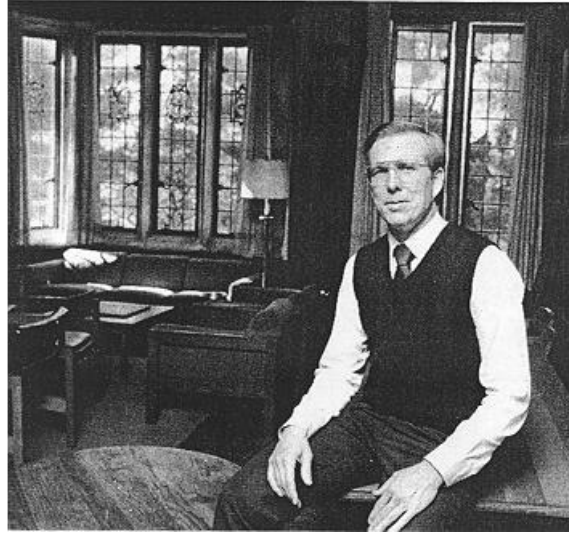# The Bible

And Opera

Read Chapter 16

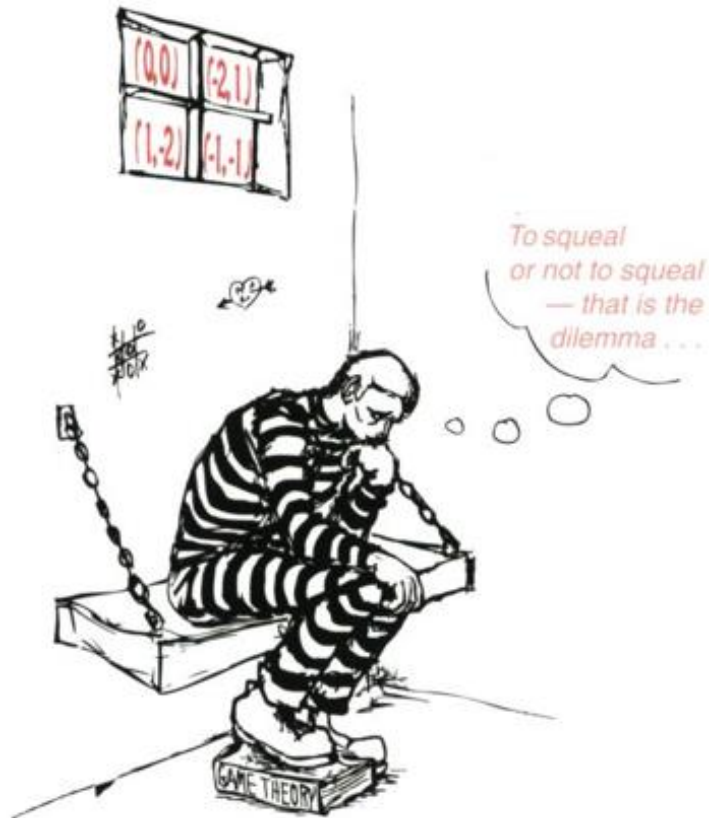# Prisoner's Dilemma (1950)

Prisoner's Dilemma

Albert William Tucker
1905 - 1995

Two members of a criminal gang are arrested and imprisoned. Each prisoner is in solitary confinement with no means of speaking to or exchanging messages with the other. The police admit they don't have enough evidence to convict the pair on the principal charge. They plan to sentence both to a year in prison on a lesser charge. Simultaneously, the police offer each prisoner a bargain: If he testifies against his partner, he will go free while the partner will get three years in prison on the main charge. Oh, yes, there is a catch ... If *both* prisoners testify against each other, both will be sentenced to two years in jail.
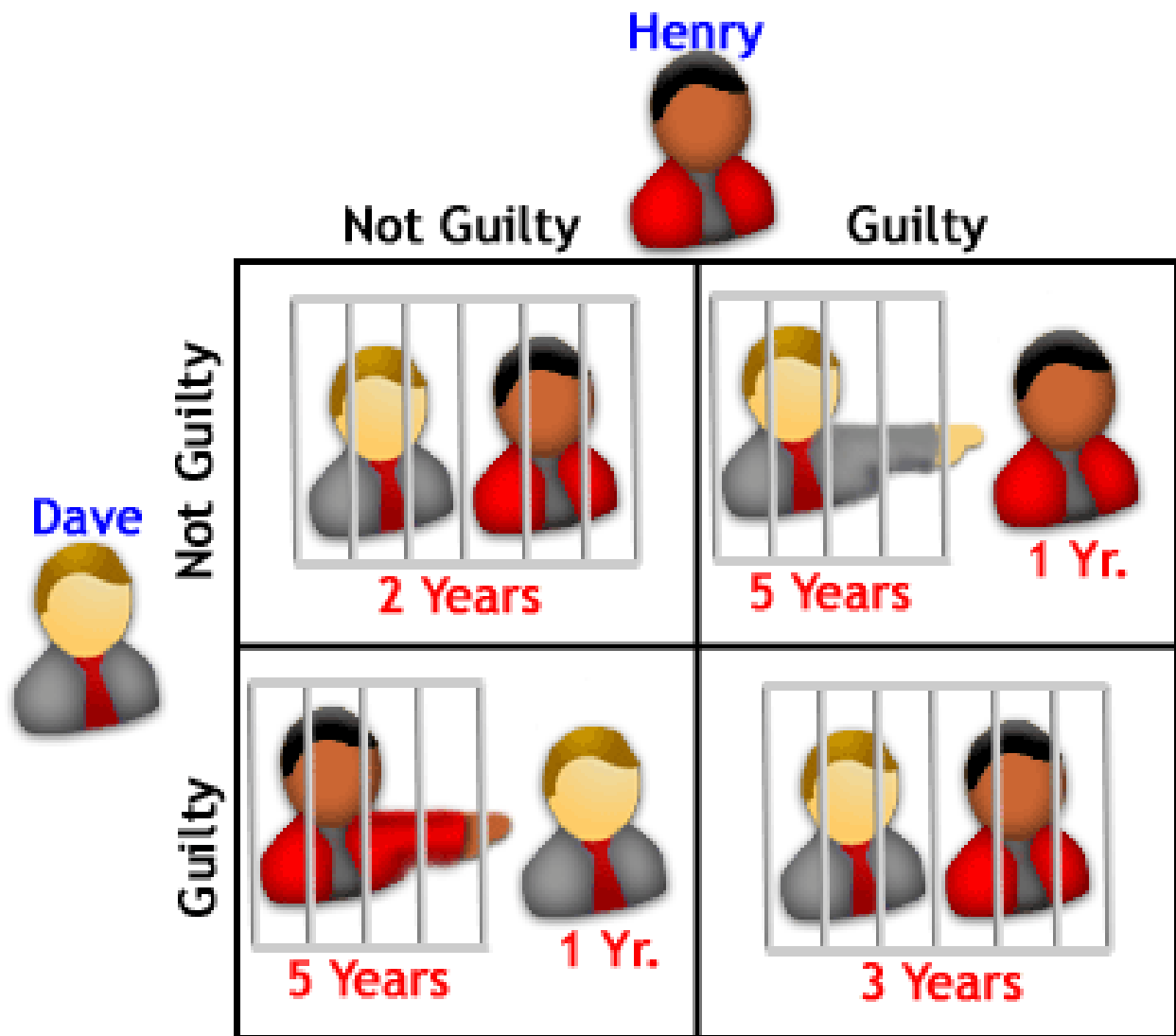
GAME THEORY and STRATEGY

PHILIP D. STRAFFIN

The Mathematical Association of America

Henry

Not Guilty   Guilty

Dave

Not Guilty

2 Years

5 Years   1 Yr.

Guilty

5 Years   1 Yr.

3 Years

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TOSCA

**To free the man she loves,
Tosca must love the man she hates.**

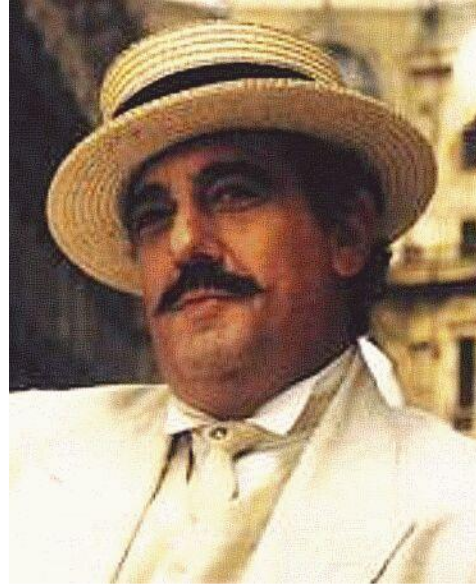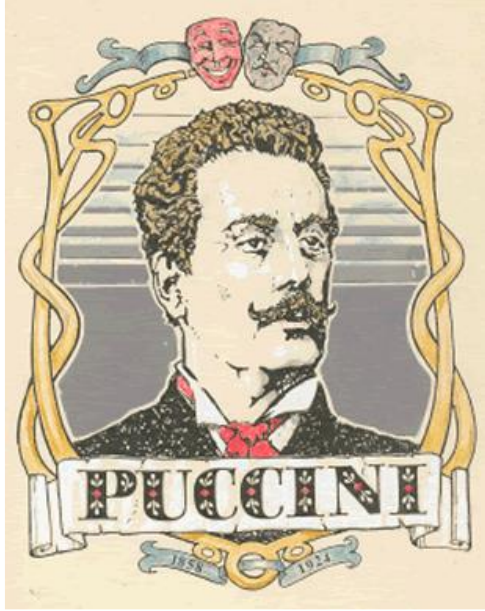*Is she prepared to make that kind of sacrifice?*

Puccini's **Tosca** is a tragic love story and a nail-biting thriller, from the famous dark opening chords to its unforgettable conclusion

.

Giacomo Antonio Domenico Michele Secondo Maria Puccini

(December 22, 1858 – November 29, 1924)

PUCCINI

1858 – 1924

FLORIA TOSCA

MARIO CAVARADOSSI

BARON SCARPIA

Prisoner's Dilemma in Puccini

| | Scarpia | |
	Keep Bargain	Double Cross
Tosca **Keep Bargain**	3	1
Double Cross	4	2

Payoffs to Tosca

| | Scarpia | |
	Keep Bargain	Double Cross
Tosca **Keep Bargain**	3	4
Double Cross	1	2

Payoffs to Scarpia

	Scarpia	
	Keep Bargain	**Double Cross**
Tosca **Keep Bargain**	(**3**,**3**)	(**1**,**4**)
Double Cross	(**4**,**1**)	(**2**,**2**)

Payoffs to Both

https://www.youtube.com/watch?v=ciPRoKKkD0k
(English subtitles)

https://www.youtube.com/watch?v=kHYFegbB7vk

https://www.youtube.com/watch?v=6GAF0szCcbQ

http://www.youtube.com/watch?v=-I8JCNUe_wI

https://www.youtube.com/watch?v=1CI879BlUwY (finale)

https://www.youtube.com/watch?v=O_tsPysOvxo (finale, English subtitles)

Angela GHEORGHIU - Vissi d'arte

https://www.youtube.com/watch?v=kYB2voRoa54
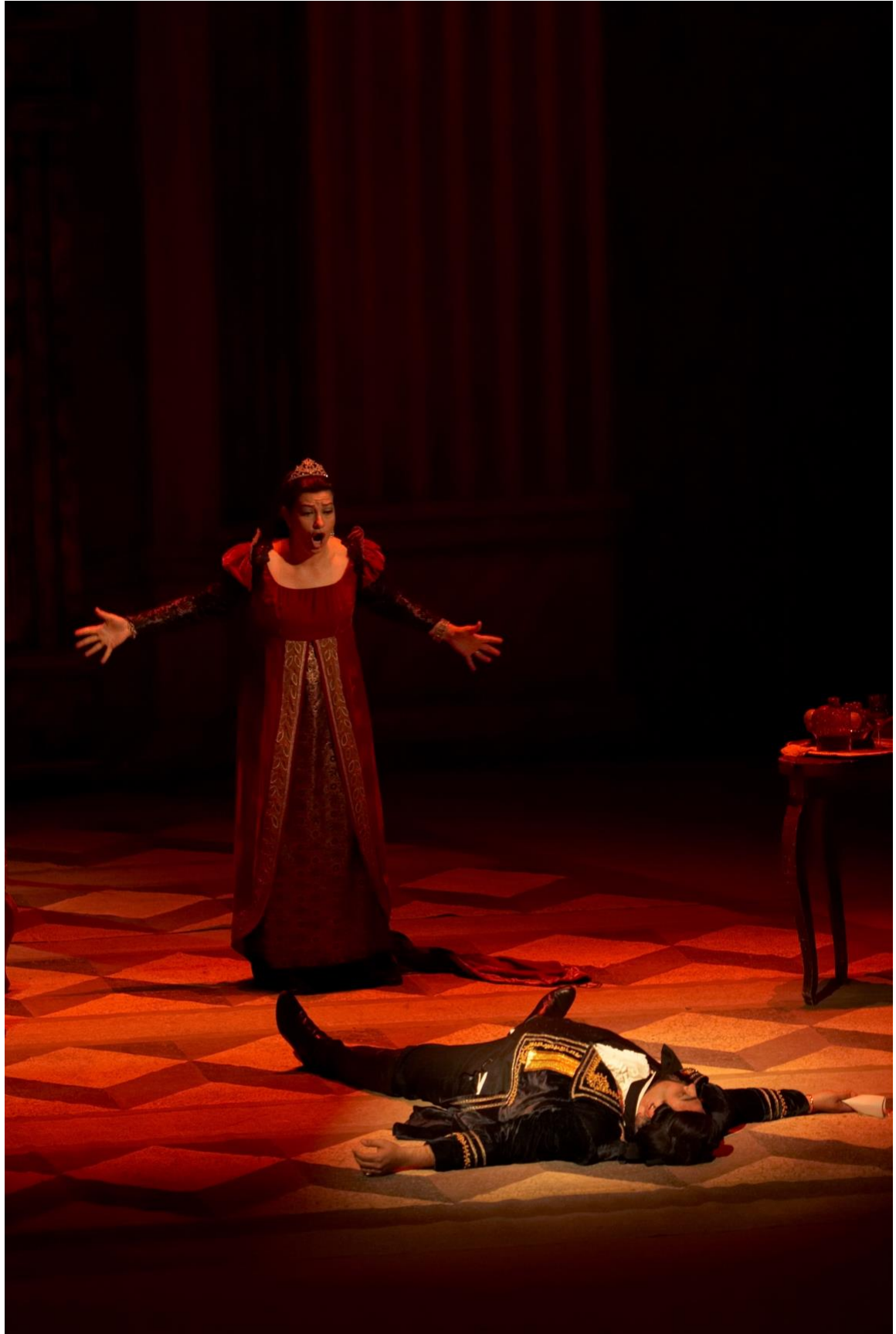
The action takes place in Rome, in June 1800

ACT I

The church of Sant'Andrea della Valle

Angelotti, a political prisoner who has just escaped from the fortress of Castel Sant'Angelo, runs into the church, looks for a key and uses it to open a private chapel, where he hides. The Sacristan bustles about and the painter Mario Cavaradossi continues work on his picture of Mary Magdalene.

He has used as his model a fair-haired woman who has been frequenting the church. While admiring her fair beauty, he prefers the dark loveliness of his mistress, the celebrated singer Floria Tosca. When the Sacristan goes outside, Angelotti emerges from his hiding place and is recognised by Cavaradossi as a fellow revolutionary. Tosca is heard calling to Cavaradossi and he advises Angelotti to hide again, giving him a basket of food he has brought for his own meal. Tosca, having heard his voice, is suspicious that he has been entertaining a woman. He soothes her and they look forward to being together in his villa after her concert that night. She is about to leave when she sees the painting. Her jealousy is aroused again, particularly when she recognises the model as the Marchesa Attavanti. Cavaradossi assures Tosca that he does not know the lady, but has seen her in the church, and she leaves, warning him playfully henceforth to paint only dark-eyed women. Angelotti, emerging from the chapel, reveals that the Marchesa Attavanti is his sister, her presence in the church due to her part in his escape plan, as she has brought women's clothes for him and hidden them in the family chapel. Cavaradossi offers him refuge in his villa outside the city, but before he can leave, a cannon shot signals that the escape has been discovered, and Cavaradossi leaves with him.

The Sacristan, full of the news of the defeat of Napoleon, calls the choirboys to prepare to sing a celebratory Te Deum. Their riotous celebration is interrupted by the arrival of Scarpia, the chief of police, with some of his agents. A search verifies his suspicions that Angelotti had taken refuge in the church, one clue being a fan which Angelotti has

dropped. Tosca, returning to tell her lover that she will be late that night because she has to sing in a victory cantata, is disconcerted to find him gone. Scarpia, who has had a lustful eye on her for some time and suspects Cavaradossi's part in the escape, plays on her jealousy in the hope that she will lead him to Angelotti. He shows her the fan, claiming that he found it near the painter's easel - a sign of an interrupted assignation.

Recognising the Attavanti crest, she is only too easily persuaded that Cavaradossi has been unfaithful and sets off for the villa to confront the supposed lovers. Sending his agents after her, Scarpia congratulates himself on the success of his plans, then joins in the Te Deum.

ACT II

Scarpia's apartment in the Villa Farnese that night. Scarpia eats his supper as he waits for his agents to bring in Angelotti. He sends a note inviting Tosca to visit him after the victory cantata. He is furious when his agent Spoletta confesses that they had found no trace of Angelotti, but mollified when he learns that they have arrested Cavaradossi because of his suspicious behavior. Cavaradossi defies Scarpia and denies knowing anything about Angelotti, so Scarpia orders his interrogation - using any means necessary. He is unsuccessful in his attempt to trick Tosca into revealing Angelotti's whereabouts, but she is unable to resist Cavaradossi's cries of pain as he is tortured, and gives the information.

Cavaradossi reproaches her bitterly. When news is brought that Napoleon had after all been victorious at Marengo, he exultantly taunts Scarpia, who orders his immediate execution. At first Scarpia turns a deaf ear to Tosca's pleas for mercy, but then reveals that the price for Cavaradossi's life is Tosca herself. In despair, she sees no way out, despite her revulsion, which only makes her more desirable in Scarpia's eyes.

In her presence he gives the orders for a fake execution, expressing himself in such a way that it is clear to Spoletta, but not to Tosca, that the execution is in fact to be real. She demands a safe-conduct for herself and Cavaradossi, so that they can leave Rome for ever. As he writes it,

she notices a knife on the table, and as Scarpia prepares to embrace her, she stabs him.

ACT III

Castel Sant'Angelo towards dawn

A shepherd sings in the distance and church bells ring as preparations are made for the execution. Cavaradossi tries to write a last letter to Tosca, but is overcome by memories of their happiness.

Tosca runs in with the safe-conduct and tells him that she has killed Scarpia. Telling him about the mock execution, she instructs him how to fall and wait till the soldiers have gone, but when she calls him, Cavaradossi does not move and she discovers that he is dead. Angry cries indicate that Scarpia's death has been discovered and Spoletta leads the soldiers in pursuit of Tosca, but she leaps from the battlements.

"A fascinating, provocative, and important book."
—Douglas R. Hofstadter,
author of Godel, Escher, Bach

THE
Evolution
OF
Cooperation

ROBERT AXELROD

What Game Theory Tells Us About Donald Trump

Hillary Clinton is tasked with outwitting the human equivalent of a four-line computer program

Game theorists have studied the counter-punching strategy Donald Trump is now known for. Joe Raedle/Getty

Donald Trump likes to brag about his negotiating skills, but for a tough negotiator, he's awfully easy to manipulate. There are two types of people in Trumpland: those who are nice to Donald, and those who are not nice to Donald. If you flatter Trump, he'll treat you well. If you criticize him, he'll retaliate. "I'm a counter-puncher," he once told CNN.

So to win Trump's favor, just say something sweet about him; Vladimir Putin praised him last December, and Trump has been preening over the compliment ever since. And to deliberately draw Trump's fire, say something nasty about him; last week Elizabeth Warren called him a bully and a loser, which dragged him into a distracting and unpresidential tweetfight with someone who is not his opponent.

Game theorists have studied the counter-punching strategy Trump is now known for. In 1980, political scientist Robert Axelrod invited

colleagues to design computer programs that would compete against each other in a contest of cooperation and betrayal known as the prisoner's dilemma. In the game, two criminals are offered immunity to turn the other in. If only one snitches, he goes free, and the other receives a five-year sentence. If both inform on each other, they get four years. If neither talks, they get two years. The game is played repeatedly, so each player faces the same choice over and over, whether to be a nice guy who protects his accomplice or a nasty one who betrays him.

One of the tournament contestants was a four-line computer program called Tit for Tat. Its strategy was simple: Whenever the other player snitched, Tit for Tat retaliated by informing on that player in the next round. Whenever the other player kept silent, Tit for Tat returned the favor by staying mum the next round. By maximizing cooperation with "nice" players and punishing "nasty" ones, Tit for Tat outmaneuvered its opponents and won the tournament.

This election cycle, we have Tit for Trump. From politicians to journalists to pollsters, Trump is quick to praise anyone who speaks favorably of him, and even quicker to denigrate those who don't. "If I am treated unfairly," he once warned BuzzFeed, "I will go after that reporter." Referring to his Republican primary opponents, he told CNN, "I thought these people were all fine, and they came after me, and then I had to go after them."

So far, the tit-for-tat strategy seems to have paid off. Trump's reputation for ferocious counterattacks helped dissuade opponents from tangling with him early in the Republican primary. Other GOP leaders refrained from criticizing him out of fear that he would retaliate against "unfair" treatment by launching a third-party campaign. As Trump's opponents fell behind, they were finally forced to engage. One by one, Lindsey Graham, Rand Paul, Jeb Bush, Marco Rubio and Ted Cruz entered Trump's tit-for-tat universe and went down under a hail of insults.

Unfortunately for Trump, not all adversaries are as hapless as the Republican presidential hopefuls. Unlike game-theory automatons, humans can identify the tit-for-tat strategy and use the knowledge to manipulate their opponents. That is Trump's weak spot, a dangerous one if he were to become president. Savvy operators like Putin would soothe Trump with praise while quietly undercutting American interests. Conversely, adversaries who wanted to drag America into diplomatic or military quarrels could provoke Trump's fury with well-placed barbs.