w = s$.

Table 1 shows the normal form of the 2×2 CG; Table 3 in Section 3 shows the parametrization of the CG in the experiment with $a = 20$ and $c = 10$ points. Obviously, due to $a > a - 2c$, both players' weakly dominant strategy is 'Drive', and the strategy profile (D, D) is a Nash equilibrium. There are two further asymmetric Nash equilibria (D, W) and (W, D), where one of the two players waits and the other player arrives in time.[4] In contrast to

[4]Since 'Drive' is a weakly dominant strategy, there are no mixed strategy equilibria.

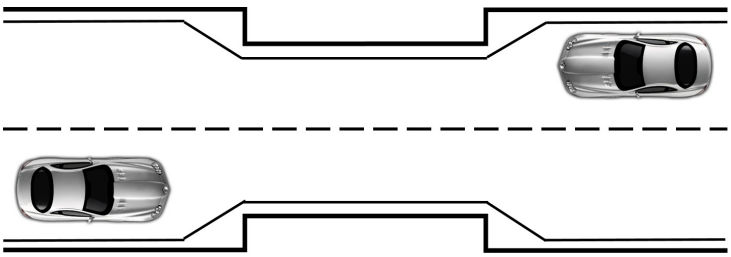


Figure 1: The Courtesy Game

the symmetric Nash equilibrium, the asymmetric Nash equilibria are Pareto efficient. We call them *courteous*, because the player who waits accepts a lower payoff than her opponent, $a - c < a$. However, players who choose the weakly dominated strategy 'Wait' are in a *courtesy dilemma*, because they would not want the other player to be courteous as well, since the strategy profile (W, W) yields the worst outcome $a - 2c$ for both players.

		Player B	
		(D)rive	*(W)ait*
Player A	*(D)rive*	$a - c$ $a - c$	a $a - c$
	(W)ait	$a - c$ a	$a - 2c$ $a - 2c$

Table 1: The 2 $\times$ 2 Courtesy Game

When the CG is finitely repeated, two possibilities open up. One is the subgame perfect Nash equilibrium, in which both players play the weakly dominant strategy of the stage game 'Drive' from start to finish. On the other hand, the players could try to coordinate on a turn-taking strategy in which both players take turns waiting. This strategy would be efficient; it would, however, require players to be altruistic and to accept inequality to their disadvantage in the rounds in which they wait.

2.2 Relation to other Games

The Assignment Game

Cason et al. (2013) experimentally studied the assignment game displayed in the top panel of Table 2. In this game, two fishermen have the choice between a good (G) and a bad (B) fishing spot. It is assumed that the catch of the good fishing spot h is more than twice as big as the catch of

The Assignment Game

		Player B			
		(G)ood Spot		*(B)ad Spot*	
Player A	*(G)ood Spot*	$0.5h$	$0.5h$	h	ℓ
	(B)ad Spot	ℓ	h	0.5ℓ	0.5ℓ

It is assumed that $h > 2\ell > 0$. Source: Cason et al. (2013, p. 337).

The Volunteer's Dilemma

		Player B			
		(D)efect		*(V)olunteer*	
Player A	*(D)efect*	0	0	U	$U-k$
	(V)olunteer	$U-k$	U	$U-k$	$U-k$

It is assumed that $U > k > 0$ (see Diekmann, 1985 for the n-player version).

The Chicken Game

		Player B			
		(D)rive		*(B)rake*	
Player A	*(D)rive*	Y	Y	H	L
	(B)rake	L	H	X	X

It is assumed that $H > X > L > Y$ (cf., e.g., Cabon-Dhersin and Etchart-Vincent, 2012).

Table 2: Related 2 $\times$ 2 Games

the bad fishing spot ℓ, so that $h > 2\ell > 0$. If the fishermen share the same spot, they each receive only half of the catch; otherwise, each receives the catch of his own spot. In the stage game, G is the dominant strategy and (G, G) is the only Nash equilibrium. However, because $\ell + h > 0.5h + 0.5h$, the two asymmetric strategy profiles (B, G) and (G, B) are efficient. In this respect, turn taking for the repeated game would be an alternative to the subgame-perfect permanent mutual choice of G. Note that the assignment game would be strategically equivalent to the CG for $h = 2\ell$, which was ruled out by assumption (in that case, (B, G) and (G, B) would also be Nash equilibria).

Cason et al. (2013) conducted the experiment as an indefinitely repeated

game with a random termination rule, with each player playing seven matches. Within a match, the game was played with fixed partners; a total stranger matching protocol was used between matches. There were a high and a low conflict treatment varying the ratio between h and ℓ. As expected, turn taking occurred more frequently in the low conflict treatment and in matches in which at least one player already had turn taking experience. Above all, however, the authors showed that it is certain players ('Teachers') who tried to initiate turn taking and carry it over from one match to the next.

Although our work is strongly inspired by Cason et al. (2013), there are important differences besides the fact that 'Drive' is only a weakly dominant strategy in the stage game.[5] We study the CG as a *finitely* repeated game with both *partner* and *total stranger matching* to investigate behavioral and, most importantly, efficiency differences between bottlenecks where vehicles meet purely by chance and bottlenecks where the same vehicles meet regularly to investigate the question of whether the partner matching versus chance leads to an improvement (or whether courtesy requires rules of conduct). We also investigate the differences between the players who never engage in turn taking, who initiate turn taking (the 'Teachers' in Cason et al. (2013), who we will call 'Leaders') and the 'Followers' who react to the initiative of the 'Leaders'. Particular attention is paid to the decision rationales stated by the participants in a post-experimental questionnaire. The main question here is whether cooperative behavior is driven solely by efficiency concerns or whether it represents 'genuine' courtesy.

The Volunteer's Dilemma

The volunteers dilemma is displayed in the middle panel of Table 2. The volunteer's dilemma is a social dilemma without a dominant strategy. Diekmann (1985) has examined the game theoretically. The question is how the players can coordinate so that one cooperates voluntarily while the other player (or all other players in the n person game) defects. A potential solution is that 'superrational' players tacitly agree on turn-taking in the repeated game.

As already mentioned in the Introduction, Diekmann and Przepiorka (2016) studied the repeated volunteer's dilemma in laboratory experiments in different constellations and found that turn-taking emerges as a kind of social norm in many groups. In the homogeneous treatment (with equal costs of cooperation), 50% of the observations could be identified as part of a turn-taking cycle. Cost heterogeneity significantly worsened coordination and more often led to the participant with the lowest costs cooperating

[5]The conflict level in our experiment is constant (20/10 points) and corresponds approximately to the conflict level (7/3) in the low conflict treatment of Cason et al. (2013).

voluntarily. Murnighan et al. (1993) used laboratory experiments to investigate which structual factors encourage volunteering. Among other things, they found that there is less cooperation in larger groups and that lower costs of cooperation (difference between the costs of the volunteer and the non-volunteers) lead to more cooperation.

The Chicken Game

The chicken game (also known as hawk-dove) is known from movies like the 1955 American melodrama "Rebel Without a Cause": in a dare, two adolescents drive towards a cliff. The first to brake is called a 'chicken' and is humiliated and loses status. If both brake, the dare results in a tie; but if neither brakes, both crash. The game has no dominant strategy (and therefore does not match Dawes' definition of a social dilemma) and two asymmetric Nash equilibria (D, B) and (B, D) in which one drives and the other brakes. In addition, in contrast to the CG, the strategy profile (B, B), in which the dare ends in a tie, is also Pareto-efficient.

Cooperation in the chicken game has also been extensively studied (cf., e.g., Bornstein et al., 1997; Cabon-Dhersin and Etchart-Vincent, 2012). Bhaskar (2000) has theoretically shown that efficient cooperation in the repeated chicken game can be maintained by an 'egalitarian convention' in which the players take turns in breaking and driving. Bornstein et al. (1997) reported on an experiment in which different variants of the chicken game were played with repetition and 'cheap talk'. In the two-person variant, one of the two efficient, asymmetric Nash equilibria was played in over 68% of the observations and the players' actions were clearly negatively correlated, so that turn-taking was observed in many cases.

Due to the different payoff matrices, however, the results are not directly comparable with the CG. Braking in anticipation of the other player's driving could also be interpreted as courtesy here, but in contrast to the CG, no courtesy dilemma arises. On the contrary, courtesy on both sides is Pareto-efficient. In our experiment, we also dispense with any communication between the players.

3 Experimental Design

In this section, we first explain the experimental design (Subjection 3.1), state conjectures for the results of the experiment (Subjection 3.2), and, finally, describe the implementation of the experiment (Subjection 3.3). The English translation of the instructions of the original experiment conducted

in German can be found in Appendix B.

3.1 The Experiment

Table 3 shows the parameterization and screen display of the stage game of the CG in the experiment. It was implemented as a two-player two-strategy simultaneous normal form game with the parameters $a = 20$ points and $w = s = 10$ points. To obtain a neutral framing, 'Drive' was renamed 'X' and 'Wait' was renamed 'Y', with the order of the strategies randomized at the individual level. Nevertheless, we will continue to use the terms 'Drive' and 'Wait' in the following for better comprehensibility when we speak of the 'discourteous' weakly dominant and the 'courteous' weakly dominated strategies. To make the payoff matrix more comprehensible, the strategies and the points of players A ('You') and B ('The other participant') were displayed in different colors.

		The other participant	
		X	*Y*
You	*X*	10 points, 10 points	20 points, 10 points
	Y	10 points, 20 points	0 points, 0 points

Table 3: The Stage Game of the Courtesy Game in the Experiment

We applied three between-subjects treatments that differed with respect to the number of rounds played (*repetition* $\in \{1 \text{ round}, 10 \text{ rounds}\}$) and—for the repeated treatments only—the *matching protocol* $\in$ {partner, total stranger} (see Table 4).

In *One-Shot*, the participants were randomly matched in groups of two players and played the game without repetition for one round. After the game, both players found out their own choices, earned points, and those of their opponents.

In the *Stranger* treatment, the participants played the game with repetition, i.e., over ten rounds. They were matched using the total stranger matching protocol, i.e., in each round the participants were re-matched with a different participant from the experiment in groups of two players and the participants never met twice over the course of the ten rounds. The participants received full feedback on both players' choices and earned points after each round. The participants knew the protocol and that they would receive feedback after each round.

In the *Partner* treatment, the participants played the game with repetition, i.e., over ten rounds. They were matched using the partner protocol, i.e., in each round, the participants were matched with the same participant from the experiment in groups of two players. The participants received full feedback on both players' choices and earned points after each round. The participants knew the protocol and that they would receive feedback after each round.

Treatment	Rounds	Matching Procedure	Feedback
One Shot	1	-	Yes
Stranger	10	Total Stranger	Yes
Partner	10	Partner	Yes

Table 4: Treatments

In all three treatments, each round was payoff relevant for the participants. The total payoff was calculated from the sum of the points earned in all rounds.

At the beginning of each round, we elicited the participants' beliefs about the other choice of the other player. Since we are primarily interested in the strategies of the participants and have tried to reduce the complexity of the experiment as much as possible, the elicitation of the beliefs was not incentivized.[6]

The post-experimental questionnaire included next to socialdemografic questions (gender, age, field of study) an item on the participant's *risk-attitude* (Dohmen et al., 2011) and a self-assessment of her *patience* (taken from the German Socio-Economic Panel, GSOEP).[7] Furthermore, participants had to indicate on a 6-point Likert scale the extent to which they agree or disagree with i) being a polite and courteous person, and ii) using or owning an autonomous vehicle. The first item (taken from Soto and John 2017) is our measure for self-stated *courtesy* and the latter (based on Panagiotopoulos and Dimitrakopoulos 2018) for the self-stated acceptance of *autonomous driving*. Finally, we are interested in the participants' decision rationales for their strategy choices in the experiment. Therefore, we asked about the extent to which *own payoff maximization*, *altruism*, *inequality aversion*, *efficiency preferences*, and *envy* played a role for decision-making in the

[6]Charness et al. (2021) compare different methods for the elicitation of beliefs and conclude that non-incentivized methods work at least no worse than complex incentivized methods.

[7]In contrast to the original literature, we used a 10-point Likert scale for both items to rule out neutral statements.

experiment using a 6-point Likert scale from 1 ('I do not agree at all') to 6 ('I completely agree').

3.2 Conjectures

In this subsection, we state conjectures about the effects of the treatments on individual and group outcomes in the CG. The above-referenced literature suggests that that is a certain number of participants who would consider playing the efficient 'courteous' turn-take strategy for various reasons. Without the repetition of the stage game, however, such a turn-taking is not possible.

Conjecture 1 (Repetition)**.** *Compared to the One-Shot treatment, the repetition of the stage game in the Stranger treatment and the Partner treatment reduces the likelihood that the weakly dominant strategy 'Drive' is played in the Courtesy Game.*

The repetition of the stage game alone may not be sufficient to establish a turn-take equilibrium, which requires both players to coordinate on reciprocal turn-taking.

Conjecture 2 (Matching Protocol)**.** *Compared to the Stranger treatment, the Partner treatment reduces the likelihood that the weakly dominant strategy 'Drive' is played in the Courtesy Game.*

We therefore expect that participants in the Partner treatment will actively alternate between 'Drive' and 'Wait' and also react accordingly to the choices of the opponent, i.e., respond to 'Drive' with 'Drive' and to 'Wait' with 'Wait' in the next round.

Conjecture 3 (Choice Dynamics)**.** *In the Partner treatment, players attempt to implement a turn-take strategy by alternating between 'Drive' and 'Wait', i.e., the probability of playing 'Drive' decreases when a player has played 'Drive' himself in the previous round, and increases when the opponent has played 'Drive' in the previous round.*

Furthermore, we suspect that there are three different types of players: those who strictly adhere to the subgame-perfect strategy of always driving; those who try to initiate a turn-take strategy by waiting first; and those who only engage in a turn-take strategy when another player initiates it, i.e., the opponent waits first. We call these players, in that order, 'Dominant', 'Leader' and 'Follower'.

Conjecture 4 (Player Types)**.** *In partner treatment, there are 'Dominant' players who never wait; 'Leaders' who try to initiate a turn-take equilibrium by waiting first; and 'Followers' who only adopt a turn-take strategy when there is a Leader in the group.*

Eventually, we turn to the group results. If we look at the first round alone, we expect that there will be no treatment differences between One-Shot, Stranger and Partner due to the small expected number of 'Wait' choices. Hence, in all three treatments, the majority of the groups are likely to end up with the strategy profile (D, D) and there are distinctly less asymmetric strategy profiles $\{(D, W), (W, D)\}$. The courtesy dilemma (W, W) should occur with very low frequency. In the repeated CG, we then expect the number of asymmetric strategy profiles to increase significantly in the Partner treatment compared to the Stranger treatment. However, we expect the number of courtesy dilemmas to increase as well, since there is no direct communication between the players in the partner treatment.

Conjecture 5 (Groups' Strategy Profiles)**.** *In the first round, most groups choose the equilibrium strategy profile* (D, D) *based on the weakly dominant strategy, regardless of the treatment. The number of played asymmetric Nash equilibria* (D, W) *and* (W, D) *is small. The Courtesy Dilemma* (W, W) *rarely occurs.*
In the repeated CG, both the asymmetric Nash equilibria (D, W) *and* (W, D) *and the courtesy dilemma* (W, W) *are played more often in the Partner treatment than in the Stranger treatment.*

While successful attempts at coordination towards a turn-take equilibrium reward the players with a higher average payoff, failure to coordinate can lead to the courtesy dilemma and thus to a lower payoff. However, we optimistically assume that the Partner treatment increases efficiency overall.

Conjecture 6 (Efficiency)**.** *The partner matching increases the group efficiency, in terms of average group payoffs, compared to the stranger matching.*

While these conjectures relate to the *causal* effects of the treatments on individual strategy choice and group outcome, the final focus is on possible *correlations* between the individual characteristics of the participants and their behavior in the CG. As discussed in the introduction, we expect courtesy to be driven by altruism and efficiency preferences on the one hand. On the other hand, we expect risk aversion, self-interested payoff maximization, inequity aversion, and envy to be associated with discourteous behavior in the CG. Accordingly, we expect the 'leaders' to differentiate themselves from 'dominant' players through these characteristics, and 'followers' to occupy

a middle position. Since courtesy is generally considered a positive value, we expect the self-assessment of the participants to be consistently high, revealing little about their actual behavior.

On the socio-demographic characteristics: Certain courtesy norms (e.g., paying in restaurants, see Lever et al., 2015) give men the giving role, so it could be that men wait more often in the CG. This could also be supported by the fact that men contribute more than women in the public goods game (Brown-Kruse and Hummels, 1993). With regard to age, younger participants would also play a giving role and older participants a taking role in rules of conduct. Economic education tends to be paired with self-interest and therefore economists are expected to drive more often. Support for autonomous driving indicates a tendency to want to relinquish decision-making responsibility and could indicate less willingness to cooperate. On the one hand, the belief that the opponent will drive could lead to the player driving herself if she does not believe in the other player's willingness to cooperate; on the other hand, the player would wait to initiate turn-taking herself is she does believe that the other player is cooperative.

3.3 Procedures

The experiment was pre-registered (AEARCTR-0010034) and conducted between September and December 2022 in the WiSo Laboratory of the University of Hamburg. Participants were recruited with hroot (Bock et al., 2014). The experiment was programmed using oTree (Chen et al., 2016). We conducted three treatments in six sessions: one session of the treatment One-Shot with 24 participants, and two sessions of the treatments Stranger and Partner with 48 participants each. Thus, our data set consists of 120 participants (41.7% male, 57.5% female and 0.8% diverse). An experimental session lasted on average 30 minutes (20 minutes in One-Shot) and participants earned on average €15.98 (€6.13 in One-Shot). An overview of the participants' characteristics can be found in Table 14 in the Appendix A.

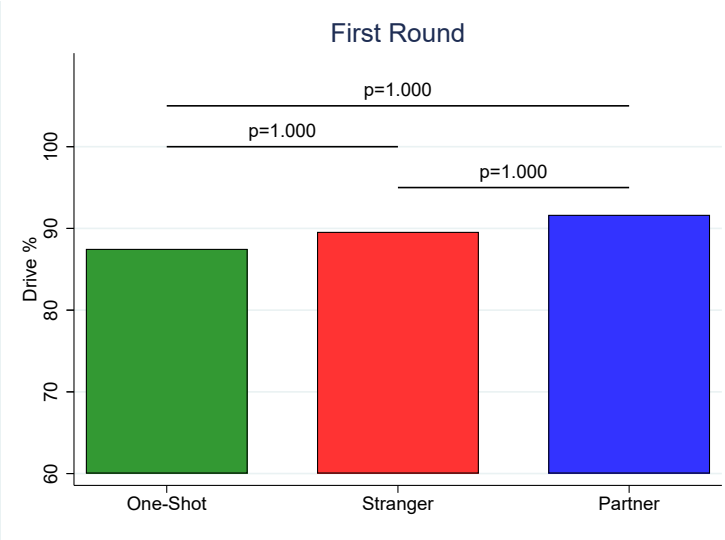
4 Results

This section has seven subsections, in which we present the results of the experiment in the order of the conjectures formulated in Subsection 3.2. In Subsection 4.1, we address individual strategy choice in the first round and then, in Subsection 4.2, individual strategy selection in the two treatments with tenfold repetition of the stage game. In both subsections, we not only look at the causal treatment effects of repetition and matching protocol as

formulated in the **Conjectures 1** and **2**, but we also analyze whether the characteristics and stated decision rationales of the participants correlate with their choice behavior and whether there are treatment differences here. In Subsection 4.3, we use a dynamic regression model to examine the strategy choice dynamics of the players as assumed in **Conjecture 3**. The existence of different types of players and their characteristics, as postulated in **Conjecture 4**, are discussed in Subsection 4.3.

In the last three subsections, the focus shifts to the analysis of the groups. In Subsection 4.5, the distribution of the strategy profiles in the first and subsequent rounds, which is the subject of **Conjecture 5**, is discussed. Subsection 4.6 then confronts the statement made in **Conjecture 6** regarding the efficiency of stranger and partner matching with the experimental results. Finally, Subsection 4.7 examines whether and to what extent the groups actually coordinate to achieve a turn-taking equilibrium.

4.1 Individual First-Round Strategy Choice



The figure shows a bar chart of the proportion of players who drive in the first round by treatment, and the significance level of a two-tailed proportions test. Significance levels are corrected for multiple hypotheses testing (Bonferoni correction). $N = \{24, 48, 48\}$.

Figure 2: Proportion of Players Driving in the First Round by Treatment

Figure 2 shows the proportion of players who drive in the first round, separately for each treatment. The corresponding figures can be found in Table 2. As can be seen from the figure and the table, there are no significant

differences between the three treatments, in each of which around 90% of the players drive in the first round.

#	Treatment	N	Proportion 'Drive'	Test p Value
(1)	One-Shot	24	87.5	(1) vs. (2) 1.000
(2)	Stranger	48	89.6	(2) vs. (3) 1.000
(3)	Partner	48	91.7	(3) vs. (1) 1.000

The table shows the proportion of players who drive in the first round by treatment. p value of a two-tailed proportions test. p values are corrected for multiple hypotheses testing (Bonferoni correction).

Table 5: Proportion of Players Driving in the First Round by Treatment

Table 6 shows how the individual first-round strategy choice correlates with the sociodemographics, attitudes, beliefs, and decision rationales of the players, and tests for treatment differences. To avoid multicollinearity problems, we entered the covariates individually into an OLS regression (linear probability model) and interacted them with the treatment.[8] To save space, only the marginal effects are given as percentage points (the full regression tables are available from the authors on request). The last three columns of the table show the significance level of a test for equality of the marginal effect between the respective treatments.

Female, age and economics are insignificant. Interestingly, the risk-attitude (risk seeking) is negatively correlated with the choice of 'Drive' in both the One-Shot and the Stranger treatment, while the correlation is positive in the Partner treatment. The corresponding treatment differences are at least weakly significant. This result can presumably be interpreted as meaning that waiting is associating with a potential loss due to a lack of coordination possibilities in One-Shot and Stranger, whereas it is seen as an opportunity to gain through coordination in Partner. The patience covariate has a similar but much weaker and largely insignificant effect. Stated courtesy, as expected, has no significant effect apart from the difference in sign between One-Shot and Stranger. In fact, almost all participants reported that they are courteous or very courteous. Support for autonomous driving is only weakly significantly positively correlated with 'Drive' in the One-Shot treatment,

[8]Using probit regression does not qualitatively change the results.

Drive=1	One-Shot (1)	Stranger (2)	Partner (3)	p Value (1)=(2)	(1)=(3)	(2)=(3)
Female	8.33	-15.15	-8.33	0.133	0.272	0.596
	(12.34)	(9.41)	(8.72)			
Age	1.47	-0.01	1.37	0.266	0.949	0.324
	(0.96)	(0.91)	(1.06)			
Economics	13.04	-17.50	-9.52	0.359	0.505	0.653
	(31.01)	(11.76)	(13.25)			
Risk-Attitude	**-10.44*** **	**-3.44***	**4.29****	**0.058**	**0.000**	**0.005**
	(3.10)	(1.92)	(1.91)			
Patience	-0.38	**-3.57****	1.84	0.318	0.490	**0.035**
	(2.64)	(1.77)	(1.82)			
Courtesy	9.78	-7.88	1.25	**0.073**	0.381	0.277
	(7.74)	(5.95)	(5.87)			
Autonomous	**7.61***	-1.14	-1.09	**0.086**	**0.098**	0.990
Driving	(4.05)	(3.02)	(3.29)			
Belief	23.81	15.91	26.67	0.746	0.912	0.653
	(18.58)	(15.72)	(17.95)			
Decision Rationales						
Own Payoff	4.38	-0.34	1.57	0.348	0.571	0.679
Maximization	(3.77)	(3.29)	(3.21)			
Altruism	-6.00	0.46	-3.66	0.248	0.698	0.429
	(4.49)	(3.28)	(4.03)			
Inequality	**7.21****	1.81	-1.88	0.222	**0.055**	0.346
Aversion	(3.61)	(2.51)	(2.98)			
Efficiency	-1.91	0.99	-1.74	0.546	0.973	0.484
Preference	(3.99)	(2.64)	(2.86)			
Envy	**8.49***	4.25	2.93	0.480	0.341	0.762
	(5.05)	(3.22)	(2.89)			

The table shows the marginal effects and standard error (in parenthesis) of the respective covariate in an OLS regression (linear probability model) with 'Drive' $\{0(\text{no}), 1(\text{yes})\}$ as the left-hand variable and full treatment interactions. $N = 120$. Legend: Female $\{0(\text{no}), 1(\text{yes})\}$; Age (years); Economics $\{0(\text{no}), 1(\text{yes})\}$; Risk-Attitude $\{1(\text{not at all risk-seeking}), \ldots, 10(\text{very risk-seeking})\}$; Patience $\{1(\text{very impatient}), \ldots, 10(\text{very patient})\}$; Belief $0(\text{opponent waits}), 1(\text{opponent drives})$; Courtesy, Autonomous Driving, Own Payoff Maximization, Altruism, Inequality Aversion, Efficiency Preference, Envy $\{1(\text{strongly disagree}), \ldots, 6(\text{strongly agree})\}$. $^{*}p \leq 0.10$ (weak significance), $^{**}p \leq 0.05$ (significance), $^{***}p \leq 0.01$ (strong significance). The last three columns show the p values of a two-sided test on the equality of the respective coefficients. For better readability, at least weakly significant marginal effects or tests are given in boldface.

Table 6: Marginal Effects of Sociodemographics, Attitudes, Beliefs, and Decision Rationales in the First Round

which could perhaps indicate a tendency to leave decisions to technology.

Somewhat surprisingly, the belief that the other player drives has a positive but insignificant marginal effect on the probability of driving oneself. The fact that very few players believed that the other player was waiting, and that the courteous players would wait themselves may have played a role for the insignificant result.

With regard to the decision rationales given ex-post, (weakly) significant correlations were only found for inequality aversion and envy in One-Shot. Stronger inequality aversion is understandably associated with a higher likelihood of driving, as is greater envy.

Result 1. *Regardless of the repetition of the Courtesy Game and the matching protocol, the 'discourteous' weakly dominant strategy 'Drive' is played in the first round in about 90 percent of all cases. The main individual factors influencing the first-round strategy choice are the participant's risk-attitude, inequality aversion, and enviousness.*

4.2 Strategy Choice in the Repeated Courtesy Game

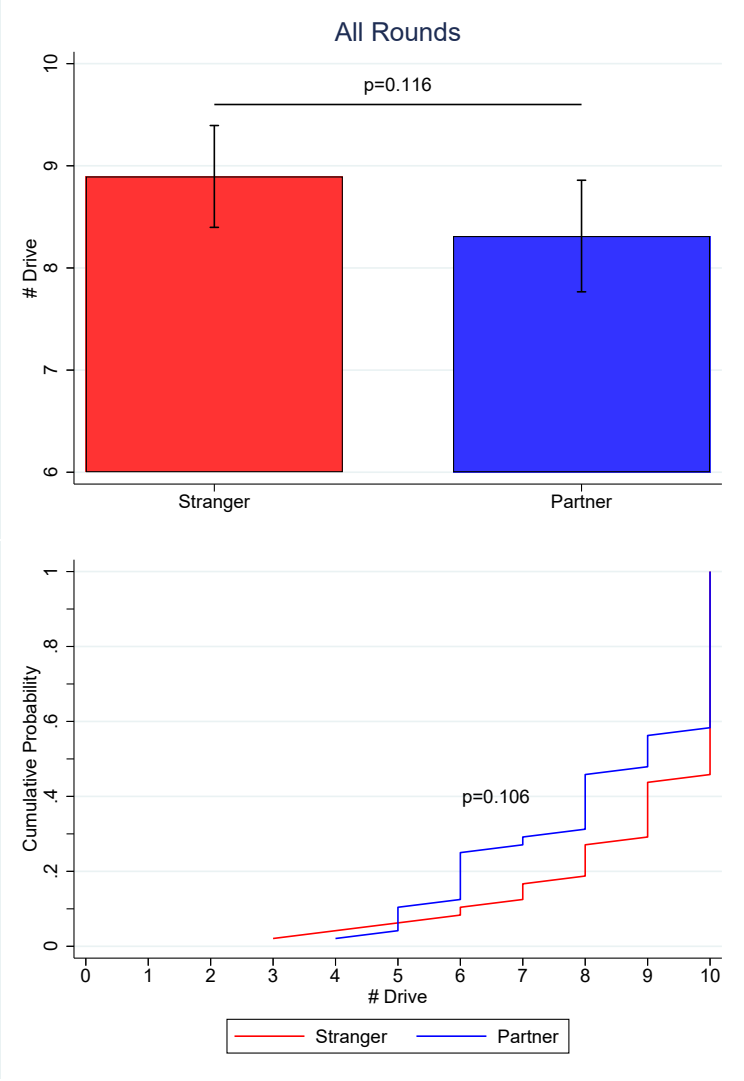
Treatment	N	Mean SE	Median	Min Max	Proportion Drive Always	Test	p Value
Stranger	48	8.90	10	3	56.3	t	0.116
		0.25		10		Rank-Sum	0.106
Partner	48	8.31	9	4	43.8	Proportion	0.221
		0.27		10			

The table shows the strategy choice in terms of the average number of 'Drive' moves by treatment. p values of a two-sided t test, a two-sided Wilcoxon rank-sum test, and a proportions test comparing the proportion of players who drive always.

Table 7: Strategy Choice in the Repeated Courtesy Game by Treatment

In Figure 3 and Table 7, we use all ten rounds and therefore only look at the strategy choice in the two repeated CG treatments. The top panel of Figure 3 shows the mean number of 'Drive' choices, based on the averages over the ten rounds for the 48 players per treatment. The mean comparison is insignificant at conventional significance levels. However, it indicates a tendency for 'Drive' to be chosen less frequently in the Partner than in the Stranger treatment.

Although the treatment effect is also (just) insignificant in the lower panel of Figure 3, which shows the cumulative distribution curves of the individual strategy choice by treatment, a more differentiated picture emerges. Apart from the fact that in the Stranger treatment one player chose 'Drive' only



The top panel shows a bar chart of the mean strategy choice in terms of the average number of 'Drive' moves by treatment, and the significance level of a two-sided t test. The lower panel shows the cumulative distribution curves of the strategy choice by treatment and the significance level of a two-sided Wilcoxon rank-sum test. $N = \{48, 48\}$.

Figure 3: Strategy Choice in the Repeated Courtesy Game by Treatment

three times, the blue curve is always above the red one, i.e., in the Partner treatment the players tended to drive less often and fewer players held out for the entire ten rounds with 'Drive' (the respective proportions test given in Table 7 is, however, also insignificant).

#(Drive=1)	Stranger	Partner	p Value S=P
Risk-Attitude	**-0.209***	-0.138	0.680
	(0.120)	(0.120)	
Belief	0.023	**0.551*****	**0.014**
	(0.167)	(0.130)	
Decision Rationales			
Own Payoff	0.125	**0.580*****	**0.083**
Maximization	(0.186)	(0.181)	
Altruism	**-0.576*****	**-0.609*****	0.911
	(0.180)	(0.221)	
Inequality	**0.296****	-0.194	**0.035**
Aversion	(0.148)	(0.175)	
Efficiency	-0.161	**-0.463*****	0.173
Preference	(0.149)	(0.162)	
Envy	**0.377****	**0.312***	0.798
	(0.188)	(0.169)	

The table shows the marginal effect and standard error (in parenthesis) of the respective covariate in an OLS regression with the number of 'Drive' choices $(0, 1, \ldots, 10)$ as the left-hand variable and full treatment interactions. $N = 120$. Legend: Risk-Attitude $\{1$(not at all risk-seeking)$, \ldots, 10$(very risk-seeking)$\}$; Belief: #(Belief=1) with 0(opponent waits)$, 1$(opponent drives); Own Payoff Maximization, Altruism, Inequality Aversion, Efficiency Preference, Envy $\{1$(strongly disagree)$, \ldots, 6$(strongly agree)$\}$. $^{*}p \leq 0.10$ (weak significance), $^{**}p \leq 0.05$ (significant), $^{***}p \leq 0.01$ (strong significance). The last column show the p values of a two-sided test on the equality of the respective coefficients. For better readability, at least weakly significant marginal effects or tests are given in boldface.

Table 8: Marginal Effects of Attitudes, Beliefs, and Decision Rationales in the Repeated Courtesy Game

Analogous to Table 6 in the previous subsection, Table 8 shows how the individual number of 'Drive' choices correlates with the sociodemographics, attitudes, beliefs, and decision rationales of the players, and it tests for differences between stranger and partner matching. To avoid multicollinearity problems, we again entered the covariates individually into an OLS regression and interacted them with the treatment. To save space, we have only listed significant covariates.

Risk-seeking participants drove slightly less frequently on average (but only significantly in the Stranger treatment). It is interesting to note that the positive first-round effect of being more risk-seeking is no longer visible in the further course of the CG. This could be due to the fact that players send out a signal of future willingness to cooperate in the first round. In addition, only in the Partner treatment do we see a highly significant positive correlation between the expectation that the opponent will choose 'Drive' and one's own number of 'Drive' choices.

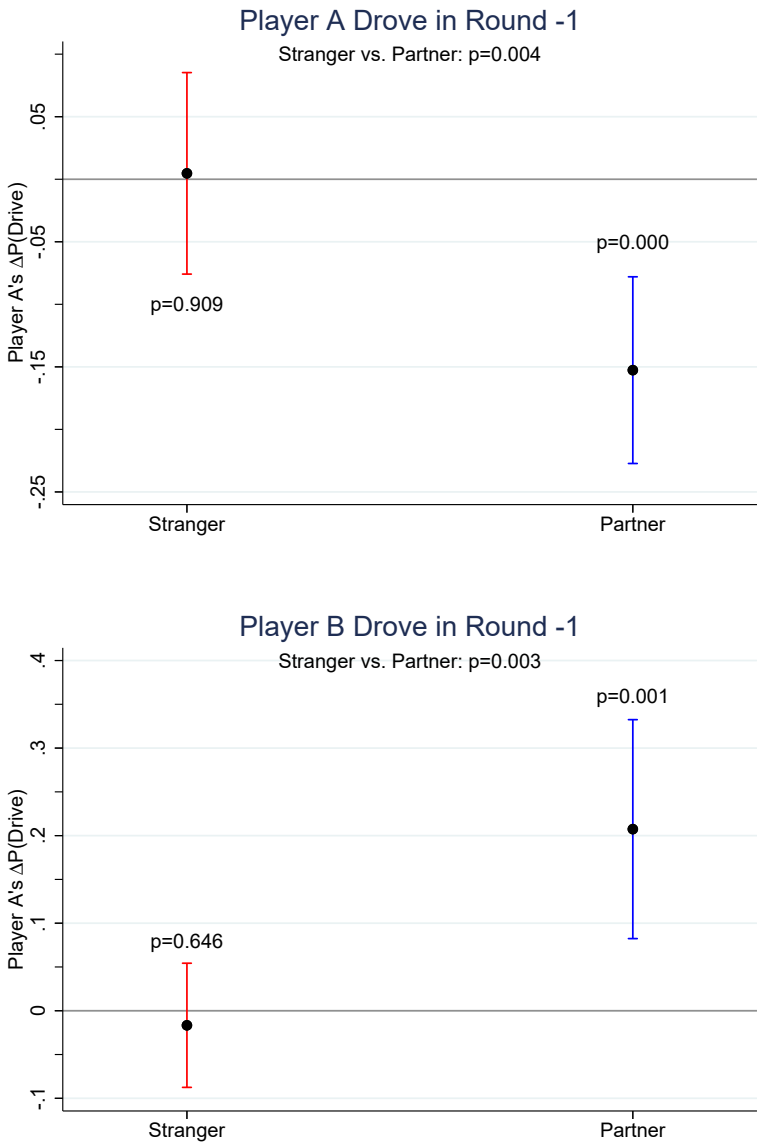
In both treatments, altruism was an almost identical decision rationale for driving less frequently and envy for driving more frequently. In the Stranger treatment, inequality aversion also played a significant role in choosing to drive. In the Partner treatment, participants who wanted to maximize their own payoff chose 'Drive' more often, while participants who wanted to maximize the total payoff (efficiency) drove less often.

Result 2. *In the repeated courtesy game, there are is a statistically insignificant tendency for players in the Partner treatment to choose 'Drive' less often than in the Stranger treatment. The players' stated decision rationales correlate with the frequency of driving in a meaningful way—courtesy is positively correlated with altruism and efficiency preferences–and partly differ between the treatments.*

Summarizing the results of the first two subsections with respect to the first round and repeated CG choices, **Conjectures 1** and **2** must be strictly speaking rejected, since neither the repetition of the CG nor the matching protocol seem to have had a significant effect on the participants' strategy choice. On the other hand, the visible tendency towards less 'Drive' choices in the Partner treatment as compared to the Stranger treatment in connection with the stated decision rationales suggests that the participants definitely perceived both decision situations as different.

4.3 Strategy Choice Dynamics in the Repeated Courtesy Game

Choosing a turn-take strategy requires a player to alternate between 'Drive' and 'Wait', and to respond to the opponent's 'Drive' with 'Drive' and to 'Wait' with 'Wait' in the following round. Figure 4 shows the marginal effects of a player's own decision (upper panel) and of the opponent's decision (lower panel) in the previous round on the probability to choose 'Drive' for both repeated CG treatments. The marginal effects were estimated using a dynamic random-effects panel probit regression with clustered standard errors at the player level. The regression takes into account the player's own



The top (bottom) panel shows the marginal effect of player A's (B's) driving in the previous round on the probability that player A drives in the current round by treatment. Dynamic random-effects panel probit regression with player clustered standard errors. Error bars indicate 95% confidence intervals around the mean estimated marginal effect. $N = 864$ (48 players with 9 observations per treatment).

Figure 4: Strategy Choice Dynamics in the Repeated Courtesy Game

and the opponent's choices lagged by one round. To account for the inconsistency of the probit model with a lagged endogenous variable, we included the player's decisions in the first round and round dummies as covariates. The lags and the first round choice were also interacted with the treatment.[9]

The top panel of Figure 4 shows that in the Stranger treatment, Player A's own previous-round decision had no significant impact on her decision to drive in the current round. In the Partner treatment, the marginal effect is negative and highly significant. The probability of driving decreased by 15.2 percentage points. Accordingly, also the treatment effect is highly significant ($p = 0.004$). The lower panel shows the opposite effect of Player B's previous round decision. Here, the probability of driving increases by 20.7 percentage points if the opponent drove in the previous round, and the treatment effect is also highly significant ($p = 0.004$).

Result 3. *In contrast to the stranger matching, the partner matching results in players driving less frequently if they have driven in the previous round and driving more frequently if their opponent has driven in the previous round.*

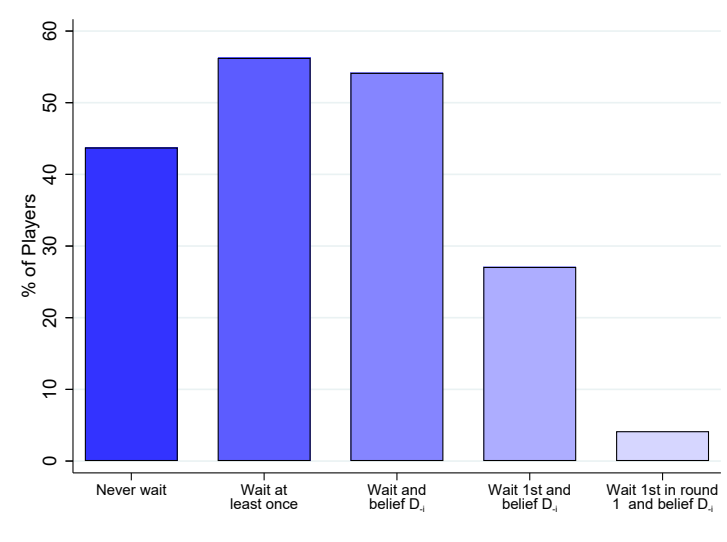
This result is perfectly in line with our **Conjecture 3** with regard to the expected individual choice dynamics in the Partner treatment.

4.4 Player Types in the Partner Treatment

In Figure 5, we now focus solely on the Partner treatment to examine the *waiting* behavior of the players. 21 players (43.75%) consistently chose 'Drive' and thus never waited. The remaining 27 players (56.25%) waited at least once within the ten rounds. Due to the looming of the courtesy dilemma, waiting can only be rationalized and be regarded as an expression of courtesy when a player believes that the opponent will drive in the current round. Indeed, this was the case for almost all waiting players (26, 54.17%). Within the group of players who waited at least once 'rationally', there are those who waited first, and thus possibly wanted to initiate a turn-take equilibrium, and those who reacted to the first 'Wait' choice of the opponent. Since the players formed fixed groups of two, there are 13 players (27.08%) of each type. In addition, the last small blue bar in the figure indicates the small number of players (2, 4.17%) who took the initiative in the first round already.

We categorized the players into the three types defined in **Conjecture 4**: 'Dominant' players always played the weakly dominant strategy 'Drive'

[9]For reasons of space, we do not present the full regression table here. It is available from the authors on request. A comparable estimation approach was taken by Kaplan and Ruffle (2012, p. 1054).



The figure shows a bar graph of the player's waiting behavior in the Partner treatment. $N = 48$.

Figure 5: Waiting Behavior and Beliefs in the Partner Treatment

(21 players), 'Followers' played at least once 'Wait' when the opponent had previously played 'Wait' (14 players).[10] 'Leaders' played at least once 'Wait' first (and believed the other player to play 'Drive'), thus trying to initiate a turn-take equilibrium. Assuming a monotonous relationship between the covariates and the player type, we then estimated an ordinal logit regression with the same covariates as before (except for the belief which is part of the type definition), the results of which are shown in Table 9. Due to the partner matching, we used group-clustered standard errors.

Neither the participants sociodemographic characteristics nor their attitudes are significant. Of the five decision rationales surveyed after the experiment, altruism, efficiency, and envy correlate at least weakly significant with the type of player. Altruism and efficiency are positively associated with the probability of being a Follower or even a Leader. This is precisely in line with the very idea of courtesy, which requires the willingness to give someone else an advantage in order to improve the situation for everyone. The Dominant type of player is associated with enviousness.

Another way of looking at the types of players is through a net diagram (see Figure 6), which does not require the monotonicity assumption. The net diagram shows that Dominant players, on the one hand, are very interested

[10]This type contains the one irrational player. Excluding this player does not qualitatively change the results.

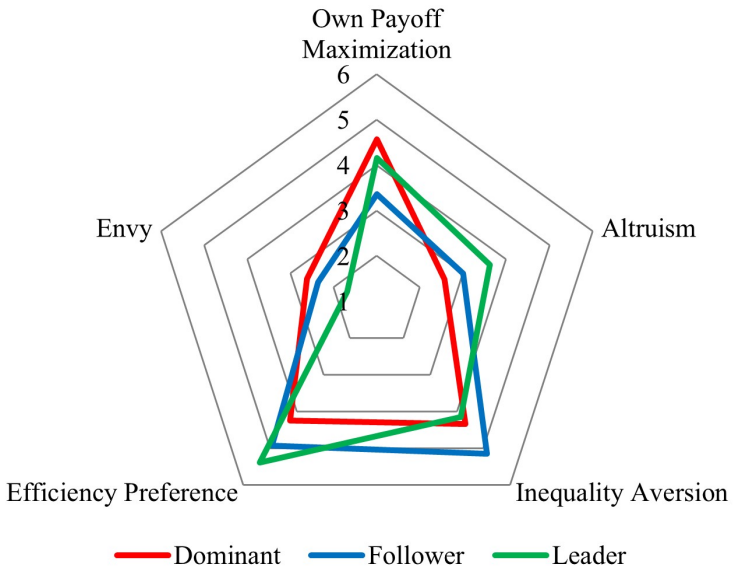
Covariate	Coeff.	SE	p Value
Female	-0.024	0.600	0.968
Age	0.006	0.057	0.917
Economics	-0.244	0.439	0.579
Risk-Attitude	0.154	0.140	0.273
Patience	-0.005	0.111	0.962
Courtesy	-0.034	0.263	0.897
Autonomous Driving	-0.261	0.210	0.214
Decision Rationales			
Own Payoff Maximization	-0.249	0.207	0.231
Altruism	0.725	0.264	**0.006**
Inequality Aversion	0.006	0.187	0.974
Efficiency Preference	0.419	0.203	**0.039**
Envy	-0.321	0.167	**0.054**

The table shows the regression coefficient, standard error, and significance level of the respective covariate in an ordered logit regression with the type of the player as the left-hand variable. $N = \{21, 14, 13\}$. Player types: $\{1(\text{Dominant}), 2(\text{Follower}), 3(\text{Leader})\}$. Group clustered standard errors. Legend: Female $\{0(\text{no}), 1(\text{yes})\}$; Age (years); Economics $\{0(\text{no}), 1(\text{yes})\}$); Risk-Attitude $\{1(\text{not at all risk-seeking}), \ldots, 10(\text{very risk-seeking})\}$; Patience $\{1(\text{very impatient}), \ldots, 10(\text{very patient})\}$, Courtesy, Autonomous Driving, Own Payoff Maximization, Altruism, Inequality Aversion, Efficiency Preference, Envy $\{1(\text{strongly disagree}), \ldots, 6(\text{strongly agree})\}$.

Table 9: Correlations of Sociodemographics, Attitudes, and Decision Rationales with the Player Types in the Partner Treatment

in maximizing their own payoff and are relatively envious. On the other hand, they show relatively little altruism, inequality aversion and efficiency preferences. Followers are not very interested in their own payoff but are very averse to inequality. They show medium levels of altruism, efficiency preference and envy. Finally, the Leaders are very altruistic and have a strong preference for efficiency. Their own payoff also plays an important role and they pay little attention to inequality as the Dominant players, but in contrast to them they are not envious.

Result 4. *In the Partner treatment, three types of players can be clearly distinguished. Slightly less than half of the players (the Dominant type) never wait. The other players are either Followers or Leaders. The decision rationales given ex post correlate with the corresponding player types and reveal*



The response scale ranges from 1 *(strongly disagree) to* 6 *(strongly agree) that the respective decision rationale played a role for the participant's strategy choice in the Courtesy Game.* $N = \{21, 14, 13\}$.

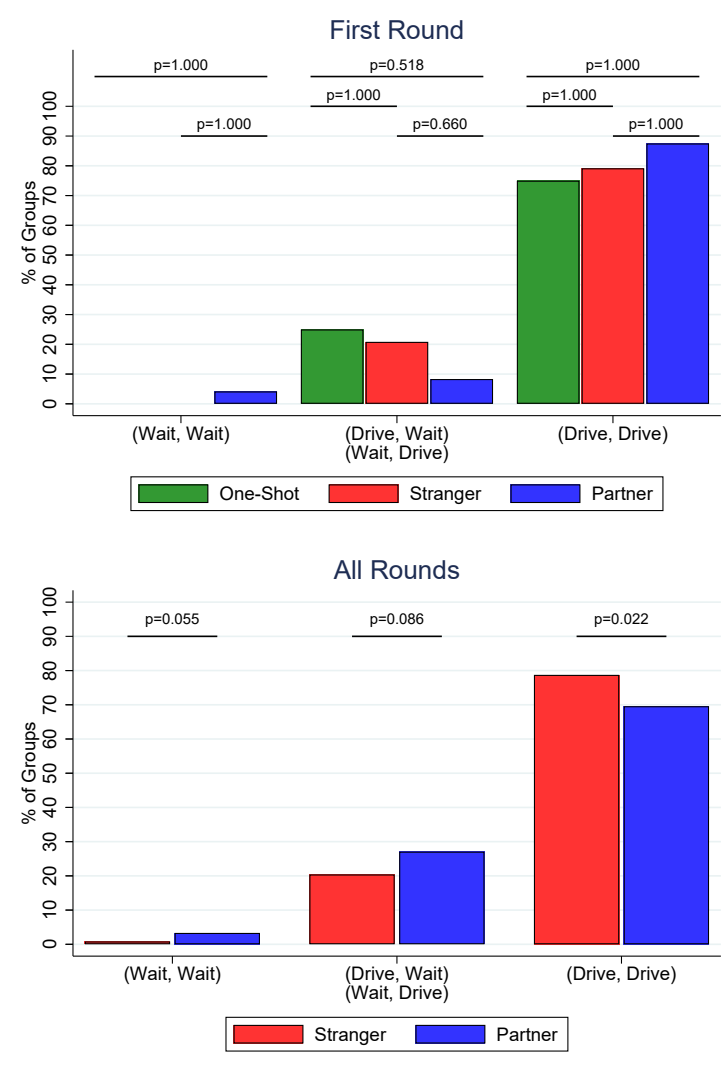
Figure 6: Net Diagram of the Decision Rationales by Player Type in the Partner Treatment

clear differences.

4.5 Analysis of the Groups' Strategic Profiles

While the analysis of the individual data was conducted from the perspective of a driver approaching a bottleneck, the analysis of the group data takes the perspective of the bottleneck, which is approached by pairs of cars. In the One-Shot treatment, this happens only once; in the Stranger treatment, this happens ten times in a row with different pairs of drivers; in the Partner treatment, the same pair of drivers approaches the bottleneck ten times in a row.

Figure 7 and Table 10 report the relative frequencies of the chosen strategy profiles by treatment. In the top panel of the figure, we only look at the first round. Around 80% of all courtesy games ended with the weakly dominant strategies Nash equilibrium (D, D), with an insignificant tendency for this strategy profile to occur somewhat more frequently in the Partner treatment. In addition, there is also an insignificant tendency for the asym-



The top panel shows a bar chart of the relative frequencies of the strategy profiles chosen in the first round by treatment. p values of a two-sided proportions test or Fisher's exact test (Wait, Wait). p values are adjusted for multiple hypotheses testing (Bonferoni correction). $N = \{12, 24, 24\}$. The bottom panel shows a bar chart of the relative frequencies of the strategy profiles chosen in all 10 rounds of the Stranger and the Partner treatment. p values of a two-sided proportions test. $N = \{240, 240\}$.

Figure 7: Chosen Strategy Profiles by Treatment

metric Nash equilibria (D, W) and (W, D) with one 'courteous' player to be somewhat less likely in the Partner treatment. The courtesy dilemma hardly occurred at all.

#	Treatment	N	Strategy Profile		
			(W,W)	$\{(D,W),(W,D)\}$	(D,D)
			First Round		
(1)	One Shot	12	0.0	25.0	75.0
(2)	Stranger	24	0.0	20.8	79.2
(3)	Partner	24	4.2	8.3	87.5
(1) vs. (2)	p Value		—	1.000	1.000
(1) vs. (3)	p Value		1.000[a]	0.518	1.000
(2) vs. (3)	p Value		1.000[a]	0.660	1.000
			All Rounds		
(2)	Stranger	240	0.8	20.4	78.8
(3)	Partner	240	3.3	27.1	69.6
(2) vs. (3)	p Value		**0.055**	**0.086**	**0.022**

The table shows the relative frequencies of the chosen strategy profiles in percent. p values of a two-sided proportions test. [a]Fisher's exact test. p values are adjusted for multiple hypotheses testing (Bonferoni correction).

Table 10: Chosen Strategy Profiles by Treatment

The analysis of the repeated CG (shown in the bottom panel of Figure 7 and in Table 10) reveals significant differences between the Stranger and the Partner matching. The 'discourteous' Nash equilibrium (D, D) is played significantly less often in the Partner treatment. Not only are the asymmetric equilibria (D, W) and (W, D) played slightly more frequently, but the courtesy dilemma (W, W) also occurs more frequently in the Partner treatment. Note, however, that this analysis treats the groups' round-wise results as independent of one another (which is a strong assumption at least for the Partner treatment).

Result 5. *Partner treatment and Stranger treatment are indistinguishable in statistical terms from the One-Shot treatment in the first round, but then develop differently. In the Partner treatment, the proportion of 'discourteous' equilibrium play is lower and the proportion of 'courteous' asymmetric equilibria is higher than in the Stranger treatment. However, the courtesy dilemma also occurs more frequently in the Partner treatment.*

Overall, these observations thus correspond to the expectations formulated in **Conjecture 5**.

4.6 Group Efficiency

In the CG, waiting theoretically pays off, because the two asymmetric equilibria (D, W) and (W, D) are Pareto efficient. However, the courteous strategy 'Wait' runs the risk, if chosen simultaneously by both players, of ending up in the courtesy dilemma (W, W), which is payoff dominated even by the strategy profile (D, D). In the previous subsection, it has already become clear that the courtesy dilemma occurs in (weakly) significantly more groups in the Partner treatment than in the Stranger treatment. Hence, in this subsection, we compare the efficiency of the matchings, both on average across all rounds and over time.

Figure 8 shows the mean group payoff (top panel) and the cumulative distribution curves of the group payoff (bottom panel) across all rounds. The corresponding figures can be found in Table 11. Recall that we interpret the mean group payoff as the efficiency of the bottleneck when it is approached multiple times by different (Stranger treatment) or the same (Partner treatment) pairs of vehicles.

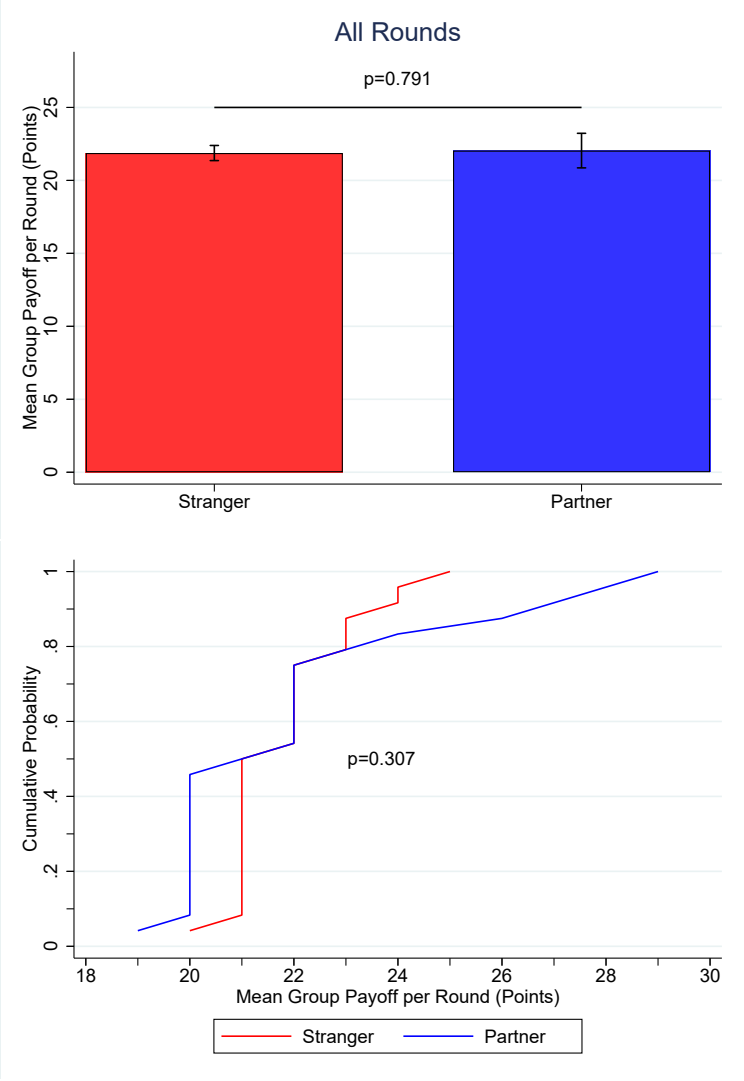
Treatment	N	Mean SE	Median	Test	p Value
Stranger	24	21.88 0.25	21.5	t Rank-Sum	0.791 0.307
Partner	24	22.04 0.57	21.5		

The table shows the mean and the median group efficiency by treatment (payoff in points). In both treatments, the group average of the 10 rounds is used. In the Stranger treatment, the group composition varies in each round; in the Partner treatment, the group composition is constant. p values of a two-sided t test and a two-sided Wilcoxon rank-sum test.

Table 11: Group Efficiency by Treatment

Based on the mean payoff (around 22 points), there is no difference in terms of the matching protocol. However, if the distribution curves are used, a difference between Stranger and Partner becomes visible: when the bottlenecks are regularly approached by different pairs of vehicles, no group comes close to the maximum efficiency of 30 Tokens. In contrast, in the Partner treatment, more groups approach the maximum efficiency. However, the difference between the treatments is not statistically significant.

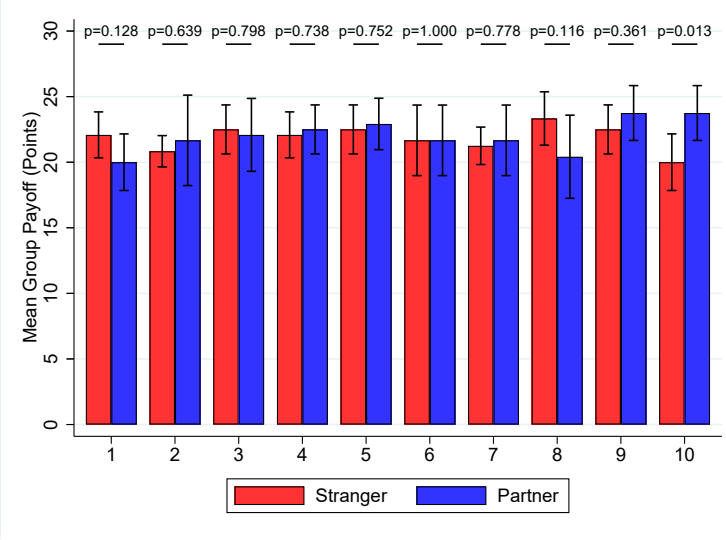
As Figure 9 and Table 12 show, the round-by-round examination of the mean group efficiency in Stranger and Partner reveals neither a 'winner'



The top panel shows a bar chart of the mean group efficiency (payoff in Tokens) by treatment and the significance level of a two-sided t test. Error bars indicate 95% confidence intervals around the mean. The lower panel shows the cumulative group efficiency by treatment and the significance level of a two-sided Wilcoxon rank-sum test. In the Stranger and the Partner treatment, the group average of the 10 rounds is used. In the Stranger treatment, the group composition varies in each round; in the Partner treatment, the group composition is constant. $N = \{24, 24\}$.

Figure 8: Group Efficiency by Treatment

nor a trend. Only in round 10 does the efficiency of the Partner treatment significantly exceed that of the Stranger treatment.



The figure shows a bar chart of the mean group efficiency (payoff in points) by round and treatment and the significance levels of a two-sided t test. Error bars indicate 95% confidence intervals around the mean. The total number of groups is $N = \{24, 24\}$ *per round.*

Figure 9: Group Efficiency by Round and Treatment

Round	Stranger		Partner		t Test
	Mean	SE	Mean	SE	p Value
1	22.1	0.6	20.0	0.7	0.128
2	20.8	0.4	21.7	1.2	0.639
3	22.5	0.6	22.1	0.9	0.798
4	22.1	0.6	22.5	0.6	0.738
5	22.5	0.6	22.9	0.7	0.752
6	21.7	0.9	21.7	0.9	1.000
7	21.3	0.5	21.7	0.9	0.778
8	23.3	0.7	20.4	1.1	0.116
9	22.5	0.6	23.8	0.7	0.361
10	20.0	0.7	23.8	0.7	**0.013**

The table shows the mean group efficiency (payoff in points) by round and treatment. p values of a two-sided t test.

Table 12: Group Efficiency by Round and Treatment

Result 6. *Partner and stranger matching do not differ from each other in terms of efficiency, either on average or over the course of the rounds.*

Conjecture 6, that the Partner treatment would lead to higher efficiency, is therefore not supported by the data. The reason for this lies on the one hand in the still relatively small number of groups that coordinate on an asymmetric equilibrium, which only slightly outperforms chance (i.e., the total stranger matching), and on the other hand in the more frequently occurring courtesy dilemma. One could also argue that ten rounds of play are still too few for the players to be able to coordinate an efficient turn-take equilibrium.

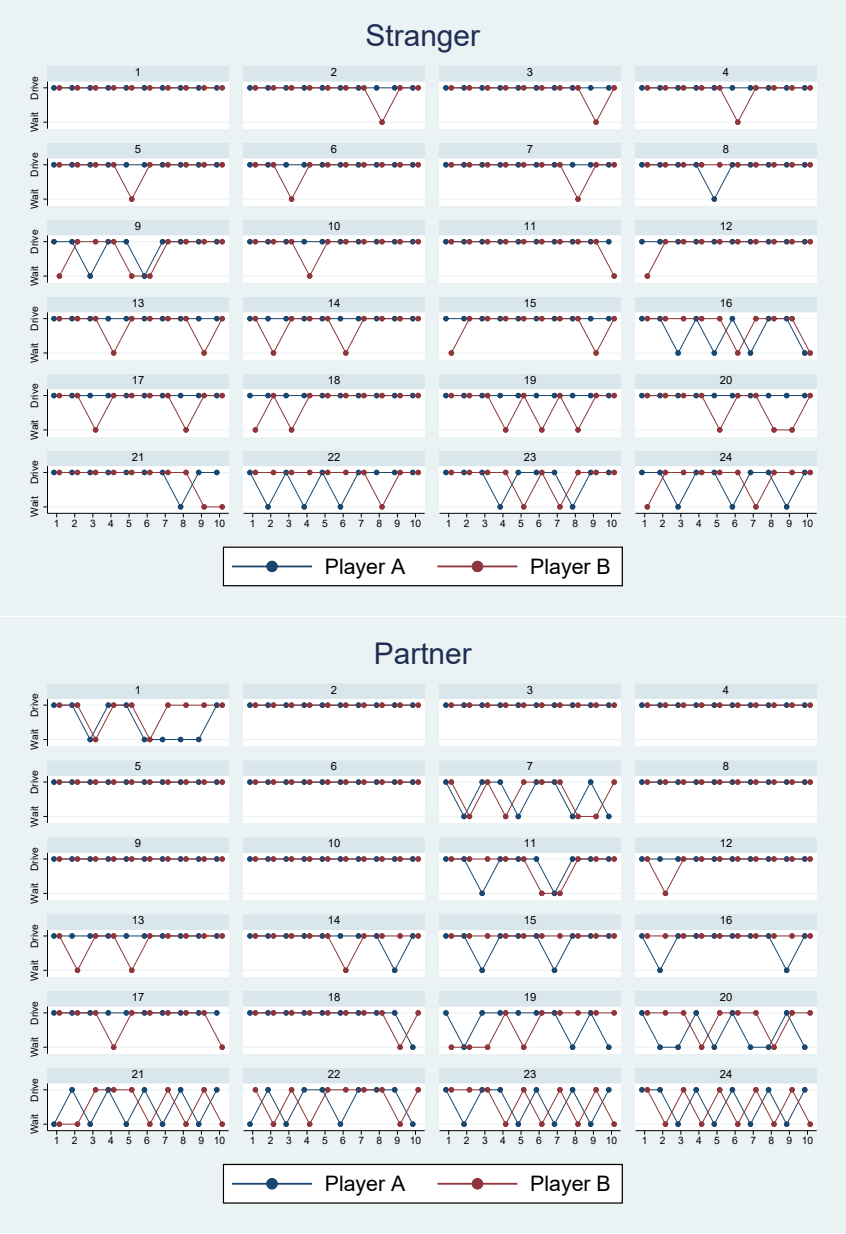
4.7 Turn-Taking

The analysis of the chosen strategy profiles so far says nothing about the actual success of the groups in playing the asymmetric Nash equilibria (D, W) and (W, D) alternately over at least two rounds, i.e., implementing a joint turn-taking strategy at least temporarily. In Figure 10, we show the progress of the individual groups over the ten rounds of the CG, separated by treatment. The groups are sorted in ascending order of efficiency, i.e., group 1 has the lowest payoff and group 24 has the highest payoff. It should be recalled that the players belonging to a group vary from round to round in the Stranger treatment, whereas in the Partner treatment a group always consists of the same players. Thus, in the figure and in the associated Table 13, a random encounter of vehicles at a bottleneck is compared with the regular encounter of the same vehicles.

When looking at the figure, the visual impression is that the Partner treatment is more 'assorted'. In more low-efficiency groups, there is never a 'Wait', and in the more efficient groups, there is a clear alternation of choices that can be interpreted as a turn-take equilibrium. In addition, the courtesy dilemma occurs more frequently (in groups 1, 7, 11, 19, 20, and 21).

The visual impression is only partially confirmed by the statistical analysis. The proportion of groups in which both players always play 'Drive' is significantly lower for random encounters (4.2%, only 1 of 24 groups) than for repeated encounters between the same players (33.3%, 8 of 24 groups). This suggests that these players consciously coordinate their play in the long term on the weakly dominant Nash equilibrium (D, D). However, the average number of (D, D) rounds per group does not differ between the treatments (7.88 vs. 6.96).

In the Stranger Treatment, we observe at least one turn-taking sequence (of at least 2 rounds duration) in 16.7% of the groups and there are on average only 0.25 sequences per group. In the partner treatment, 29.2% of all groups take turns at least once and, on average, there are 1.21 sequences per group. According to the proportions test, the hypothesis that turn-taking groups are equally frequent in both treatments cannot be rejected. However, at least



The figure shows the progress of the individual groups over the 10 rounds, separated by treatment. Groups are sorted in ascending order of efficiency.

Figure 10: Turn-Taking by Treatment

with regard to the group mean, it is confirmed that turn-taking sequences occur more frequently on average in the Partner treatment as a whole (weakly significant) and within the turn-taking groups (significant).

In the Partner treatment, the courtesy dilemma occurs about three times

		Proportion of Groups (%)		
Treatment	N	*Both players drive all 10 rounds*	*Both players take turns at least once*	*Both players simultaneously wait at least once*
Stranger	24	4.2	16.7	8.3
Partner	24	33.3	29.2	25.0
p Value[p]		**0.010**	0.303	0.121
		Group Means (Rounds/Sequences)		
Treatment	N	*Both players drive*	*Both players take turns*	*Both players simultaneously wait*
Stranger	24	7.88	0.25	0.08
Partner	24	6.96	1.21	0.33
p Value[t]		0.207	**0.063**	**0.082**
p Value[r]		0.815	0.191	0.153
			Conditional Group Means (Rounds/Sequences)	
Treatment	N		*Both players take turns*	*Both players simultaneously wait*
Stranger	4/2		1.50	0.33
Partner	7/6		4.14	1.33
p Value[t]			**0.036**	0.175
p Value[r]			0.139	1.000

[p]Two-sided proportions test. [t]Two-sided t test. [r]Two-sided Wilcoxon rank-sum test.

Table 13: Turn-Taking by Treatment

as often as in the Stranger treatment, and the average number of rounds in which the dilemma occurs per group (or per group in which the dilemma occurs at least once) is also higher in each case. However, these results are weakly significant at best, which is certainly due to the overall low frequency of the courtesy dilemma and the relatively small number of groups per treatment.

5 Conclusions

Courtesy is a virtue, more specifically the skill to recognize when it is best in a situation to consciously and voluntarily do what is best for another (Culp, 1971). But is courtesy also an economically relevant category of behavior? In this paper, we have characterized courtesy as a social preference

that combines altruism with efficiency preferences. We then investigated whether courtesy can spontaneously emerge in a strategic dilemma situation and contribute to solving it. Our initial attitude was skepticism, as courtesy itself can lead to a dilemma, and experimental and empirical evidence tends to point in the direction of many people being inequality averse or selfish. So, are explicit rules of conduct as compiled in Spenser (1596)'s *The Faerie Queene* needed?

To address this question, we introduced the Courtesy Game, which, similar to a Dawesian social dilemma, has a weakly dominant discourteous strategy, but two other asymmetric Nash equilibria in which one of the players is courteous and the other discourteous. In contrast to a social dilemma, mutual courtesy would be counterproductive as it leads to a courtesy dilemma: When both drivers wait at a bottleneck, they neither make progress nor resolve the situation.

The literature offers a prominent solution for games with asymmetric equilibria. In the assignment game (Cason et al., 2013), the volunteer's dilemma (Diekmann, 1985; Diekmann and Przepiorka, 2016), and the chicken game (Bornstein et al., 1997), the repetition of the stage game opens up the possibility of taking turns. Accordingly, based on this literature, we conducted a laboratory experiment in which the participants played the CG in three different treatments. Firstly, we investigated the effect of repeating the game and secondly, the effect of the matching protocol. While there was hardly any courteous waiting in the one-shot treatment and the first round of the repeated CG treatments, the likelihood for a courteous move increased with repetition. In contrast to the (total) Stranger treatment, the Partner treatment revealed a significant correlation between the choices of the players, which was also observed by Bornstein et al. (1997) in the repeated chicken game.

Turn-taking is difficult to establish without sequentiality, focal points, heterogeneity, or cheap talk, it depends on leadership. Three player types can be distinguished in our experiment: the dominant player (44%) never waits, maximizes selfishly her own payoff, and is envious. Half of the other players are leaders or followers. The leader initiates turn-taking with the first courteous move, is altruistic, and wants to maximize group efficiency. The follower accepts the leader's offer by waiting in the next round, as she is also efficiency-loving and least interested in her own payoff; however, she is inequality-averse and thus apparently fears being cheated by the other player if she were to make the first courteous move herself.

Analyzing the data at the group level, the single groups can be interpreted as bottlenecks that are repeatedly approached by different vehicles in the Stranger treatment and are always approached by the same pair of

vehicles in the Partner treatment. Coordination on a common turn-taking strategy is therefore only possible in the Partner treatment and turn-taking sequences in the Stranger treatment are purely random. The partner treatment does not outperform chance particularly well, as only relatively few groups succeed in achieving an efficient 'courtesy equilibrium'. Moreover, the Partner treatment also gives rise to more courtesy dilemmas. Hence, the average group efficiency does not exceed that of the stranger treatment.

Our initial skepticism therefore seems to have been justified. Courtesy in the sense of taking turns on an efficient but personally disadvantageous strategy of the stage game only occurs with low frequency in our experiment (however, these cases are clearly visible in Figure 10). This frequency is also rather low compared to the aforementioned studies on the assignment game, volunteer's dilemma, and chicken game, even when one only considers experiments without focal points, cheap talk, and other coordination devices. One reason for this could be that we only ran the game for 10 rounds, while others sometimes used a random termination rule (i.e., simulated infinite play). We also think that the low frequency of turn-taking is due to the special feature of the CG, viz., the courtesy dilemma, which makes the cooperative move of waiting particularly risky. Varying the duration of the game, repeating matches or conducting the CG with different parameters leading to a less 'costly' dilemma could therefore change the picture somewhat in favor of spontaneous coordination.

However, if spontaneous coordination on courtesy at least does not work well, rules of conduct are needed. The drivers in our example would certainly be happy if traffic signs regulated the passage through the bottleneck. It can therefore be assumed that there is an economically measurable and relevant demand for rules of courtesy. In future research, we therefore want to combine the CG with various devices such as a traffic light on demand in order to determine the willingness-to-pay for courtesy.

References

Andreoni, J. and Miller, J. (2002). Giving according to garp: An experimental test of the consistency of preferences for altruism. *Econometrica*, 70(2):737–753.

Ashley, K. M. and Clark, R. L., editors (2001). *Medieval Conduct*. University of Minnesota Press, Minneapolis. Medieval Cultures, vol. 29.

Bhaskar, V. (2000). Egalitarianism and efficiency in repeated symmetric games. *Games and Economic Behavior*, 32(2):247–262.

Bock, O., Baetge, I., and Nicklisch, A. (2014). hroot: Hamburg registration and organization online tool. *European Economic Review*, 71:117–120.

Bornstein, G., Budescu, D., and Zamir, S. (1997). Cooperation in intergroup, n-person, and two-person games of chicken. *Journal of conflict resolution*, 41(3):384–406.

Brown-Kruse, J. and Hummels, D. (1993). Gender effects in laboratory public goods contribution: Do individuals put their money where their mouth is? *Journal of Economic Behavior & Organization*, 22(3):255–267.

Cabon-Dhersin, M.-L. and Etchart-Vincent, N. (2012). The puzzle of cooperation in a game of chicken: an experimental study. *Theory and decision*, 72:65–87.

Cappelen, A. W., Reme, B.-A., Sørensen, E. Ø., and Tungodden, B. (2016). Leadership and incentives. *Management Science*, 62(7):1944–1953.

Cason, T. N., Lau, S.-H. P., and Mui, V.-L. (2013). Learning, teaching, and turn taking in the repeated assignment game. *Economic Theory*, 54(2):335–357.

Charness, G., Gneezy, U., and Rasocha, V. (2021). Experimental methods: Eliciting beliefs. *Journal of Economic Behavior & Organization*, 189:234–256.

Chen, D. L., Schonger, M., and Wickens, C. (2016). otree—an open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9:88–97.

Culp, D. W. (1971). Courtesy and moral virtue. *Studies in English Literature, 1500-1900*, 11(1):37–51.

Dawes, R. M. (1975). Formal models of dilemmas in social decision making. In Kaplan, M. F. and Schwartz, S., editors, *Human judgement and decision processes*, pages 87–107. Academic Press.

Diekmann, A. (1985). Volunteer's dilemma. *Journal of conflict resolution*, 29(4):605–610.

Diekmann, A. and Przepiorka, W. (2016). "take one for the team!" individual heterogeneity and the emergence of latent norms in a volunteer's dilemma. *Social Forces*, 94(3):1309–1333.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., and Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3):522–550.

Fischbacher, U., Gächter, S., and Fehr, E. (2001). Are people conditionally cooperative? evidence from a public goods experiment. *Economics letters*, 71(3):397–404.

Gächter, S. and Renner, E. (2018). Leaders as role models and 'belief managers' in social dilemmas. *Journal of Economic Behavior & Organization*, 154:321–334.

Helbing, D., Schönhof, M., Stark, H.-U., and Hołyst, J. A. (2005). How individuals learn to take turns: Emergence of alternating cooperation in a congestion game and the prisoner's dilemma. *Advances in Complex Systems*, 8(01):87–116.

Kaplan, T. R. and Ruffle, B. J. (2012). Which way to cooperate. *The Economic Journal*, 122(563):1042–1068.

Kaplan, T. R., Ruffle, B. J., and Shtudiner, Z. (2018). Cooperation through coordination in two stages. *Journal of Economic Behavior & Organization*, 154:206–219.

Kerschbamer, R. and Müller, D. (2020). Social preferences and political attitudes: An online experiment on a large heterogeneous sample. *Journal of Public Economics*, 182:104076.

Lever, J., Frederick, D. A., and Hertz, R. (2015). Who pays for dates? following versus challenging gender norms. *Sage Open*, 5(4):2158244015613107.

Levitt, S. D. and List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world? *Journal of Economic perspectives*, 21(2):153–174.

List, J. A. (2009). Social preferences: Some thoughts from the field. *Annu. Rev. Econ.*, 1(1):563–579.

Messer, K. D., Poe, G. L., Rondeau, D., Schulze, W. D., and Vossler, C. A. (2010). Social preferences and voting: An exploration using a novel preference revealing mechanism. *Journal of Public Economics*, 94(3-4):308–317.

Murnighan, J. K., Kim, J. W., and Metzger, A. R. (1993). The volunteer dilemma. *Administrative Science Quarterly*, pages 515–538.

Paetzel, F., Sausgruber, R., and Traub, S. (2014). Social preferences and voting on reform: An experimental study. *European Economic Review*, 70:36–55.

Panagiotopoulos, I. and Dimitrakopoulos, G. (2018). An empirical investigation on consumers' intentions towards autonomous driving. *Transportation Research Part C: Emerging Technologies*, 95:773–784.

Soto, C. J. and John, O. P. (2017). The next big five inventory (bfi-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, 113(1):117.

Spenser, E. (2007 [1596]). The faerie queene. In Hamilton, A. C., editor, *Longman Annotated English Poets*. Routledge, London. 2nd revised edition. Text edited by H. Yamashita and T. Suzuki.

Van Dijk, E. and De Dreu, C. K. (2021). Experimental games and social decision making. *Annual Review of Psychology*, 72(1):415–438.

A Additional Figures and Tables

	Total	One Shot	Stranger	Partner
N	120	24	48	48
Female	57.5%	50.0%	68.8%	50.0%
Age	26.8	28.2	26.8	26.0
Economics	12.5%	4.2%	16.7%	12.5%
Risk-Attitude	5.43	5.42	5.50	5.38
Patience	2.44	2.38	2.48	2.41
Courtesy	4.82	4.83	4.79	4.83
Autonomous Driving	2.83	3.08	2.77	2.77

The table reports the mean, respectively the share, for the fully sample and by treatment. Legend: Female $\{0(\text{no}), 1(\text{yes})\}$; Age (years); Economics $\{0(\text{no}), 1(\text{yes})\}$); Risk-Attitude $\{1(\text{not at all risk-seeking}), \ldots, 10(\text{very risk-seeking})\}$; Patience $\{1(\text{very impatient}), \ldots, 10(\text{very patient})\}$; Courtesy, Autonomous Driving $\{1(\text{strongly disagree}), \ldots, 6(\text{strongly agree})\}$.

Table 14: Participants' Characteristics

B Experimental Instructions

B.1 Welcome Screen

Welcome to the experiment and thank you for your participation.

If you read the instructions carefully, you can earn money in this experiment. You will receive €5.00 as a fixed payment. Depending on your decisions and the decisions of other participants, you can earn additional money. During the experiment, we do not talk in euros, but in points. These are converted according to the following exchange rate:

10 points = €1.00

Please take your time to read the explanations and make your decisions. You can not influence the duration of the experiment by making a quick decision, as you will always have to wait for the other participants. This experiment consists of one part, which is explained on the following page. The experiment is expected to take about 30 minutes.

We would like to briefly explain this experiment to you: This experiment is an economic experiment on decision-making behavior. Participation in this experiment is voluntary. The experiment is anonymous. We will ask you some socio-demographic questions at the end, such as your age or gender, but we will not ask your name. The data will be stored anonymously and used exclusively for scientific purposes. If you have any questions, you can contact us at any time.

Please check the following box to continue with the experiment: I have read and understood the above information and would like to participate in this experiment.

B.2 Instructions [Treatment Stranger][11]

This experiment consists of 10 rounds. In each of the 10 rounds, you will be randomly assigned a new "other participant" in the experiment. Likewise to you, the other participant remains anonymous. It is never a participant from a previous round, but always a new, other participant.

[11] Instructions for the treatments *One Shot* and *Partner* are available from the authors upon request.

In each round, you and the other participant can choose between the two options X and Y. The two options X and Y are associated with the following payouts for you and the other participant:

[Screenshot of the payoff matrix]

The first entry in a cell (before the comma) in the color green represents the payout for you in a round. The second entry in a cell (after the comma) in the color purple represents the payout for the other participant in a round.

This means:

- If you choose option X and the other participant chooses option X, you will receive 10 points and the other participant will receive 10 points.
- If you choose option X and the other participant chooses option Y, you will receive 20 points and the other participant will receive 10 points.
- If you choose option Y and the other participant chooses option X, you will receive 10 points and the other participant will receive 20 points.
- If you choose option Y and the other participant chooses option Y, you will receive 0 points and the other participant will receive 0 points.

In each round, we would like to ask you to choose between the two options X and Y.

At the end of each round:

After you and the other participant have made a decision, you will be informed on a next page which choice (option X or Y) the other participant has made in this round. You will also see how many points you receive for this round and how many points the other participant receives for this round.

At the beginning of each round:

At the beginning of each round, we would like to ask you to indicate: Which of the two options do you think the other participant will choose in this round? This statement has no effect on your payout and the further course of the experiment.

Calculation of your payout:

Your total points is made up of your points from all 10 rounds of the experiment:

Points round 1 + Points round 2 + ... + Points for round 10 = Total points

Your decision and the decision of the other participant of a round are relevant for your payout and the payout of the other participant of that round. You will be informed about your point score from each round at the end of each round. You will also be informed about the point score of the other player from a round.

You will be informed about your total point score at the end of the experiment. Reminder: The points are converted according to the following exchange rate: 10 points = €1.00

B.3 Comprehension Questions

1. Assume you have chosen option X and the other participant has chosen option X. Which of the following statements is correct?
   - I receive 10 points. The other participant receives 10 points.
   - I receive 0 points. The other participant receives 0 points.
   - I receive 10 points. The other participant receives 20 points.
2. Assume you have chosen option Y and the other participant has chosen option X. Which of the following statements is correct?
   - I receive 10 points. The other participant receives 10 points.
   - I receive 0 points. The other participant receives 0 points.
   - I receive 10 points. The other participant receives 20 points.
3. Which of the following statements regarding the other participant is correct?
   - In each of the 10 rounds, I will meet the same other participant.
   - In each of the 10 rounds, I will meet a new other participant. This can be the same participant as in a previous round.
   - In each of the 10 rounds, I will meet a new other participant. This is never the same participant as in a previous round.

4. Which of the following statements regarding the payout is correct?
    - At the end of the 10 rounds, the computer randomly selects one round. The point score from this round corresponds to my total point score.
    - My total point score is the sum of the point scores from each of the 10 rounds.
5. At the beginning of each round, we would like to ask you to indicate: For which of the two options do you think the other participant will decide in this round? Which of the following statements is correct?
    - This specification has an impact on my payout.
    - This specification has no impact on my payout.

B.4 Belief Elicitation

Your statement for round 1

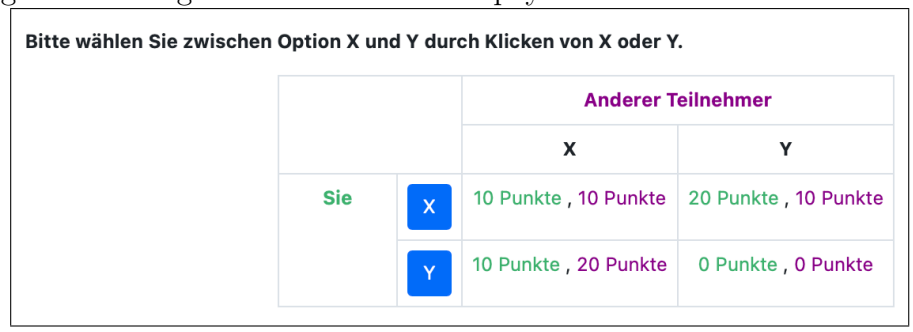
Please indicate: Which of the two options do you think the other participant from round 1 will choose in this round?

- I think the other participant will choose option X.
- I think the other participant will choose option Y.

This statement has no effect on your payout and the further course of the experiment.

B.5 Decision

Figure A1: Original screenshot of the payoff matrix in a decision round



Please choose between option X and Y by clicking on X or Y.

B.6 Feedback

You have chosen option Y and the other participant has chosen option X.

You receive 10 points for this round and the other participant receives 20 points.

B.7 Payout

Your total point score from all 10 rounds is 100 points.

B.8 Post-experimental Questionnaire (1/2)

Gender

Year of birth

Study program

How do you rate yourself personally: are you generally a risk-taker or do you try to avoid risks?[12]

Please select a value on the scale, where the value 1 means "not at all willing to take risks" and the value 10 means "very willing to take risks". You can use the values in between to grade your assessment.

How do you rate yourself personally: are you generally an impatient person or do you always have a lot of patience?[13]

Please select a value on the scale, where the value 1 means "very impatient" and the value 10 means "very patient". You can use the values in between to grade your assessment.

[12]This item was taken from Dohmen et al. (2011).

[13]This item was taken from the German Socio-Economic Panel Study: TNS Infratest Sozialforschung. 2011. SOEP 2007 – Methodenbericht CAPI-Innovationsbefragung zum Befragungsjahr 2007 (Welle 24) des Sozio-oekonomischen Panels – "Persoenlichkeit und Gesundheit". SOEP Survey Papers 63: Series B. Berlin: DIW/SOEP.

B.9 Post-experimental Questionnaire (2/2)

Please indicate the extent to which you agree or disagree with the following statements.

[disagree very strongly, disagree strongly, disagree, agree, agree strongly, agree very strongly]

When making my decisions in the experiment, I mainly tried to make sure that I get the highest possible payout myself.

When making my decisions in the experiment, I mainly tried to make sure that the other participant gets the highest possible payout.

When making my decisions in the experiment, I mainly tried to make sure that I and the other participant get an equal payout.

When making my decisions in the experiment, I mainly tried to make sure that the total payout that I and the other participant receive together is as high as possible.

When making my decisions in the experiment, I mainly tried to make sure that the other participant did not get more than me.

I am a person who is polite and courteous to others.[14]

The chance of me using or owning autonomous vehicles as soon as they are available on the market is very high.[15]

[14]This item was taken from Soto and John (2017).

[15]This item is based on Panagiotopoulos and Dimitrakopoulos (2018).