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Article

Framing and Feedback in Social Dilemmas with Partners and Strangers

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Abstract: We study framing effects in repeated social dilemmas by comparing payoff-equivalent Give- and Take-framed public goods games under varying matching mechanisms (Partners or Strangers) and levels of feedback (Aggregate or Individual). In the Give-framed game, players contribute to a public good, while in the Take-framed game, players take from an existing public good. The results show Take framing and Individual-level feedback lead to more extreme behavior (free-riding and full cooperation), especially for Partners. These results suggest Take framing and Individual-level feedback increase the variability of cooperation.

Keywords: public goods; experiment; framing; cooperation

JEL Classification: C72; C73; C92; H41

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1. Introduction

There is extensive evidence that behavior in social dilemmas is affected by framing, that is, whether the game is posed in the form of contributing from private accounts to provide a public good ("Give" frame) or extracting from an existing common pool to enrich one's own private account ("Take" frame). However, previous studies show mixed results, with some finding higher cooperation

in cases of Give framing, while others find no differences, or even the opposite effect. In this paper, we seek to discover the types of environments in which framing effects are most prevalent, while also helping to explain the mixed results in the literature. Specifically, we examine the nature of the feedback provided, whether subjects are informed about aggregate contribution/extraction ("Aggregate" feedback) or provided disaggregated information at the level of individual choices ("Individual" feedback), and the mechanism used for matching subjects, whether subjects are matched with the same subjects for all rounds ("Partners" matching) or randomly re-matched with different subjects in each round ("Strangers" matching).

Framing effects may differ depending on the level of feedback subjects receive. An individual's action being observed may increase the intensity of Andreoni's [1] "warm glow" or "cold prickle," due to a sense of pride or shame in cooperating or free-riding. Furthermore, framing, feedback, and matching each may affect social norms which arise in the lab, and may interact in interesting ways not yet well understood. We seek to systematically explore these interactions with our empirical results.[1]

The results of the experiment show Take framing and Individual feedback lead to more extreme behavior (free-riding and full cooperation), especially for Partners. The effect is particularly noticeable for the Partners-Take-Individual (PTI) treatment, where a majority of cooperation decisions are at the extremes. These results suggest Take framing and Individual feedback increase the variability of cooperation. Such high variability could be responsible for the mixed results of previous studies on framing and feedback. We also find gender differences in response to framing, with men responding more negatively to Take framing than women. Such gender differences might also help explain the mixed results in previous studies.

Table 1 summarizes a number of studies of Give/Take framing effects in social dilemmas, while Table 2 summarizes several experiments on feedback.[2] The effect of framing and the effect of feedback on average cooperation are mixed. These previous studies on framing and feedback differ from one another on a number of design features which may partly explain the inconsistent results. To our knowledge, our paper is the first to systematically study the interaction between framing, matching, and feedback conditions to investigate the types of environments in which Give/Take framing effects are most prevalent. The inconsistent previous results may be partly due to differences in such conditions. Moreover, we examine matching and feedback with Take framing, while the previous literature examining cooperation in these environments has primarily focused on Give framing.

The paper is organized as follows. Section 2 discusses the experimental design and hypotheses. Section 3 reports the results. Section 4 concludes with a discussion of the key findings. Experimental instructions and additional analyses are shown in the Appendices.

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[1] Similar to Andreoni's warm glow and cold prickle explanation is the idea that free-riding may have different "moral costs" depending on framing, level of feedback, and repetition. See Banerjee (2015a [2], b [3]) for further discussion of moral costs.

[2] We focus on studies using a linear VCM game, as in our experiment. See Andreoni and Croson [4] for a summary of previous experiments comparing partners and strangers.

Table 1. Summary of Experiments on Give/Take Framing in Linear VCM Game.

Paper	Feedback	Matching
No Framing Effect		
Fleishman [5]	Aggregate	Partners
Sell and Son [6]	Aggregate & None	Partners
Messer *et al.* [7]	Aggregate	Partners
Cubitt *et al.* [8]	Individual	One-Shot
Cox *et al.* [9]	None	One-Shot
Stoddard [10]	None	Strangers
Cox *et al.* [11]	Individual	Partners
Cooperation Higher in Give		
Andreoni [1]	Aggregate	Strangers
Park [12]	Aggregate	Strangers
Brandts and Schwieren [13]	None	Strangers
Fujimoto and Park [14]	Aggregate	One-Shot
Dufwenberg *et al.* [15]	Aggregate	One-Shot
Gächter *et al.* [16]	None	Strangers
Cox [17]	Aggregate	Strangers
Khadjavi and Lange [18]	Aggregate	Partners
Cooperation Higher in Take		
Sell *et al.* [19]	Aggregate	Partners
Fosgaard *et al.* [20]	Individual	One-Shot

Table 2. Summary of Experiments on Individual/Aggregate Feedback in Linear VCM Game.

Paper	Framing	Matching
No Feedback Effect		
Weimann [21]	Give	Partners & Strangers
Croson [22]	Give	Partners
Bigoni and Suetens [23]	Give	Partners
Cooperation Higher in Individual		
Sell and Wilson [24]	Give	Partners
Kreitmair [25]	Give	Partners
Cooperation Higher in Aggregate		
Van der Heijden and Moxnes [26]	Take	Partners
Carpenter [27]	Give	Strangers

2. Experimental Design and Procedures

The experimental sessions were conducted at the University of South Dakota. Undergraduate subjects from a wide range of disciplines were recruited from classrooms. At the beginning of each session, subjects read a set of instructions, which were then summarized publicly. After reading the instructions, subjects took a post-instruction quiz and were not allowed to continue until all answers were correct.

Subjects made all decisions on computers in private.[3] At the beginning of each session, the computer randomly and anonymously assigned subjects to three-person groups. No person could identify his/her group members. Each session consisted of 15 decision periods.

The first treatment variable is framing (Give *vs.* Take). In the Give frame, each group member received a endowment of 80 tokens each round to allocate between his/her private account and a group account. Each token allocated to the group account produced 2.25 tokens for the group. Each group member received an equal share of the ending value of the group account, *i.e.*, a marginal per-capita return of 0.75 tokens for each token provided to the group account. In the Take frame, by contrast, the group account was endowed with 540 tokens. Each group member could appropriate a maximum of 80 tokens from the group account to his/her private account. Each token appropriated from the group account decreased the group account by 2.25 tokens. Each person received an equal share of the ending value of the group account, *i.e.*, one third of each token remaining in the group account.

The second treatment variable is feedback level (Aggregate *vs.* Individual). Under Aggregate feedback, each subject was informed of his/her group's aggregate contribution to or appropriation from the group account and his/her earnings at the end of each period. Under Individual feedback, subjects were also informed of the other two anonymous group members' individual allocation decisions in each period.

The third treatment variable is matching (Partners *vs.* Strangers). Under Partners matching, subjects were randomly and anonymously assigned into groups of three before the first decision period and remained in the same group for all 15 periods. Under Strangers matching, subjects were randomly and anonymously assigned into new groups of three before each of the 15 decision periods.

Three treatment variables with two levels each gives us a $2 \times 2 \times 2$ design. Treatment conditions are identified by the matching mechanism-framing-feedback level. For instance, the treatment condition with Strangers matching, Give framing, and Aggregate feedback is identified as the Strangers-Give-Aggregate treatment (or SGA). Table 3 lists each treatment and summarizes its design. Most sessions had 15 subjects, though one session had only 12 due to absences. In total, data were collected from 252 subjects.[4] In all sessions, monetary information was denominated in tokens. The conversion rate of tokens to U.S. dollars was 100 to 1. Earnings averaged \$18.74 per subject across all periods, which ranged in duration from 45–60 min.

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[3] Co-author Cox programmed the experiment using z-Tree Fischbacher [28]. Co-author Stoddard conducted all sessions, including a review of the instructions. See the Appendices for a copy of the instructions. Note, following the previous economics literature on framing in social dilemmas, steps were taken to minimize unwanted demand effects. We used a between-subjects design, and instructions avoided terms such as "give" and "take" in favor of more neutral language.

[4] As we will show in the Results section, the data from the first two sessions in each treatment suggested more complete free-riding and more full cooperation in PTI treatment. We had funds remaining for one additional session, and we chose PTI to see if these results replicated. Our results show that PTI continues to exhibit a greater degree of such extreme behavior.

Table 3. Design information for treatments.

Treatment	Sessions	Independent Groups	Subjects (Men/Women)
Partners-Give-Aggregate (PGA)	2	10	30 (15/15)
Partners-Give-Individual (PGI)	2	10	30 (13/17)
Partners-Take-Aggregate (PTA)	2	10	30 (14/16)
Partners-Take-Individual (PTI)	3	15	45 (32/13)
Strangers-Give-Aggregate (SGA)	2	2	30 (9/21)
Strangers-Give-Individual (SGI)	2	2	27 (20/7)
Strangers-Take-Aggregate (STA)	2	2	30 (8/22)
Strangers-Take-Individual (STI)	2	2	30 (12/18)

Predictions

On the basis of prior research findings, we state the following hypotheses. As summarized in Table 1, related studies find mixed results regarding the effect of framing on average cooperation. However, among papers that find a significant framing effect, cooperation tends to be higher with Give framing.

Hypothesis 1: Between treatments with the same matching mechanism and feedback condition, average cooperation will be higher with Give framing compared to Take framing.

Furthermore, the framing effect may be sensitive to gender. Fujimoto and Park [14] and Cox [17] find higher cooperation in Give compared to Take, with a stronger effect for men than women.[5]

Hypothesis 2: Between treatments with the same matching mechanism and feedback condition, the framing effect will be stronger for men than for women.

The literature studying information feedback in public-goods games also finds mixed results on average cooperation, as summarized in Table 2. However, cooperative decisions have more variance with Individual feedback (Croson [22], Bigoni and Suetens [23]).

Hypothesis 3: Between treatments with the same matching mechanism and frame condition, there will be more extreme behavior (free riding and full cooperation) with Individual feedback compared to Aggregate feedback.

Studies examining matching mechanisms with Give framing do not find consistent results, and to our knowledge, the effect of matching mechanisms has not been examined with Take framing. It is thus unclear ex ante what effect of matching should be expected.

[5] One possible reason why men may be more responsive to Take framing is it may prime competitive norms and men often have a stronger response to competition than women (Croson and Gneezy [29]).

3. Results

The results from the experiment are discussed in two subsections according to the matching mechanism.[6] Within each subsection, the cooperation levels, proportion of free riders, and the proportion of full cooperators are examined. Each analysis begins with a graphical overview, followed with individual-level regressions.[7] Take and Give decisions are standardized across frames as cooperation decisions. A cooperation decision in Take framing equals 80 tokens minus the tokens appropriated from the group account. A cooperation decision in Give framing equals the number of tokens provided to the group account.

Recall the treatments are identified by matching mechanism-frame-feedback condition. For brevity in the discussion of the results, the Partners-Give-Aggregate treatment will be referred to as PGA, the Partners-Give-Individual treatment as PGI, the Partners-Take-Aggregate treatment as PTA, and the Partners-Take-Individual treatment as PTI. Similar acronyms are used for the Strangers treatments.

3.1. Partners-Matching Data

3.1.1. Graphical Overview: Partners

Figure 1 displays the path of average individual-level cooperation for each treatment. The pattern of average cooperation across decision periods is similar in all four treatments. Holding constant the feedback condition, the Take treatments have higher levels of average cooperation. Similarly, holding constant the frame, the Individual-feedback treatments have higher levels of average cooperation. Focusing on the first period, visually it appears there is a framing effect where Take framing leads to higher average cooperation than Give framing. This observation is supported by two-sample t-tests (PGA *vs.* PTA $p = 0.030$, $n = 60$; PGI *vs.* PTI $p = 0.066$, $n = 75$).[8]

Result 1: Contrary to Hypothesis 1, first period average cooperation is higher with Take framing compared to Give framing.

Previous research indicates average cooperation can mask a large degree of variation in cooperation decisions. Some of the variation is caused by extreme behavior of subjects, which has been shown to be sensitive to Take framing (Cox [17]) and Individual feedback (Croson [22], Kreitmair [25]). Figure 2 displays the path of the proportion of complete free riders for each treatment. Within a feedback condition, there is always a higher proportion of free riders with Take framing.

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[6] We also compare cooperative behavior between Partners and Strangers matching for given frame and feedback conditions. The results do not find strong differences between matching conditions, and are reported in the Appendices. To reduce the size of the Results section, we also report descriptive statistics, proportions of free riders, and proportions of full cooperators in the Appendices.

[7] In regression tables, we report statistical significance for 2-tailed tests. However, as our hypotheses are 1-sided, we will also report 1-tailed tests in the text where relevant.

[8] Wilcoxon Rank-sum tests support the significant difference between PGA *vs.* PTA, but not a significant difference between PGI *vs.* PTI ($p = 0.180$). The insignificant Wilcoxon test is likely due to the higher proportions of extreme behavior observed with Individual feedback. The full set of treatment comparisons and tests are included in the Appendices.

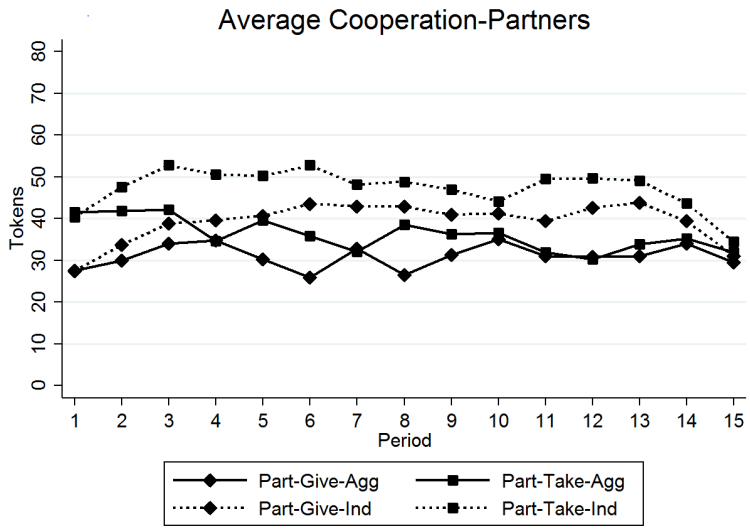

Figure 1. Average Cooperation Over Time (Partners).

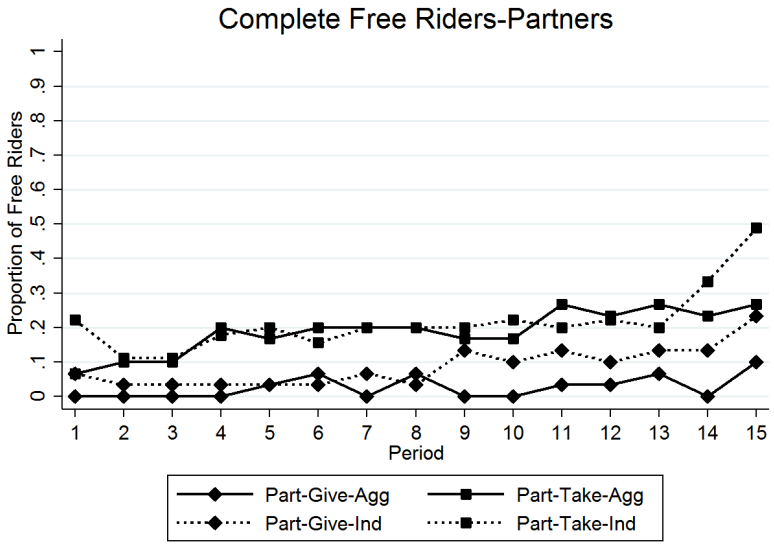

Figure 2. Proportion of Free Riders Over Time (Partners).

Finally, a group's total payoff is maximized when each individual member fully cooperates (coop = 80). Figure 3 displays the path of the proportion of full cooperators for each treatment. There are not large differences in the proportions of full cooperation between treatments, except for the much higher proportion of full cooperators in the PTI treatment.

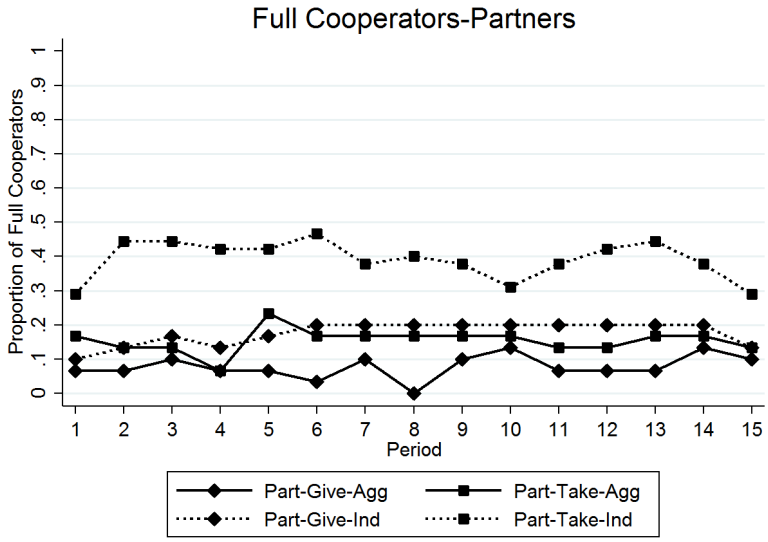

Figure 3. Proportion of Full Cooperators Over Time (Partners).

3.1.2. Individual-Level Cooperation Regression Analysis: Partners

Models 1 and 2 in Table 4 present results from two-limit censored Tobit regression models. The dependent variable in each model is individual-level cooperation. Each model pools data from the four Partners-matching treatments across all 15 periods. The independent variables in Model 1 are treatment indicators (with PGA as the reference category), a female gender indicator, and a time-trend variable. Model 2 has the same independent variables as Model 1, as well as an additional independent variable, the one-period lagged average cooperation of other group members.[9]

Model 1 reveals a strong positive effect on cooperation with Take framing and Individual feedback, PTI coefficient (p-value = 0.031). Consistent with other previous linear public good studies, Model 2 reports lagged average cooperation of others has a significant and positive impact on individual cooperation decisions, (p-value < 0.001). Including lagged cooperation of others decreases the size and significance of the effect of Take framing and Individual Feedback, PTI coefficient (p-value = 0.142 in Model 2). In addition, common to public goods studies, Model 2 reports a significant and negative time trend of cooperation, Period (p-value < 0.001 in Model 2). There is not a gender effect with average cooperation decisions in either model (p-values = 0.642 in Model 1 and 0.488 in Model 2). Finally, more than a third of the observations in each model are censored due to free-riding or full cooperation.[10]

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[9] Lagged cooperation decisions of others influence contributions to public goods and control for feedback effects (Sefton *et al.* [30], Frechette [31], Samek and Sheremeta [32]).

[10] As a robustness check for Models 1 and 2, models with the same dependent and independent variables are examined using pooled OLS with Driscoll and Kraay (DK) standard errors, rather than clustered standard errors. Driscoll and Kraay [33] developed standard errors that are robust to arbitrary spatial and serial correlation. Vogelsang [34] shows that for panels with large time dimensions and finite cross-sectional dimensions, the DK standard errors are consistent even in specifications with time fixed effects. The estimation procedure developed by Hoechle [35] is implemented in STATA. The results from the specifications with DK standard errors are generally consistent with those from the Tobit models reported in Table 4.

Table 4. Individual-Level Regressions: Average Cooperation, Free-Riding, and Fully Cooperating (Partners).

Independent Variables	Cooperation		Free-Riding		Fully Cooperating	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Coeff.	Coeff.	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Constant	36.71 ***	15.10 ***	0.02 ***	0.03 ***	0.11 ***	0.04 ***
	(5.44)	(4.57)	(0.01)	(0.01)	(0.05)	(0.02)
Lagged Average Cooperation of Others	—-	0.79 ***	—-	0.98 **	—-	1.04 ***
	—-	(0.14)	—-	(0.01)	—-	(0.01)
PTA	–2.98	–1.51	9.50 ***	10.06 ***	2.23	1.84
	(9.44)	(4.45)	(3.49)	(3.12)	(1.54)	(1.02)
PGI	9.48	3.93	3.82 **	4.11 ***	2.70	2.00
	(10.36)	(4.56)	(2.15)	(2.02)	(1.78)	(1.10)
PTI	20.65 **	7.84	8.88 ***	11.63 ***	6.77 ***	4.21 ***
	(9.58)	(5.33)	(3.76)	(4.41)	(3.45)	(1.86)
Female	–2.09	–2.60	0.34 ***	0.34 ***	0.46 ***	0.40 ***
	(4.50)	(3.74)	(0.13)	(0.13)	(0.14)	(0.13)
Period	–0.45	–0.73 ***	1.11 ***	1.11 ***	1.00	0.99
	(0.38)	(0.23)	(0.02)	(0.02)	(0.02)	(0.02)
Pseudo R^2	—-	—-	0.127	0.171	0.106	0.375
Wald Tests	*p*-value	*p*-value	*p*-value	*p*-value	*p*-value	*p*-value
PTA=PTI	0.126	0.178	0.863	0.657	0.092*	0.135
PGI=PTI	0.366	0.542	0.142	0.027**	0.143	0.156

Standard errors are in parentheses. In all models, errors are clustered by group (45). ***, **, and * indicate significance at the 1%, 5%, and 10% levels using 2-tailed tests. Partners-Give-Aggregate (PGA) serves as the reference treatment indicator variable in all models; Model 1: n = 2025, 282 left-censored (coop = 0) & 447 right-censored (coop = 80) observations; Model 2: n = 1890; 268 left-censored (coop = 0) & 424 right-censored (coop = 80) observations; Model 3: n = 2025; Model 4: n = 1890; Model 5: n = 2025; Model 6: n = 1890.

Result 2: Contrary to Hypothesis 1, average cooperation is not higher with Give framing compared to Take framing, and there is some evidence the opposite is true with Individual feedback.

3.1.3. Free-Riding Regression Analysis: Partners

Models 3 and 4 in Table 4 report logit regressions for complete free-riding (coop = 0).[11] The dependent variable in each model is an indicator variable equal to one if a subject's cooperation decision in a particular period is 0. The independent variables in Models 3 and 4 are the same as those in Models 1 and 2, respectively. There is significantly higher likelihood of free-riding with Take framing (p-values < 0.001 in Model 3 and Model 4). With Give framing, Individual feedback leads to significantly higher likelihood of free-riding (1-tailed p-value < 0.001 in Model 3 and Model 4). With Take framing, however, Wald tests comparing PTA and PTI indicate Individual feedback does not lead to significantly higher likelihood of free-riding (1-tailed p-values = 0.432 in Model 3 and 0.329 in Model 4). Women are significantly less likely to free ride compared to men (p-value < 0.001 in Model 3 and Model 4).

[11] Note that for logit regressions we report odds ratios, so that estimates greater than 1 indicate a positive effect, and estimates less than 1 indicate a negative effect.

Finally, the time-trend odds ratios are significant and greater than one (p-values < 0.001 in Model 3 and Model 4), indicating free-riding is more likely to occur in later periods of the game.

3.1.4. Full Cooperation Regression Analysis: Partners

Models 5 and 6 in Table 4 report logit regressions for full cooperation (coop = 80). The dependent variable in each model is an indicator variable equal to one if a subject's cooperation decision in a particular period is 80. The independent variables in Models 5 and 6 are the same as those in Models 1 and 2, respectively. Full cooperation is more likely in PTI combining Take framing with Individual feedback compared to the other treatments (p-value < 0.001 in Model 5 and Model 6). Wald tests comparing PTA and PTI indicate full cooperation with Take framing is weakly more likely with Individual feedback compared to Aggregate feedback (1-tailed p-values = 0.046 in Model 5 and 0.068 in Model 6). Women are much less likely to fully cooperate than men (p-value < 0.001 in Model 5 and Model 6).[12] Finally, time trends do not significantly impact the likelihood of subjects' full cooperation (p-values = 0.862 in Model 5 and 0.453 in Model 6).

Result 3: Supporting Hypothesis 3, with Give framing there is significantly more free-riding with Individual feedback compared to Aggregate feedback. However, such a feedback effect is not present with Take framing. Examining full cooperation, there is weak support of Hypothesis 3 with Take framing, but no support with Give framing. Free-riding and full cooperation increase significantly when Take framing and Individual feedback are combined.

3.2. Strangers-Matching Data

3.2.1. Graphical Overview: Strangers

Figure 4 displays the path of average individual-level cooperation for each treatment. The pattern of average group-level cooperation across decision periods is similar in all four treatments. Focusing on the first period, visually it appears there is a framing effect where Take framing leads to higher average cooperation than Give framing. This observation is supported by two-sample t-tests (PGA *vs.* PTA p-value = 0.011, n = 60; PGI *vs.* PTI p-value = 0.022, n = 57).[13]

Result 4: Contrary to Hypothesis 1, first period average cooperation is higher with Take framing compared to Give framing (similar to *Result 1* with Partners matching).

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[12] The full-cooperation rate for women in the PGA treatment was precisely zero.

[13] Wilcoxon Rank-sum tests also support this observation. The full set of treatment comparisons and tests are included in the Appendices.

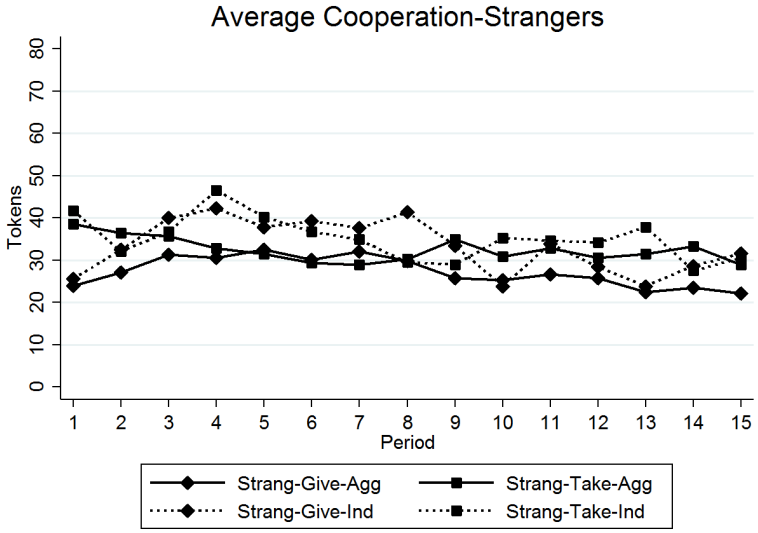

Figure 4. Average Cooperation Over Time (Strangers).

To investigate the variation in cooperative decisions due to extreme behavior, we examine the proportions of complete free riders and full cooperators. Figure 5 displays the path of the proportions of complete free riders for each treatment. The pattern of the proportions of free riders across decision periods are similar across SGA, STA, and SGI. However, for the last ten periods, the proportion of free riders in STI is above the other three treatments.

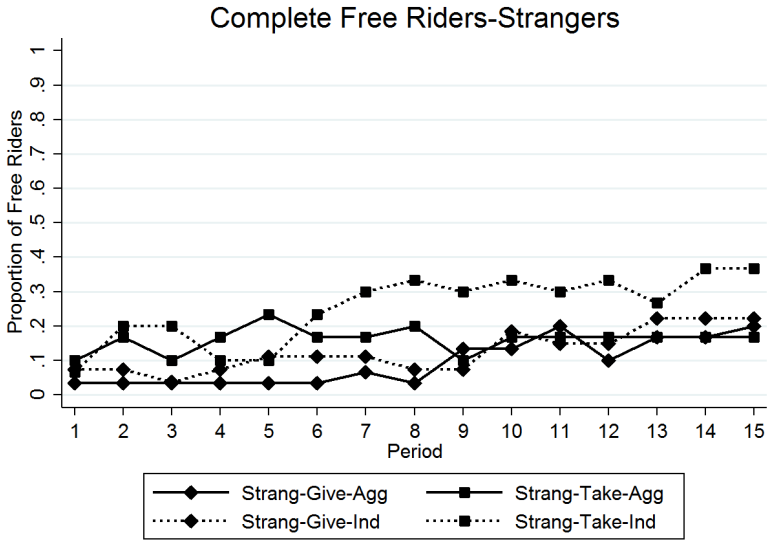

Figure 5. Proportion of Free Riders Over Time (Strangers).

Figure 6 displays the path of the proportions of full cooperators for each treatment. The pattern of the proportions of full cooperators across decision periods are higher in treatments with Individual feedback compared to treatments with Aggregate feedback.

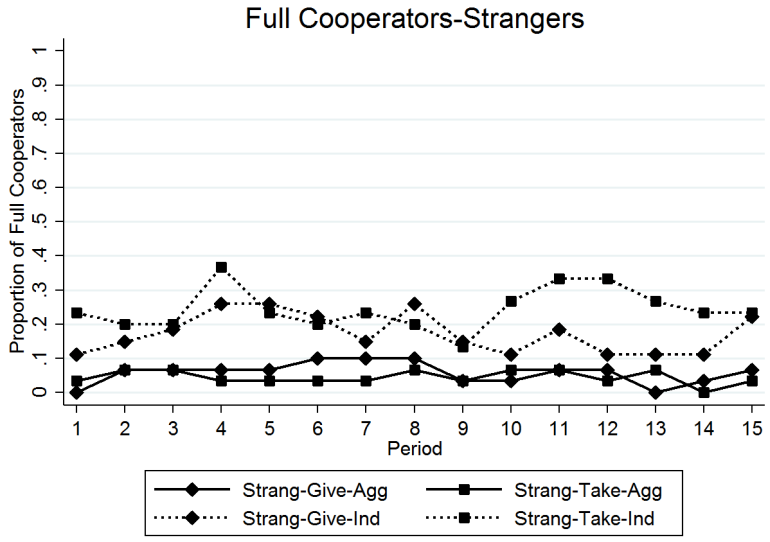

Figure 6. Proportion of Full Cooperators Over Time (Strangers).

3.2.2. Individual-Level Cooperation Regression Analysis: Strangers

Models 1 and 2 in Table 5 present results from two-limit censored Tobit regression models. The dependent variable in each model is individual-level cooperation. Each model pools data from the four Strangers-matching treatments across all 15 periods. Independent variables in Model 1 are treatment indicators (with SGA as the reference category), a female gender indicator, and a time-trend variable. Model 2 has the same independent variables as Model 1, as well as an additional independent variable, the one-period lagged average cooperation of other group members.

Models 1 and 2 report no significant treatment effects for cooperation decisions. However, the lagged cooperation of others increases cooperation, Lagged Average Cooperation of Others (p-value < 0.001 in Model 2). Moreover, time trends significantly reduce cooperation (p-value < 0.001 in Model 1 and Model 2). There is not a gender effect with average cooperation decisions in either model (p-values = 0.501 in Model 1 and 0.644 in Model 2). Finally, greater than a fourth of the observations in each model are censored due to free-riding and full cooperation.[14]

Result 5: Contrary to Hypothesis 1, average cooperation is not higher with Give framing compared to Take framing (similar to *Result 2* with Partners matching).

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[14] Strangers matching leads to dependency across subjects within a session. In Table 5, standard errors are clustered by individual subjects, with lagged cooperation of others used to control for feedback effects. Another method for controlling session-level dependency is to cluster by session (Frechette [31]). In cases where there are low numbers of clusters, the DK standard errors provide an attractive alternative to clustered standard errors. Pooled OLS models with DK standard errors and the same dependent and independent variables as Models 1 and 2 are conducted as robustness checks for the results in Table 5. The general results are consistent across both specifications.

Table 5. Individual-Level Regressions: Average Cooperation, Free-Riding, and Fully Cooperating (Strangers).

Independent Variables	Cooperation		Free-Riding		Fully Cooperating	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Coeff.	Coeff.	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
Constant	35.54***	27.22***	0.08***	0.12***	0.12***	0.09***
	(6.50)	(7.18)	(0.04)	(0.06)	(0.08)	(0.06)
Lagged Average Cooperation of Others	—-	0.28***	—-	0.99**	—-	1.01***
	—-	(0.08)	—-	(0.01)	—-	(0.01)
STA	3.92	1.72	1.94	2.03	0.79	0.69
	(6.38)	(6.42)	(1.14)	(1.15)	(0.64)	(0.54)
SGI	5.78	5.20	1.02	1.05	2.17	2.00
	(7.61)	(7.81)	(0.66)	(0.65)	(1.43)	(1.35)
STI	7.86	4.81	3.18**	3.57***	4.96***	4.12***
	(7.13)	(7.34)	(1.71)	(1.85)	(2.72)	(2.33)
Female	–4.32	–3.05	0.47*	0.45*	0.32***	0.36**
	(6.42)	(6.59)	(0.20)	(0.19)	(0.14)	(0.17)
Period	–0.80***	–0.78***	1.10***	1.08***	1.00	0.99
	(0.24)	(0.26)	(0.02)	(0.02)	(0.02)	(0.02)
Pseudo R^2	—-	—-	0.070	0.076	0.121	0.124
Wald Tests	*p*-value	*p*-value	*p*-value	*p*-value	*p*-value	*p*-value
STA = STI	0.624	0.707	0.287	0.220	0.011***	0.012***
SGI = STI	0.814	0.966	0.044**	0.031**	0.110	0.168

Standard errors are in parentheses. In all models, errors are clustered by subject (117). ***, **, and * indicate significance at the 1%, 5%, and 10% levels using 2-tailed tests. Strangers-Give-Aggregate (SGA) serves as the reference treatment indicator variable in all models. Model 1: n = 1755, 279 left-censored (coop = 0) & 226 right-censored (coop = 80) observations; Model 2: n = 1638, 271 left-censored (coop = 0) & 215 right-censored (coop = 80) observations; Model 3: n = 1755; Model 4: n = 1638; Model 5: n = 1755; Model 6: n = 1638.

3.2.3. Free-Riding Regression Analysis: Strangers

Models 3 and 4 in Table 5 report logit regressions for complete free-riding (coop = 0) for Strangers treatments. The dependent variable in each model is an indicator variable equal to one if a subject's cooperation decision in a particular period is 0. Independent variables in Models 3 and 4 are the same as those in Models 1 and 2, respectively. Free-riding is more likely in STI combining Take framing and Individual feedback compared to the other treatments (p-values = 0.031 in Model 3 and p-value = 0.014 in Model 4). With Individual feedback, Wald tests comparing SGI and STI indicate Take framing increases the likelihood of free-riding compared to Give framing (p-values = 0.044 in Model 3 and 0.031 in Model 4). However, with Take framing, Wald tests comparing STA and STI indicate Individual feedback does not lead to significantly higher likelihood of free-riding (1-tailed p-values = 0.144 in Model 3 and 0.110 in Model 4). Women are weakly less likely to free ride compared to men (p-values = 0.077 in Model 3 and 0.056 in Model 4). Finally, time-trend odds ratios are significant and greater than one (p-value < 0.001 in Model 3 and Model 4), indicating free-riding is more likely to occur in later periods of the game.

3.2.4. Full Cooperation Regression Analysis: Strangers

Models 5 and 6 in Table 5 report logit regressions for full cooperation (coop = 80). The dependent variable in each model is an indicator variable equal to one if a subject's cooperation decision in a particular period is 80. The independent variables in Models 5 and 6 are the same as those in Models 1 and 2, respectively. Full cooperation is more likely in STI combining Take framing with Individual feedback compared to the other treatments (p-values = 0.004 in Model 5 and 0.012 in Model 6). Wald tests comparing STA and STI indicate full cooperation with Take framing is more likely with Individual feedback compared to Aggregate feedback (1-tailed p-values < 0.001 in Model 5 and Model 6). Women are less likely to fully cooperate compared to men (p-values = 0.011 in Model 5 and 0.027 in Model 6). Finally, time trends do not significantly impact the likelihood of subjects' full cooperation (p-values = 0.814 in Model 5 and 0.652 in Model 6).

Result 6: Contrary to Hypothesis 3, holding constant the framing condition, there is not more free-riding with Individual Feedback compared to Aggregate feedback (unlike *Result 3* with Give framing and Partners matching). Examining full cooperation, there is support of Hypothesis 3 with Take framing, but no support with Give framing (similar to *Result 3* with Partners matching). However, free-riding and full cooperation increase significantly when Take framing and Individual feedback are combined (similar to *Result 3* with Partners matching).

3.3. Framing Effects by Gender

3.3.1. Graphical Overview: Partners

Figure 7 displays the path of average cooperation for men and women by treatment. It appears average cooperation levels for women may vary more by treatment condition than average cooperation levels for men. For instance, women on average cooperate more in PTA with Take framing and Aggregate feedback compared to PGA with Give framing and Aggregate feedback.

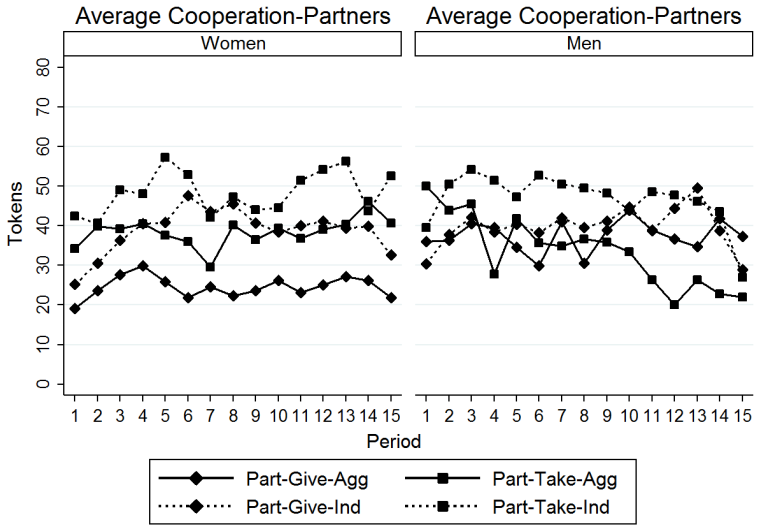

Figure 7. Average Cooperation Over Time (Partners).

3.3.2. Graphical Overview: Strangers

Figure 8 displays the path of average individual-level cooperation for men and women by treatment. For women, the most clear observation is average cooperation with Aggregate feedback is always higher in STA with Take framing than in SGA with Give framing. However, for men, it appears the framing effect with Aggregate feedback is reversed. That is, in most periods, average cooperation is higher in SGA with Give framing than in STA with Take framing.

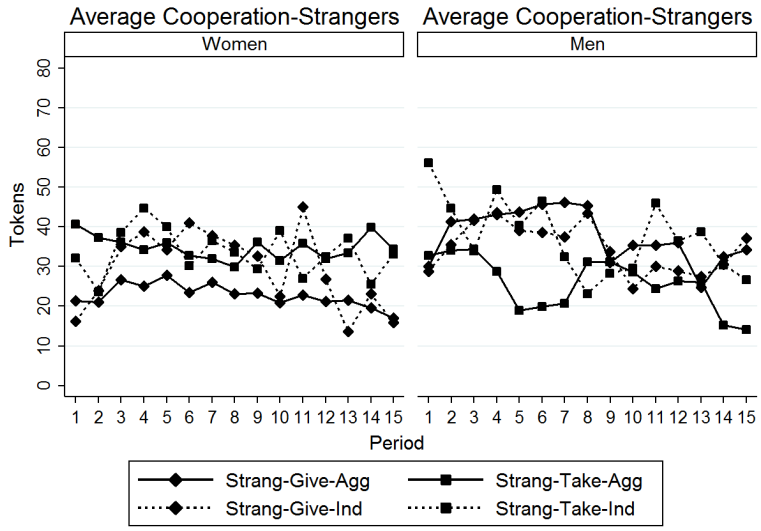

Figure 8. Average Cooperation Over Time (Strangers).

In Table 6 we test Hypothesis 2 by examining the interaction between gender and Take framing. Unlike previous regressions, we use indicators for Take framing, Individual feedback, and Partners matching instead of indicators for individual treatments (such as STA, PGI, *etc.*). In Model 3 in Table 6 we fully interact these treatment variables with one another, which is equivalent to controlling for a full set of treatment indicators (with SGA as the reference category). This approach simplifies the interpretation of the main effect of Take framing and its interaction with gender, compared to interacting gender with treatment condition indicators.

The main effect of Take framing measures the framing effect for men. It is negative, showing only weak statistical significance (1-tailed p-value = 0.090 in Model 3). Women are significantly less cooperative than men. Moreover, the interaction between Take framing and female gender is positive and significant (1-tailed p-values = 0.058 in Model 1, 0.036 in Model 2, and 0.018 in Model 3). This result suggests, consistent with Hypothesis 2, the effect of Take framing differs by gender in the predicted direction. There is some weak evidence that the overall effect of Take framing for women (a linear combination of the Take framing coefficient and the interaction coefficient) is positive (p-values = 0.046 for Model 1, 0.109 for Model 2, and 0.629 for Model 3). While we cannot show strong evidence of a significant Take framing effect for either men or women separately, we do find the effect of Take framing is different for men and women.

Result 7: Take framing weakly reduces cooperation for men and weakly increase cooperation for women. Consistent with Hypothesis 2, Take framing interacts significantly with gender.

Table 6. Tobit Regressions for Cooperation Interacting Gender with Take Framing.

Independent Variable	Model 1	Model 2	Model 3
Constant	33.06 ***	18.51 ***	23.87 ***
	(4.85)	(4.99)	(5.89)
Lagged Cooperation of Others	—	0.59 ***	0.58 ***
		(0.11)	(0.11)
Take	–0.87	–4.88	–11.59
	(6.75)	(5.37)	(8.63)
Individual	9.70 **	6.94 *	0.55
	(4.80)	(3.85)	(7.78)
Partners	10.06 **	6.69 *	1.59
	(4.72)	(3.77)	(4.35)
Take × Individual	—	—	4.30
			(11.51)
Take × Partners	—	—	3.40
			(8.63)
Individual × Partners	—	—	5.37
			(9.86)
Take × Individual × Partners	—	—	3.09
			(14.91)
Female	–9.28 **	–8.68 **	–9.71 **
	(4.37)	(3.88)	(4.08)
Female × Take	11.45	11.96 *	14.57 **
	(7.29)	(6.62)	(6.95)
Period	–0.61 ***	–0.78 ***	–0.78 ***
	(0.23)	(0.20)	(0.20)

Standard errors are in parentheses. In all models, errors are clustered by subject for Strangers and group for Partners (162). ***, **, and * indicate significance at the 1%, 5%, and 10% levels using 2-tailed tests; Model 1: n = 3780, 561 left-censored (coop = 0) & 673 right-censored (coop = 80) observations; Models 2 & 3: n = 3092, 473 left-censored (coop = 0) & 582 right-censored (coop = 80) observations.

4. Discussion

In this paper, we explore how framing, feedback, and matching interact in determining cooperation in social dilemmas. The results indicate that Take framing and Individual feedback lead to more extreme behavior (free-riding and full cooperation). This effect is especially pronounced for Partners matching. In the treatment combining these three features, PTI, more than half of all cooperation decisions are on the extremes.

One possible conjecture to explain these findings is Take framing, Individual feedback, and Partners matching are conducive to the formation of norms for full cooperation, especially in combination. As suggested by Andreoni [1], taking may be viewed more negatively than not giving. This "omission bias" effect may be especially strong when individual cooperation decisions are revealed to fixed partners. In such cases, norm breakers may be inclined to free ride completely, since taking even a small amount still breaks the norm. This result may be explained by the "Broken Window Theory" (Wilson and Kelling [36], Keizer *et al.* [37]). This theory suggests a broken window in a building, *i.e.*, a signal of

another's non-compliance to a social norm, will lead to more broken windows and, if gone unpunished, could escalate to larger crimes in a community. Further investigation of such norm formation and how procedural details affect it is an interesting direction for future research.[15]

Our findings may help explain the mixed results of the previous literature on framing, feedback, and matching in public goods games and related social dilemmas. Extreme behavior at both ends of the strategy space leads to high variance in cooperation. Such high variance could lead to very different results in small samples typical of experiments. Furthermore, our results suggest interactions between these design features, so one design choice (e.g., level of feedback) may affect the observed treatment effect of another variable (e.g., framing). Critically, this finding suggests framing effects may exist, but are not always observed in other studies that focus on average cooperation as the primary variable of interest.

Finally, like Fujimoto and Park [14] and Cox [17], our finding of heterogeneous treatment effects for men and women suggests uncontrolled gender differences might partly explain previous mixed results. Other uncontrolled variables, as well as differences in statistical power, may also be part of the explanation. Nonetheless, our results suggest researchers studying framing, feedback, and matching in social dilemmas should be aware of how these design features may interact, as well as the potential for heterogeneous treatment effects by gender.

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Author Contributions

Both authors contributed equally to this article.

Conflicts of Interest

The authors declare no conflict of interest.

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