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All Symmetric 2x2 One-Shot Games and How They Might Be Played

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The symmetric 2x2 one-shot game is one of the simplest and most commonly used representations of strategic conflict. Among others, it includes the prisoner's dilemma, the game of chicken, the volunteer's dilemma, and the assurance game. All of these games share three characteristics: (1) both players have to make a single choice between two options; (2) they decide simultaneously; and (3) the payoff structure is symmetric. Figure 1 depicts the payoff matrix of such a symmetric 2x2 one-shot game. We use the notation Rapoport (1967) introduced for the prisoner's dilemma where players' options are cooperation (C) or defection (D): P stands for the penalty received for mutual defection; R for the reward received for mutual cooperation; T for the temptation payoff received for defecting against a cooperating partner; and S for the sucker's payoff received for cooperating while the partner defects. Note that the labels "cooperation" and "defection" can be interpreted literally only when T > R > P > S as in the prisoner's dilemma. Nevertheless, we adopt this notation for all symmetric 2x2 one-shot games.

P1 / P2	C	D
C	R, R	S, T
D	T, S	P, P

Figure 1: Payoff matrix of a symmetric 2x2 one-shot game.

Typically, social scientists who examine (symmetric) 2x2 one-shot games either focus on one game or compare a small number of such games (e.g., Capraro et al., 2020; de Heus et al., 2010; Franzen, 1995). There are comparatively few studies which analyzed (symmetric) 2x2 one-shot games in a more comprehensive manner (e.g., Brams & Mattli, 1993; Bruns, 2015; Rapoport & Guyer, 1966; Kilgour & Fraser 1988). The goal of the present paper is to initiate research on the strategies people use to play any or all symmetric ordinal two-player two-moves games. We propose comparisons between eight different strategies (see Appendix for a listing of the games). As will be shown, this analysis lays the groundwork for many possible follow-up projects.

The total number of 67 symmetric ordinal two-player two-moves games is derived as follows: Factorial combination of the four outcomes R, S, T, P assuming a value between 1 and 4 yields symmetric 256 payoff matrices. We assume that the worst outcome is always 1 and that either R or T yields the best outcome (i.e., 4). There are

- 12 games without ties (i.e., 4 unique values for R, S, T, P),
- 44 games with one tie (i.e., 3 unique values for R, S, T, P),
- 5 games with double ties (i.e., 1 and 4 appear twice),
- 6 games with triple ties (i.e., three 1's and one 4 or three 4's and one 1).

For the sake of simplicity, the games' payoffs are restricted to range from 1 to 4. In order to calculate mixed strategies, the payoffs are on an interval scale.

The eight strategies to play the games are: standard game theory (Nash equilibrium), Rapoport's (1967) K-Index, selfish superrationality (Diekmann, 1985), prosocial superrationality, collective maximization, projection (Krueger et al., 2012), the individualist heuristic, and the collectivist heuristic. These eight strategies should largely exhaust the space of possible approaches to symmetric 2x2 one-shot games as they include: a rational maximizer who wants to maximize their individual payoff (Nash equilibrium), the collective payoff (collective maximization), or a combination of both (K-Index) while being ignorant about the co-player's choice; a heuristic maximizer who chooses the option with higher expected individual payoff (individualist heuristic) or with higher expected collective payoff (collectivist heuristic) while being ignorant about the co-player's choice; a heuristic maximizer who chooses the option with higher expected individual payoff while projecting that the co-player choose the same option with *p* = 2/3 (projection);[1] and a rational maximizer who knows that the co-player is also a rational maximizer (and vice versa) and that both

[1] A heuristic maximizer who chooses the option with higher expected collective payoff while projecting that the co-player chooses the same option with *p* = 2/3 leads to the same strategy as the collectivist heuristic, which is why we do not list it.

players know that from each other, with being selfish (selfish superrationality) or prosocial (prosocial superrationality).

In what follows, each of these strategies is presented in more detail. Note that for all strategies, *p* indicates the probability of choosing C. Furthermore, EU_i (X) is the expected utility of doing X from a selfish perspective; EU_c (X) is the expected utility of doing X from a collective perspective. For players who are ignorant about their co-player's choice, EU_i (C) = (R+S)/2, EU_i (D) = (T+P)/2, EU_c (C) = (2R+S+T)/2, and EU_c (D) = (2P+S+T)/2.

Standard Game Theory (Nash Equilibrium)

In the case of standard game theory, a player wants to maximize their individual payoff while being ignorant about their co-player's choice. Accordingly, the player follows the following strategy:

1. If one option leads to a better individual outcome regardless of what the other player does, choose that option.
2. Otherwise, choose *p* such that C and D lead to the same expected individual outcome, which is the case if: $p = \frac{P-S}{P+R-T-S}$.

Rapoport's K-Index

In the case of Rapoport's K-Index, a player wants to maximize both their individual payoff and the collective payoff (or some trade-off of the two) while being ignorant about their co-player's choice (see Rapoport, 1967). Accordingly, the player follows the following strategy:

1. If $EU_i(C) > EU_i(D)$ and $EU_c(C) > EU_c(D)$, then choose C.
2. If $EU_i(C) < EU_i(D)$ and $EU_c(C) < EU_c(D)$, then choose D.
3. If $EU_i(C) = EU_i(D)$, then choose the option with higher EU_c.
4. If $EU_c(C) = EU_c(D)$, then choose the option with higher EU_i.

5. If $EU_i(C) = EU_i(D)$ and $EU_c(C) = EU_c(D)$, then apply a mixed strategy $p = 0.5$.[2]
6. Otherwise, apply a mixed strategy with $p = \frac{R-P}{T-S}$ (which is the actual "K-Index").

Selfish Superrationality

In the case of selfish superrationality, each player wants to maximize their individual payoff and knows that the co-player wants to do so too (and vice versa), which is why they end up choosing the same option or mixed strategy (see Diekmann, 1985). Accordingly, the player follows the following strategy:

1. If (precisely) one of the two possible mutual actions maximizes collective payoff, choose the option resulting in that mutual action.
2. If both possible mutual actions maximize collective payoff but only one of the mutual actions maximizes individual payoff, choose the option that maximizes individual payoff.
3. Otherwise, optimize the payoff function in regard to p under the assumption that the other player does so too, which leads to:[3] $p = \frac{S+T-2P}{2(S-R+T-P)}$.

Prosocial Superrationality

In the case of prosocial superrationality, each player wants to maximize the collective payoff and knows that the co-player wants to do so too (and vice versa), which is why they end up choosing the same option or mixed strategy (see Diekmann, 1985). Accordingly, the player follows the following strategy:

1. If (precisely) one of the two possible mutual actions maximizes collective payoff, choose the option resulting in that mutual action.
2. Otherwise, optimize the payoff function in regard to p under the assumption that the other player does so too, which leads to: $p = \frac{S+T-2P}{2(S-R+T-P)}$.

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[2] Here, the player is actually indifferent between C and D and could therefore choose any *p*.

[3] This formula only leads to a "maximizing" p if $R + P > S + T$.

Collective Maximization

In the case of collective maximization, a player wants to maximize the collective payoff while being ignorant about their co-player's choice.[4] Accordingly, the player follows the following strategy:

1. If one option leads to a better collective outcome regardless of what the other player does, choose that option.
2. Otherwise, choose p such that C and D lead to the same expected collective outcome, which is the case if: $p = \frac{S+T-2P}{2(S-R+T-P)}$.

Individualist Heuristic

In the case of the individualist heuristic, the player chooses the option which leads to the higher expected individual payoff while being ignorant about their co-player's choice.

1. If $EU_i(C) > EU_i(D)$, then choose C.
2. If $EU_i(C) < EU_i(D)$, then choose D.
3. If $EU_i(C) = EU_i(D)$, then apply a mixed strategy with $p = 0.5$.[5]

Collectivist Heuristic

In the case of the collectivist heuristic, the player chooses the option which leads to the higher expected collective payoff while being ignorant about their co-player's choice.

1. If $EU_c(C) > EU_c(D)$, then choose C.
2. If $EU_c(C) < EU_c(D)$, then choose D.
3. If $EU_c(C) = EU_c(D)$, then apply a mixed strategy with $p = 0.5$.[6]

Projection

[4] Thanks to Jim Allen for suggesting this strategy.
[5] Here, the player is actually indifferent between C and D and could therefore choose any *p*.
[6] Here, the player is actually indifferent between C and D and could therefore choose any *p*.

In the case of projection (see Krueger et al., 2012), the player chooses the option which leads to the higher expected individual payoff while projecting that the co-player chooses the same option with $p = 2/3$.

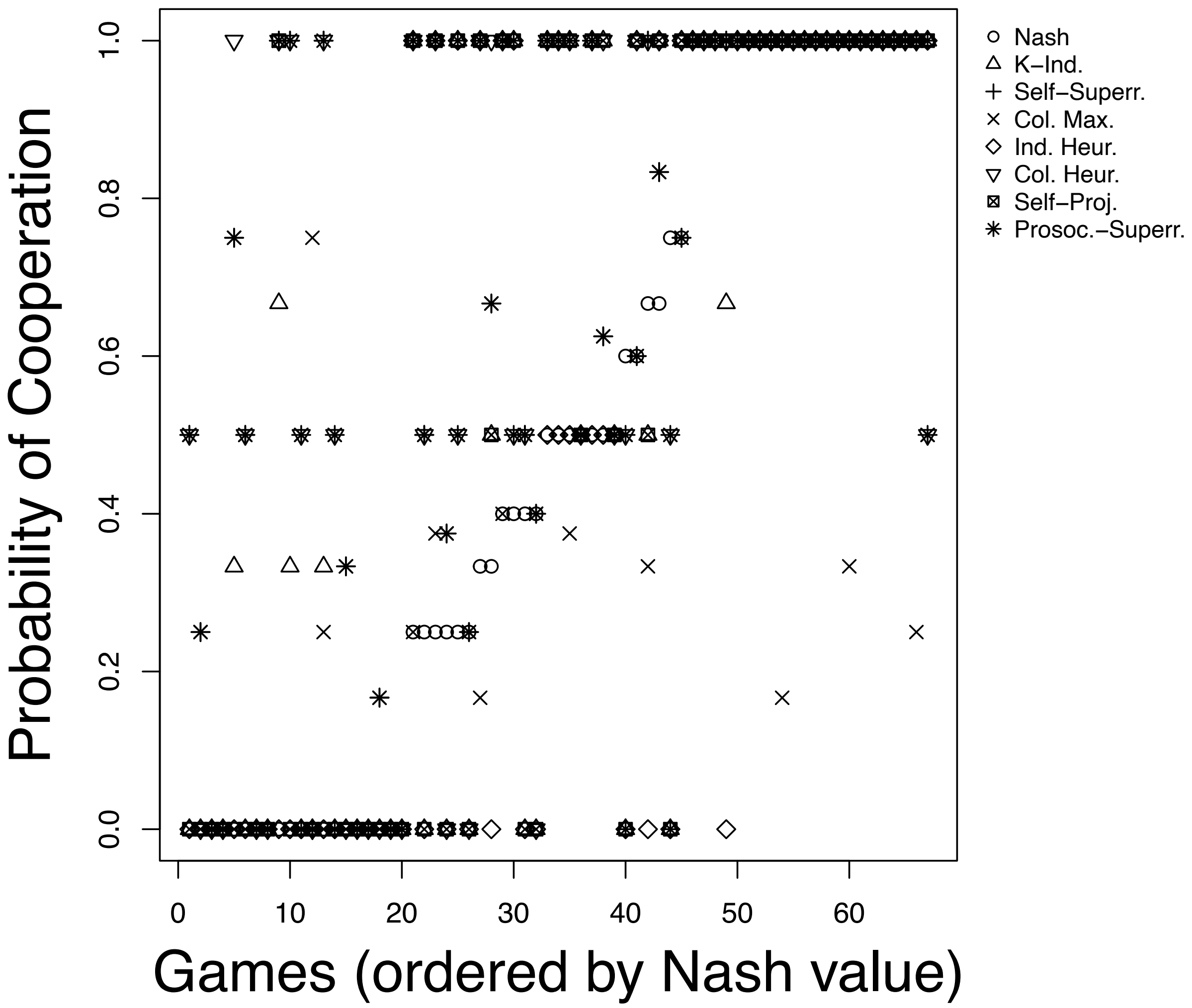
1. If $\frac{2R+S}{2P+T} > 1$, then choose C.
2. If $\frac{2R+S}{2P+T} < 1$, then choose D.
3. If $\frac{2R+S}{2P+T} = 1$, then apply a mixed strategy with $p = 0.5$.[7]

Non-Redundancy of Strategies

For 27 of the 67 games, the different strategies suggest the same level of cooperation, which results in an average correlation of the probabilities of cooperation across all games of $r = .76$ (with *r*s ranging from .49 for collective maximizer with individualist heuristic to .98 for selfish projection with the K-index). The average correlation drops to $r = .54$ in the subset of 40 games where at least one strategy disagrees with another one. Of particular interest for empirical comparisons, there are 33 games in which at least one strategy suggests a cooperative move ($p_c > .5$) and at least one strategy suggests a defective move ($p_c < .5$). Figure 2 displays the probabilities of cooperation suggested by the different strategies with each strategy coded by a different symbol. The games were arbitrarily ordered from lowest to highest Nash value.

Figure 2. *Probabilities of cooperation suggested by the different strategies.*

[7] Here, the player is actually indifferent between C and D and could therefore choose any *p*.



As can be seen in Figure 2, the set of 67 games includes sufficient variation of the probabilities of cooperation suggested by the different strategies to allow for empirical contrasts.

Possible Empirical Research Projects

The list of the 67 symmetric 2x2 one-shot games and the cooperation probabilities following afforded by these eight strategies forms a basis for several possible follow-up projects. To mention four such projects: First, participants could play all 67 games. This would provide first empirical data on the whole set of symmetric 2x2 one-shot games. In a next step, it could be analyzed which of the eight strategies predicts participants' choices best, revealing whether players rather focus on individual or collective payoff, are rather rational or heuristic, or make specific assumptions about their co-player.

Second, a study could concentrate on those games where the eight strategies lead to markedly different predictions. For example, in games #23 (Mid Hunt) or #33 (Mid Battle / Volunteer’s Dilemma minor), five of the eight strategies make a distinct prediction, ranging from D as a dominant strategy to C as a dominant strategy. A close analysis of such games could provide valuable insights into how they are played and, in this way, which (if any) of the eight strategies players follow.

Third, participants could play those games where the eight strategies lead to the same (mixed) choice. If participants’ choices differ from what the eight strategies predict, they must follow some other strategy or play randomly. Accordingly, such a study could reveal whether the eight strategies are any good in explaining players’ choices and, given they are not, how participants actually play symmetric 2x2 one-shot games.

Fourth, the ecological validity of the whole set of symmetric 2x2 one-shot games could be explored. How often do people actually experience situations that resemble these matrix games? Work by Columbus et al. (2021) suggests that daily life provides more coordination situations than dilemma situations. The prevalence of different games might explain why the predictions of the different strategies are more closely borne out for some games than for others, assuming that greater experience makes for better judgment.

Of course, many other studies that build on this paper’s groundwork are possible too. With the present paper, we therefore hope to inspire future research projects that aim at better understanding the whole set of symmetric 2x2 one-shot games and how they are played.

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Appendix

This appendix lists the payoff matrices for all 67 symmetric ordinal two-player two-moves games and the probability of cooperation mandated by each of eight strategies. If there is a * next to the probability, it means that the player is indifferent and could choose any probability. We have noted the probability of 0.5 in such cases because 0.5 constitutes the mean value of all possible probabilities. Names of the games were adopted from Bruns (2015). The appendix is also available as .csv and .xls files as online supplemental material.

1. Basic Dilemma

P1 / P2	Cooperate	Defect
Cooperate	1, 1	1, 4
Defect	4, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0.5	0.5	0.5	0	0.5*	0

2. Low Lock Minor

P1 / P2	Cooperate	Defect
Cooperate	1, 1	1, 4
Defect	4, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0.25	0.25	0.25	0	0	0

3. Low Lock

P1 / P2	Cooperate	Defect
Cooperate	1, 1	1, 4
Defect	4, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

4. Double Compromise

P1 / P2	Cooperate	Defect
Cooperate	1, 1	1, 4
Defect	4, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

5. Low Dilemma minor

P1 / P2	Cooperate	Defect
Cooperate	2, 2	1, 4
Defect	4, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	1/3	0.75	0.75	0.75	0	1	0

6. Mid Lock minor

P1 / P2	Cooperate	Defect
Cooperate	2, 2	1, 4
Defect	4, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0.5	0.5	0.5	0	0.5*	0

7. Deadlock

P1 / P2	Cooperate	Defect
Cooperate	2, 2	1, 4
Defect	4, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

8. High Lock

P1 / P2	Cooperate	Defect
Cooperate	2, 2	1, 4
Defect	4, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

9. Low Dilemma

P1 / P2	Cooperate	Defect
Cooperate	3, 3	1, 4
Defect	4, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	2/3	1	1	1	0	1	1

10. Prisoner's Dilemma

P1 / P2	Cooperate	Defect
Cooperate	3, 3	1, 4
Defect	4, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	1/3	1	1	1	0	1	0

11. Mid Lock

P1 / P2	Cooperate	Defect
Cooperate	3, 3	1, 4
Defect	4, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0.5	0.5	0	0.5*	0

12. High Lock major

P1 / P2	Cooperate	Defect
Cooperate	3, 3	1, 4
Defect	4, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0.75	0	0	0

13. Basic Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 1
Defect	1, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

14. Low Concord minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 2
Defect	2, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

15. Low Concord

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 3
Defect	3, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

16. Double Hunt/Dilemma

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 4
Defect	4, 1	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	1	1	1	1	0.5*	1	1

17. Low Coordination minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 1
Defect	1, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	1	1	1	0.25	1	1	1

18. Mid Hunt minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 2
Defect	2, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1/3	1	1	1	1/6	1	1	1

19. Stag Hunt

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 3
Defect	3, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	1	1	1	1	0.5*	1	1

20. High Hunt/Dilemma

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 4
Defect	4, 1	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	2/3	1	1	1	0	1	1

21. Low Coordination

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 1
Defect	1, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.4	1	1	1	0.4	1	1	1

22. Assurance

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 2
Defect	2, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	1	1	1	0.375	0.5*	1	1

23. Mid Hunt

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 3
Defect	3, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	2/3	0.5	1	1	1/3	0	1	0.5*

24. High Hunt/Dilemma major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 4
Defect	4, 1	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	1/3	1	1	0.25	0	1	0

25. Double Coordination

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 1
Defect	1, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	0.5*	0.5	0.5	0.5	0.5*	0.5*	0.5*

26. High Assurance

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 2
Defect	2, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.6	0	0	0.5	0.5	0	0.5*	0

27. High Assurance major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 3
Defect	3, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.75	0	0	0.5	0.5	0	0.5*	0

28. Reverse Triple Lock

P1 / P2	Cooperate	Defect
Cooperate	4, 4	1, 4
Defect	4, 1	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0.5	0.5	0	0.5*	0

29. Low Battle minor

P1 / P2	Cooperate	Defect
Cooperate	1, 1	2, 4
Defect	4, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	0	0.5	0.5	0.5	0	0.5*	0

30. Mid Compromise minor

P1 / P2	Cooperate	Defect
Cooperate	1, 1	2, 4
Defect	4, 2	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	1/3	1/3	1/3	0	0	0

31. Compromise

P1 / P2	Cooperate	Defect
Cooperate	1, 1	2, 4
Defect	4, 2	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

32. High Compromise

P1 / P2	Cooperate	Defect
Cooperate	1, 1	2, 4
Defect	4, 2	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

33. Mid Battle/Volunteer's Dilemma minor

P1 / P2	Cooperate	Defect
Cooperate	2, 2	2, 4
Defect	4, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1/3	0.5	2/3	2/3	2/3	0	1	0.5*

34. Chicken

P1 / P2	Cooperate	Defect
Cooperate	3, 3	2, 4
Defect	4, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	1	1	1	1	0.5*	1	1

35. Low Harmony minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 1
Defect	1, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

36. Mid Harmony minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 2
Defect	2, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

37. Concord

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 3
Defect	3, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

38. High Chicken/Concord

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 4
Defect	4, 2	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

39. Mid Peace minor

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 1
Defect	1, 2	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1/6	1	1	1

40. Coordination

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 1
Defect	1, 2	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	1	1	1	0.375	1	1	1

41. High Coordination

P1 / P2	Cooperate	Defect
Cooperate	4, 4	2, 1
Defect	1, 2	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.4	1	1	0.5	0.5	1	0.5*	1

42. Low Battle

P1 / P2	Cooperate	Defect
Cooperate	1, 1	3, 4
Defect	4, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.4	0	0.5	0.5	0.5	0	0.5*	0

43. Hero

P1 / P2	Cooperate	Defect
Cooperate	1, 1	3, 4
Defect	4, 3	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	0	0.375	0.375	0.375	0	0	0

44. Mid Compromise

P1 / P2	Cooperate	Defect
Cooperate	1, 1	3, 4
Defect	4, 3	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	1/6	1/6	1/6	0	0	0

45. Mid Compromise major

P1 / P2	Cooperate	Defect
Cooperate	1, 1	3, 4
Defect	4, 3	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

46. Battle

P1 / P2	Cooperate	Defect
Cooperate	2, 2	3, 4
Defect	4, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	1	0.625	0.625	0.625	0.5*	1	1

47. Mid Battle / Volunteer's Dilemma

P1 / P2	Cooperate	Defect
Cooperate	3, 3	3, 4
Defect	4, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	2/3	1	5/6	5/6	5/6	1	1	1

48. Low Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 1
Defect	1, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

49. Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 2
Defect	2, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

50. Mid Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 3
Defect	3, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

51. High Chicken / Concord major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 4
Defect	4, 3	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

52. Peace

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 1
Defect	1, 3	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

53. Mid Peace

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 1
Defect	1, 3	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1/3	1	1	1

54. High Coordination major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	3, 1
Defect	1, 3	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	1	1	0.5	0.5	1	0.5*	1

55. Double Hero

P1 / P2	Cooperate	Defect
Cooperate	1, 1	4, 4
Defect	4, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.5	0.5*	0.5	0.5	0.5	0.5*	0.5*	0.5*

56. High Hero

P1 / P2	Cooperate	Defect
Cooperate	1, 1	4, 4
Defect	4, 4	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.4	0	0.4	0.4	0.4	0	0	0

57. High Hero major

P1 / P2	Cooperate	Defect
Cooperate	1, 1	4, 4
Defect	4, 4	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.25	0	0.25	0.25	0.25	0	0	0

58. Reverse Triple Harmony

P1 / P2	Cooperate	Defect
Cooperate	1, 1	4, 4
Defect	4, 4	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0	0	0	0	0	0	0	0

59. High Battle

P1 / P2	Cooperate	Defect
Cooperate	2, 2	4, 4
Defect	4, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.6	1	0.6	0.6	0.6	1	1	1

60. High Battle major

P1 / P2	Cooperate	Defect
Cooperate	3, 3	4, 4
Defect	4, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	0.75	1	0.75	0.75	0.75	1	1	1

61. Double Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 1
Defect	1, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

62. High Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 2
Defect	2, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

63. High Harmony major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 3
Defect	3, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

64. Triple Harmony

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 4
Defect	4, 4	1, 1

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

65. High Peace

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 1
Defect	1, 4	2, 2

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	1	1	1	1

66. High Peace major

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 1
Defect	1, 4	3, 3

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	1	0.25	1	1	1

67. Triple Lock

P1 / P2	Cooperate	Defect
Cooperate	4, 4	4, 1
Defect	1, 4	4, 4

	Nash	K-Index	Self. Sup.	Pros. Sup.	Coll. Max.	Indiv. Heur.	Coll. Heur.	Proj.
p	1	1	1	0.5	0.5	1	0.5*	1