PRISONER'S TRILEMMA

GAME THEORY IN ACTION

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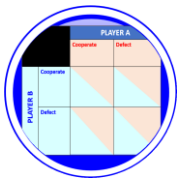
30-60 min

2-6

10+



Game Theoretic Genre

RULES VERSION 3
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THE TECH DECK

Playing cards were created in China during the 9th Century. Playing cards were imported into Europe from Mamluk, Egypt, in 1370. By 1377, the French used playing cards with Hearts, Diamonds, Clubs and Spades. The Tech Deck **MODERNIZES** classic playing cards by depicting 21st century concepts on each card. It is **PORTABLE** and **VERSATILE**: play games anywhere, any time with anyone. It is a **GAME PLATFORM** you can play many games with.

THE DOMAINS (SUITS) OF THE TECH DECK

KNOWLEDGE (BOOK) INFORMATION TECHNOLOGIES
Knowledge is facts and information accumulated by science. It is the theoretical and practical understanding of a subject foundational to science and technology.

SCIENCE (BEAKER) RESEARCH & DEVELOPMENT
Science is organized knowledge with testable explanations. The natural sciences (biology, chemistry, and physics) study nature. The social sciences (economics, psychology, and sociology) focuses on societies. The formal sciences (logic, mathematics, and computer science) are for abstract concepts.

TECHNOLOGY (GEAR) INDUSTRY, MANUFACTURING
Technology is the application of scientific knowledge for practical purposes. Engineering is the creative application of science and math to the design and construction of machines, systems, and processes.

SERVICES (GLOBE) MARKETING
Services are the integration of knowledge, science and technology to create a product to benefit consumers. Services provide a benefit or product for a customer.

GAME THEORY GENRE

GAME THEORY GENRE – Game Theory as a discipline was founded by John von Neumann and Oskar Morgenstern in 1944 with their book *Theory of games and Economic Behavior* to study two-person zero-sum games. Now, modern Game Theory is the science of logical decision making in humans, animals, and computers through strategic interactions among agents. It has applications in all fields of social science, logic, systems theory, and computer science. Game Theoretic Games include the Prisoner's Dilemma, Selton's Chain Store Paradox, Shelling's Solitaire, O'Neill's Card Game and the Ultimatum Game.

OBJECTIVE & WINNING THE GAME

OBJECTIVE OF THE GAME – Players try to score points based on outcomes of their decisions for various trilemmas. Players get points from a payout table based on whether other players chose to cooperate, betray, or compromise.
GAME END – The game ends after five rounds (after five trilemmas are considered).

GAME SETUP

CREATE TEAMS – This is a head-to-head game. If playing with more than 2 players, divide players into two teams. One player/team is designated Player A or Pa. The other player/team is designated Player B or Pb.
PREPARE DECKS – Expel (remove) the Wild cards. Take out the Science domain cards to form the Payout deck. Expel the values 8 through 13 of the Technology domain cards. Shuffle the remaining cards together to form the draw deck.
DRAW CARDS – Each player/team draws 13 cards from the common draw deck. Have the Trilemmas for use.

1 **CREATE TEAMS** Divide into 2 teams

2 **EXPEL CARDS** Expel Wilds & 8-13 of

2 **SETUP DECKS**
Common Draw Deck
Payout Deck

3 **DRAW CARDS** Each team draws 13 cards

BASIC GAME THEORY CONCEPTS & PRISONER'S DILEMMA

GAME THEORY CONCEPTS – Game theory uses the basic concepts of a *Game, Players, Rules, Strategies* and *Payoffs*. Modern Game Theory is the science of logical decision making in humans, animals, and computers through strategic interactions among agents.

GAMES – Games can be *cooperative, non-cooperative, zero-sum, non-zero-sum, repeated,* and *single-play*. In *cooperative games*, players can form binding commitments. A game is non-cooperative if players cannot form alliances or agreements. Collaborative game theory studies how groups of coalitions interaction or behave with known payoffs. In a *symmetric game*, payoffs depend only on the other strategies used, not on who is using them. In asymmetric games, there are strategies that are not identical available to the players. In *Zero-sum games*, the choices by players can neither increase nor decrease the available resources. *Simultaneous games* are ones where both players move simultaneously, or where players are unaware of the earlier players' actions. *Sequential games* (or dynamic games) are games where later players have some knowledge about earlier actions.

RULES – The rules are the directions to be followed to play a given game.

STRATEGIES – The strategies are the set of all possible actions that define the behavior of the players in a game. Game theory studies which strategies players might employ given a set of rules and available strategies based on what rivals do. A *Dominant strategy* is the best strategy for a player irrespective of the ones used by other players.

EQUILIBRIUM STRATEGIES – A key concept in game theory is the idea of equilibrium strategies developed by John F. Nash, Jr. A *Nash equilibrium* is where everyone in a game pursues their best possible strategies given other player's strategies.

PAYOFFS – Player *payoffs* are received from arriving at a specific outcome of a game. These outcome rewards are described in a *payoff matrix* that can have *continuous* or *discrete payoffs*. Information available to players can be *symmetric* (equally known) or *asymmetric* (secretive). Players may *collude* (collaborate), negotiate, or *betray* (oppose) other players.

GAME THEORY NORMAL FORM – The normal or strategic form of a game is represented by a matrix showing the players, strategies, and payoffs. It can be represented by any function that associates a payoff for each player with every possible combination of actions. The example below is one of a 2-player 2-strategy game. The two players are Player A (Pa) and Player (Pb). Each player has two strategies (#1 and #2) available to them, which are shown in the rows and columns. The payoff matrix describes the outcomes of the player's choices with some example payouts.

Normal Form Payout Table	Player A (Pa) picks strategy #1	Player A (Pa) picks strategy #2
Player B (Pb) picks strategy #1	Payout for Pa picking #1 & Pb picking #1. Pa gets 2, Pb gets 3.	Payout for Pa picking #2 & Pb picking #1. Pa gets 6, Pb gets 7.
Player B (Pb) picks strategy #2	Payout for Pa picking #1 & Pb picking #2. Pa gets 4, Pb gets 5.	Payout for Pa picking #2 & Pb picking #2. Pa gets 8, Pb gets 9.

PRISONER'S DILEMMA – The Prisoner's Dilemma is the most famous example in Game Theory where the police have caught two criminals for a misdemeanor but thought to have committed a felony. The police offer a deal to each person: if they will betray the other with incriminating testimony they will be let go. However, if each betray the other, they will both serve a lot of time in prison. If they both stay silent, they can only be convicted of the minor misdemeanor. This classic example has a canonical payoff matrix and a Nash equilibrium.

Prisoner's Dilemma Payout Table	Player A (Pa) Cooperates	Player A (Pa) Betray
Player B (Pb) Cooperates	If both Pa & Pb cooperate, they are convicted of a misdemeanor and serve 1 year each.	Pb cooperates and serves 12 years in prison. Pa betrays and goes free.
Player B (Pb) Betray	Pa cooperates and serves 12 years in prison. Pb betrays and goes free.	If both Pa & Pb betray, they are convicted of a felony, and both serve 10 years each.

GAME THEORY APPLICATIONS – Game theory has been used in computational economics, experimental economics, behavioral economics, and information economics to study auctions, bargaining, pricing, fair division, duopolies, oligopolies, social networks, equilibriums, and voting systems. Game theory has been used in Political Science for political economy, public choice, war bargaining, positive political theory, and social choice theory. In Biology, it is used to study fighting behavior, territoriality, biological altruism, and evolutionarily stable strategy (ESS). In Computer science, Game theory is used to model interactive computations, multi-agent systems, and algorithmic game theory. It is also used in Philosophy, the Retailing industry, and Epidemiology.

PRISONER'S TRILEMMA GAME PLAY

Prisoner's Trilemma is played in rounds. Each game round has the following phases:

1. DRAW PHASE – Each player/team draws two cards from the deck.

2. SELECT TRILEMMA PHASE – Select any of the 10 Trilemmas from these rules or select any of the 20 from the Trilemma website home page for players to ponder in the round.

3. TRILEMMA PHASE – Players consider the selected Trilemma with a fixed payout table (below). If playing in teams, players may deliberate. Decide whether you/team will cooperate, defect or compromise. Choose a service domain card to represent cooperating. Use a knowledge domain card to defect. Choose a technology domain card to compromise. Each player/team plays their chosen card face down. Reveal cards and consult the Trilemma phase payout table. Find the cell in the Payout table below based on the cards played to calculate scores. Note the scores.

PAYOUTS TABLE FOR TRILEMMA PHASE

Trilemma Phase Payout Table	Player A (Pa) Cooperates (Service Domain)	Player A (Pa) Defects (Knowledge Domain)	Player A (Pa) Compromises (Tech)
Player B (Pb) Cooperates	If both Pa & Pb cooperate, they each get a 1 points	Pb cooperates scores 1 points. Pa defects and scores 2 points.	Pb looks at face down Game Theory Phase card. Pa Scores 0.
Player B (Pb) Defects	Pa cooperates scores 1 points. Pb defects and scores 2 points	If both Pa & Pb defect, they score 0 points.	Pb looks at face down Game Theory phase card. Pa Scores 0.
Player B (Pb) Compromises	Pb looks at the face down card for Game Theory Phase. Pa Scores 0.	Pb looks at the face down card for Game Theory Phase. Pa Scores 0.	Both Pa & Pb see face down Game Theory Phase card.

4. GAME THEORY PHASE – Reveal a card face up from the Payout Deck for the cooperate payout score card; another for the defect payout score card. Draw a third payout card and place it face down for the compromise payout card. Reshuffle the payout discard to form a new Payout Deck if necessary. Players consider the Trilemma again. If playing in teams, players may deliberate. Decide whether you/team will cooperate, defect or compromise. Choose a service domain card from your hand to represent cooperating. Use a knowledge domain card to defect. Choose a technology domain card to represent compromising. Play the chosen card face down.

5. GAME THEORY SCORING PHASE – Both players/teams reveal their chosen face-down play cards. The Game Theory Phase uses the Game Theory Payout table below. Find the cell in the Game Theory Payout table based on the row and column of the revealed player cards. Follow the instructions in the Game Theory Payout table cell. Some instructions will have you claim Payout (science) score cards. Discard any unclaimed Payout (science) score cards.

6. CHECK FOR END OF GAME – The game ends after the fifth game round. Afterwards, calculate scores. Add the points earned from all five Trilemma phases. Value 1-8 Payout (science) score cards in your/team score pile are worth 1 point. Value 9-13 Payout (science) score cards are worth 2 points.

PAYOUTS TABLE FOR GAME THEORY PHASE

Game Theory Payout Table	Player A (Pa) Cooperates	Player A (Pa) Defects	Player A (Pa) Compromises
Player B (Pb) Cooperates	The highest service card gets the cooperate payout card. The other player gets the lowest payout card.	Pa takes the lowest payout (score) card from a player. Cooperator (Pb) takes the cooperate payout Card.	Pb takes cooperate payout card. Pa takes compromise payout card.
Player B (Pb) Defects	Pb takes the lowest payout (score) card from a player. Cooperator (Pa) takes the cooperate payout card.	Defector (Pa) takes any payout (score) card from a Player. Cooperator (Pb) takes the cooperate payout Card.	Pb takes defect payout card. Pa takes compromise payout card.
Player B (Pb) Compromises	Pa takes cooperate payout card. Pb takes compromise payout card.	Pa takes defect payout card. Pb takes compromise payout card.	Highest Tech card player may swap 2 cards between the two score piles.

#1: PRISONER'S TRILEMMA

Two people are captured by the police each for a minor crime (misdemeanor). However, the police suspect that they have committed a major crime (felony). They separate them into two separate rooms and make an offer to each. If one will betray the other and testify against the other, they will cut them a deal and offer to let them go. This is a Self-imposed moral dilemma.

- **COOPERATE:** If they both cooperate with each other, and do not assist the police, both can only be convicted of the minor misdemeanor crime and serve a light sentence.
- **BETRAY:** If one betrays the other, testifying against them, the betrayer serves no time. The other will be convicted of the major crime, serving time for a felony. If both betray each other, they will each serve a lot of jail time, both being convicted of a felony.
- **COMPROMISE:** If either compromises, they will try to make a deal with the police working with their lawyer to create a middle ground offer. The new deal will possibly be better than the original one.

#2: THAT SINKING FEELING

Your daughter and her best friend are swimming in the ocean and are caught in a sudden storm. Your daughter is a strong swimmer. However, her friend is a weak swimmer. Your daughter asks you to save her friend. You can only assist one person. This is an Obligation moral dilemma.

- **COOPERATE:** If you cooperate with your daughter's request, you will surely save her best friend. But you must trust in your daughter's swimming ability to get herself to safety.
- **BETRAY:** If you betray your daughter's request and choose to save your daughter, she is sure to survive. However, her friend is likely to drown.
- **COMPROMISE:** If you compromise, you try to find a middle ground. You will work to save your daughter. If it is clear she can get to safety, you will switch to assist her best friend. However, there is a chance that both will drown.

#3: THE GREATER OF TWO GOODS

You are driving and two people dart out in front of your car from opposite sides of the road. You have just enough time to decide to swerve choosing to hit the person on the left or right. Do you hit the president of your country or your wife? This is a Prohibition moral dilemma.

- **COOPERATE:** If you cooperate, you hit the president of the country and your wife lives.
- **BETRAY:** If you choose to betray, you will hit your wife and the president of your country will live.
- **COMPROMISE:** If you choose to compromise, you slam on the brakes hoping to try to navigate between the two people. You will hope that the two will each only glance off the side of the car. But you this move is risky, may end up killing both instead.

#4: YOUNG AND INNOCENT

You are the prosecuting lawyer for a high-flying court case. The defendant is accused of a serious crime. Deep into the trial, you discover that there is credible evidence that proves the defendant is truly innocent. This is a Prohibition moral dilemma.

- **COOPERATE**: If you cooperate, you will throw the case in favor of the defendant and allow the innocent defendant to go free.
- **BETRAY**: If you betray, you will prosecute the case to the best of your ability, sending the innocent person to jail.
- **COMPROMISE**: If you choose to compromise, you will attempt to strike a deal with the defendant and defending lawyer. This has a chance to fail; however, it also has a chance to save your reputation and put your conscience at ease.

#5: GET RICH QUICK SCHEME

Your best friend requests for you to make a sizeable investment in what you assess is a get rich quick scheme. You estimate that this "business opportunity" is unlikely to produce favorable results. Additionally, it is questionable in its legality. Should you support your best friend?

- **COOPERATE**: If you choose to cooperate with your best friend, you provide a large investment into his business opportunity that has only a small chance to produce potentially large returns.
- **BETRAY**: If you choose to betray your friend, you point out that it is unlikely to succeed and respectfully decline to support him.
- **COMPROMISE**: If choose to compromise, you choose to make a small investment in his scheme. However, even a small investment might indict you as a conspirator, if the activity is deemed illegal.

#6: A MATTER OF PRINCIPLES

You have promised your spouse to be at a social event that you are hosting for your anniversary. You have been planning this event for months. Many of your close friends will be at the event. However, your presence is needed at a crucial project presentation that has just been scheduled at the same time. This project is dear to you. Will you choose to celebrate your anniversary or make the project presentation?

- **COOPERATE**: If you choose to support your spouse and host the anniversary event, it is likely that the project presentation will fail.
- **BETRAY**: If you choose to betray your spouse, and instead support the project presentation the project will get the funding that it needs to proceed.
- **COMPROMISE**: If you choose to compromise, you will try to seek an alternative. You will try to move the date of one of the two events. However, this will require quite a bit of effort and may cause both events to fail.

#7: TRAPPED

You and a good friend go diving together. You are exploring some underwater caves. Suddenly the cave entrance trembles and froths with bubbles starts to collapse. Your friend's leg has become pinned by a rock. Will you save yourself or stay to help your friend, possibly endangering both of your lives?

- **COOPERATE:** If you choose to cooperate with your friend to try to free him, it is possible that both of you will die as the cave entrance collapses.
- **BETRAY:** If you choose to betray your friend, you will certainly get to safety, and very likely your friend will perish.
- **COMPROMISE:** If you seek to find a compromise, you will see if there is any way to prevent the collapse or delay it. This might buy you enough time to free your friend and escape. However, there is also a chance that this method will not work, and you will both perish.

#8: PROMISES, PROMISES

You have promised a loved one that you would be able to attend an event very special to them, such as their birthday. You have been looking forward to the event for a month now. However, on the day of the event, one of your best friends asks you for help. They are counting on you for help.

- **COOPERATE:** If you cooperate, you will keep your promise to your loved one, and attend their special event.
- **BETRAY:** If you betray your loved one, you will forego attending their special event and help your best friend instead.
- **COMPROMISE:** You can try to partially attend your loved one's special event for a time and then go to help your friend. However, due to the separation in distance of the two events, it is possible that by the time you get to the place where to help your friend their event will have passed.

#9: TEMPTATION

You have made a promise to yourself to cut back on sugary snacks and desserts. You are at a large party with close friends, and they have an amazing spread of snacks and desserts. These heavenly foods look incredible and beckon to you.

- **COOPERATE:** If you cooperate with your dietary promise, then you will show discipline and avoid the temptation to dive into the desserts.
- **BETRAY:** If betray the promise to yourself, you will give in and sample a range of culinary masterpieces.
- **COMPROMISE:** If you compromise, you will mostly keep to your promise and only indulge in one small piece of your favorite dessert. However, there is a strong chance that you will completely break down and fall down a slippery slope of eating many desserts.

#10: THE CAREER LESS TRAVELED

Your good friend, in your estimation, is about to make a bad decision. He is about to pursue a career in Medicine to become a doctor, but you know this is a profession that he is considering just to appease his parents. He has already confessed to you that it is not a profession he is interested in. Your friend loves music, is a very talented composer, and has a dream to form a band. You know he would estrange his parents if he pursued a career in music.

- **COOPERATE**: If you cooperate with your friend, you encourage them to pursue their dreams in the music industry and confront his parents about their career expectations of him.
- **BETRAY**: If you betray your friend, you encourage him to obey his parents but abandon his musical aspirations.
- **COMPROMISE**: If you compromise, you will speak to your friend's parents in order to persuade them to let your friend pursue his dreams. However, this has a chance to backfire; and you may draw the scorn of your friend's parents.

TERMS & DEFINITIONS

1. **CARD** – An individual card which has a value, a domain (suit) and a game effect.
2. **DISCARD** – Discarded cards go to the discard.
3. **DOMAIN** – One of the four suits in the game (information, technology, science, services).
4. **(Domain symbols)** – The four domain symbols are equivalent to suits.
5. **EXCHANGING** – Exchanging two cards causes two cards to swap places putting one where the other card was.
6. **EXPEL** – A card that is expelled is permanently removed from the game.
7. **PICK** – The act of selecting something (a player, card, company).
8. **SUIT** – A term used inter-changeably with domain. The traditional suits (club, heart, spade, diamond) are also printed on the cards in the Tech Deck to help you acclimate to domains.

TECH DECK RESOURCES: RULES, VIDEOS

Rules and videos for Tech Grid Poker, Tech City, Tech Exchange, Tech Chess, Gears of Industry, Chronological, Elevator Pitch, Peer-to-Peer and Cardoku are at my homepage cheung.interzone.com, Boardgamegeek (BGG) and my Youtube channel.

CREDITS

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