

Game Theory and The Dark Knight

There are many reasons that "The Dark Knight" is an awesome movie. But we are going to sidestep all those and focus on the parts that appeal to the mathematician in each of us. Joker's cunning schemes and his lethal use of game theory added a whole new dimension to the movie, never seen before in a superhero flick. As such, the entire movie is immersed in a series of games.

Let us discuss the part which is the clearest illustration of game theory. This happens to be the ferry scene, a situation very similar to the classic Prisoner's Dilemma.

In the scene, the Joker has rigged to ferries carrying people out of Gotham with explosives. One ferry consists of mostly ordinary civilians, while the other one is carrying prison inmates and some guards. The Joker has rigged both to explode, and he has given the crew on each boat the detonators - the detonator for the other boat. He announces the rules of the game to the crew and passengers of each vessel simultaneously:

- Each of them can detonate the other boat, meaning that the boat that does so first will live on.
- If by midnight none of the boats have been exploded, the Joker will explode both
- Any attempt to leave or defuse will also lead to destruction of both boats
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Now lets see how pay-off matrix for this problem looks like:

		Prisoner's Boat	
		Detonate	Don't detonate
Civilian Boat	Detonate	0, 0	1, 0
	Don't detonate	0, 1	0, 0

The tricky part for the people on both boats is to try and guess what the other party is likely to do. In game theory, we trust someone not because someone agreed on a plan with us or someone promised us something, but we trust someone because it is in his/her self interest to help us. Clearly, the best strategy in the above scenario is to rush and press the button as soon as possible. Thus, this situation would end in the destruction of both boats,

But it is not *that* simple. The assumption of a simple pay-off matrix like the one above is wrong, there are a few more complexities added to this game:

1. There would be likely legal and social consequences of blowing up the boat. These would also be different for the two boats. For the civilians, there is the social benefit of being moral agents in comparison to the stigma of being murderers. There might be legal repercussions (or it might be seen as a case of self defence-though it is arguable). The boat filled with civilians might feel entirely justified in blowing up a boat filled with felons to save themselves. The civilians would also feel more insecure due to the presence of felons on the other boat. On the other hand, the

prisoners might overlook the social and legal factors. They might feel even more insecure, since the society already views them as “worthy of punishment” and the other boat consists of civilians.

In my own personal view, being moral is never as beneficial as being alive, so survival should overshadow morality.

2. Also, there is a non-zero probability of rescue by midnight, especially due to the presence of a superhero in the city!

Thus the pay-off matrix would look more complex, depending on how much penalty is assigned to pressing the button, and the probability we assign to the rescue. The presence of complexities explains why this situation doesn't immediately degenerate into explosion. Example:

		Prisoner's Boat	
		Detonate	Don't detonate
Civilian Boat	Detonate	0, 0	1, 0.5
	Don't detonate	0.5, 1	0.7, 0.7

You can all draw your own pay-off matrix according to your opinions and strategy. The Joker could also be lying about the deadline. I personally think that considering the twisted mind Joker has, there's a high possibility that each boat had the detonators for their own boat! In any case, this film has set up the perfect platform for Riddler to become the master game theoretician in the next sequel. We can all hope, at least...

- Piyush Ahuja