

morality and significance of the act of giving.

The Game Theorist in the Dark Knight

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The Joker's (with reference to the movie "the dark knight") final act as a criminal mastermind involves two ferries filled with people. The first ferry is filled with normal, law-abiding citizens while the second ferry is filled with the inhabitants of Gotham Prison. The Joker, without having prior knowledge of the passengers and city officials in the two ferries, wires the ships with powerful explosives such that their detonation would destroy the ships and everyone who is aboard. No single individual is allowed to escape. Each ship is given a detonator for the other ferry. The use of the detonator saves the ship while killing everyone aboard on the other ship. Thus, if any member of Ship A pushes the detonator, then Ship B is destroyed and Ship A is saved. Additionally, if either ship fails to use the detonator to destroy its opponent (i.e. each other), the joker will destroy both ships. Assuming that the actors must make their decision simultaneously, the following game would result:

Figure 1: Joker's Ferry Game

		Ship B	
		Cooperate	Detonate
Ship A	Cooperate	0,0	0,1
	Detonate	1,0	0,0

Solving this game is pretty straightforward, and (detonation, detonation) becomes the dominant strategy as cooperation is weakly dominated. Thus, passengers on both ships have a very clear strategy to, destroy their opponents without fail and in doing so; both ships will be destroyed.

However, in Gotham City (the fictitious city in the movie), this does not happen - nor would it necessarily happen in a laboratory experiment even if few more complications are introduced into the game. First, the game appears to be pseudo-sequential or, perhaps, a series of simultaneous game with a finite end. The Joker gives both ferries 30 minutes in which they can detonate the other side. Even with this complication, the outcome should be the same and both actors ought to choose detonation at the first node. Using backward deduction, both players recognize that their opponent will choose to detonate in the final iteration even if there are some gains in short-term cooperation. In other words, if they cooperate then both the ships can remain undestroyed for at most 30 minutes, thus mutual detonation is the ultimate result.

Decision Rules—"Social norms"

It appears that the decision making process for both ships is different. In the ship containing prisoners, the decision to detonate is decentralized and any one actor willing to grab the detonator could do so. However there are armed guards in the ship as well which gives the contrary impression of authoritarianism. Decentralization becomes apparent as the clock ticks. Thus, decentralized decision-making should lead to optimal play as any single individual among the 500 has a preference for survival.

On the civilian ship, the decision mechanism becomes a simple majority vote. Yet, there is no executive to carry out the decision and the will of the majority does not prevail as no single sub-actor is willing to push the button. The civilians act rationally as long as they can individually and are not directly involved in carrying out a potentially immoral act.

Morality?

Perhaps social norms mattered for the actors in the game? In the second game, we can assume that there are some social benefits from being a moral agent; however, being moral is not as beneficial as being alive. Since survival trumps morality, we get the second game:

Figure 2: Joker's Ferry Game; Survival > Morality

		Ship B	
		Cooperate	Detonate
Ship A	Cooperate	1,1	1,2
	Detonate	2,1	0,0

The pure strategy equilibria is {cooperate-detonate} and {detonate-cooperate} with a Mixed Nash Equilibrium of playing cooperation and detonation with a probability of 0.5 for both players. The specification would change depending on how we parameterize the value for being moral and the value for surviving. However, this is not the full specification of the game; let's assume that the parameters allow for morality to trump survival:

Figure 3: Joker's Ferry Game; Survival < Morality

		Ship B	
		Cooperate	Detonate
Ship A	Cooperate	2, 2	2, 1
	Detonate	1, 2	0,0

Then the pure strategy Nash equilibrium is to never detonate as cooperation is always more beneficial than destroying the other ship. While both specifications may be able to explain the movie, I think there might be a fourth game that explains the game the best.

The Joker misspecified his Game?

While it is not the moral of the story that Batman wants the Joker or Gotham City to learn (in fact, he says that people are not all evil - there is some good in Gotham), adding an additional parameter to the game can easily induce a cooperation solution. If the people aboard both ships believe that the cost of dying is probabilistic, then they would cooperate as long as the benefit to cooperating trumped both the probabilistic chance of punishment and the likelihood that the other ship decides to detonate. Thus, each ship has to calculate the value for morality (m) minus the cost of punishment $P(c)$ and the cost of the other ship defecting $P(dx)(d)$ where x is the other actor. The cost of opponent defection and punishment are the same (the value of survival), so the equation reduces to:

$$U(\text{Ship A}) = M - (Pc + P(dB)) * (S)$$

$$U(\text{Ship B}) = M - (Pc + P(dA)) * (S)$$

Each equation must still be greater than the value of Survival Minus the Cost of morality such that for Ship A (or B with appropriate substitution):

$$S - M < M - (Pc + P(dB)) * S$$

If $M = S$, then the joint probability of punishment and opponent detonation must be less than 1 for cooperation to be preferred, else defection dominates. As M and S vary in relation to each other, the threshold for the joint probabilities to make a preference in strategy also changes. Here,

if the value for M is zero for the observed actor and survival is infinitesimal greater than 0, detonation dominates. Likewise, if we build in opponent morality into the probability of opponent detonation, and opponent morality is zero, then the cost of morality becomes too high. Obviously, the game becomes increasingly complicated, as these parameters are made endogenous.

The actors must determine a subjective probability of the game being false (i.e. there may be incomplete or incorrect information given to them by the joker, hence they need to figure out such things by themselves): may be, the probability of punishment is not 1. The probability of punishment could go down from a 100 per cent if the passengers believe that the Joker is lying about the deadline and if they think there is a chance of technological failure such that their detonator may indeed destroy their own ship (adding a hidden cost to detonation), or if they live in a world with Batman. I would venture forth to assume that the probability of punishment is inversely proportional to the probability that Batman exists with some modification based on his likelihood of failing to save people -- but that is just what I think me.

There are a few other circumstances in this movie that can be subject to game theory applications and I have not exhausted the ways in which this game could be modelled. However, I think this calls for a new villain in the third movie of the trilogy, "The Game Theorist", who will be more of riddler, but probably deadlier, and will compel Batman to use mathematics to fight crime.

References:

1. www.quantitativepeace.com/blog/2008/07/the-dark-knight.html

Costs and Benefits of a College Dropout

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III Year

"Whenever you find yourself on the side of the majority,

It is time to pause and reflect." ~ Mark Twain

Larry Ellison of Oracle, Bill Gates and Paul Allen of Microsoft, Mark Zuckerberg and Dustin Moskovitz of Facebook, Michael Dell of Dell Computers, Brian Dunn of Best Buy, Anna Wintour of Vogue, Barry Diller of IAC, John Mackey of Whole Foods, David Geffen, Ralph Lauren and Ted Turner. What is the common thing among these people? They are successful. What else? Yes, they are among those business leaders who got their starts without the benefit of degrees. We all know the story of Steve Jobs, who dropped out of Reed College. Even David Plouffe, senior advisor to President Barack Obama and architect of his innovative and historically unprecedented campaign, dropped out of the University of Delaware to work in politics (returning to complete his degree in 2010). President George W. Bush's top adviser, Karl Rove, and John McCain's 2008 campaign manager, Steve Schmidt, also lacked degrees. Examples are profound that prove that a degree or two from college may not be a necessary condition to achieve monetary success in life. Some would call these cases exceptional. Well, all of them? So, here I attempt to find a pattern in these unconventional realities of success. The article carries the assumption that we are taking into consideration factors other than