

# Game Theory Through Smartphone App Use in Support of for-Hire Transportation Network Companies

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## Abstract

The basic premise of For-Hire Transportation Network Companies (TNC) such as Uber and Lyft is to employ the use of the smartphones to communicate with their drivers and customers to operate. Drivers are summoned by customers through apps, which use GPS to guide the drivers to the destination. These smartphone apps for the drivers utilize Game Theory and variable rewards in their design and use to manipulate drivers to continue operating longer than they may have originally planned to and travel to locations they may not have desired to in order to gain a more expensive fare. The use of these apps manipulates behavior that takes much of the power from the independent contractor drivers and puts it in the hands of the companies. This paper focuses on the smartphone app manipulations of the two largest TNCs: Uber and Lyft.

**Keywords:** Uber, Lyft, Game Theory, smartphone, variable reward, addiction

## 1. INTRODUCTION

The Twenty-first Century ushered in the establishment of For-Hire Transportation Network Companies (TNC). The two best-known US companies are Uber and Lyft. Using a smartphone app, a rider will summons a driver to a location and after the ride is completed, will pay the TNC and hence the driver through the app. The driver also has a TNC app but it is designed for the driver community and will indicate whether they have a fare and where to pick them up. Additional information can be relayed such as the driver's photograph, the rider's name, etc. All the drivers are considered independent contractors and thus do not receive a salary from the TNC. All income related to their participation in the TNC comes from the fares they accept. The drivers do not know the course from when they receive the summons, which means they do not know how much they will receive from the fare. This incentivizes the driver to take as many fares as often as they can in order to receive the highest reimbursement. In addition to the

incentive to participate as fully as possible, TNCs have incorporated game theory into the design of their apps, both for the driver and the passenger to get them to participate as much as possible too. This paper examines the use of game theory through smartphone apps for the two largest US TNCs: Uber and Lyft.

## 2. UBER & LYFT BUSINESS MODELS

Uber and Lyft have at their heart business models which function similarly in that they use drivers' vehicles as transportation vehicles with drivers who act as independent contractors to pick up passengers who contact them through smartphone apps.

Uber, one of the most successful ride-sharing companies in the world, was conceptualized by Travis Kalanick in 2009. Available as a smartphone application, the Uber app allows users to book a cab ride from their desired pickup location to the required destination, with the utilization

of a couple of basic prerequisites – their location and an internet connection. (Singh, 2018, p. 1)

The apps function as guides to both the driver and passenger calculating a route to the location. This calculation also estimates a fare based upon location data and other variables such as events occurring at or near the location which might increase or decrease demand for transportation. Surge pricing affects fare calculations; high demand locations might be lower in fares and lower demand locations might be higher to incentivize drivers to move towards the lower demand areas and thus spread out the demand.

Surge pricing is displayed to drivers through a type of heat map visualization, where the algorithmic assessment of supply and demand will temporarily raise fares for a particular geographic location. (Rosenblat & Stark, 2016, pp. 3765-3766)

“Course-plotting technologies then determine the most suitable cab ride for them based on proximity and route, and the driver uses GPS and other such trackers to reach the client and deliver them to their destination” (Singh, 2018, p. 1). Riders can also pick from a number of car options: cars with more room and luxury models as well, for an increased initial fare charge. “The payment to be made by the client is systematized through an algorithmic procedure which takes into consideration the factors of time taken, distance traversed and fuel used. In fact, surge pricing also makes use of these algorithms” (Singh, 2018, p. 1).

“The business model of Lyft is something similar to that of Uber and that’s why Lyft is often termed as an alternative to Uber” (How Lyft works, n.d., p. 1). Uber riders sit in the back seat while Lyft riders are urged to join the driver in the front seat. This has given some the appearance that Lyft is the friendlier service than Uber.

Both of these business models are based upon supply and demand but not particularly in how one might normally consider the concept. Supply and demand is dictated by the TNCs to ensure there are always enough drivers dispersed over a wide area to keep up with variable demands. This concept uses game theory through the drivers apps to incentivize drivers’ opt-in to the concept.

### 3. GAME THEORY

What is Game Theory or Gamification and how does it relate to TNCs? “[Gamification] is the use of game elements – point scoring, levels, competition with others, measurable evidence of

accomplishment, ratings, and rules of play – in non-game contexts.” (Mason, 2018, p. 19) TNCs use all of these concepts in manipulating drivers’ participation. Game theory incentivizes optimum participation.

If you want to maximize addictiveness, all tech designers need to do is link a user’s action (like pulling a lever) with a *variable reward*. You pull a lever and immediately receive either an enticing reward (a match, a prize!) or nothing. Addictiveness is maximized when the rate of reward is most variable” [emphasis original] (Harris, 2016, p. 1).

The variable reward tricks the brain into anticipating what comes next and incentivizes it to continue to seek the reward. Uber and Lyft do not hide these manipulations, they rely on them. Work in general also uses gamification as a reward. “Salaries (*points*) rise with seniority (*levels*), which brings promotions and new titles (*badges*). [emphasis original] (Alter, 2017, p. 306)

“In the context of gaming, experts call this sensation the *ludic loop* – from the Latin *ludere*, for playful. You enter a ludic loop when, each time you enjoy the brief thrill of solving one element of a puzzle, a new and incomplete piece presents itself” [emphasis original] (Alter, 2017, p. 177). The ludic loop provides an anticipatory thrill which continues the function. Our brains are hard wired to seek the variable reward.

“Our neurochemical response to every ping and ring tone seems to be the one elicited by the ‘seeking’ drive, a deep motivation of the human psyche” (Turkle, 2011, p. 227). When we receive a signal from our smartphone device it elicits a shot of dopamine to our system, which reinforces the feeling that what we are doing is both pleasurable and important. “We are stimulated by connectivity itself. We learn to require it, even as it depletes us” (Turkle, 2011, p. 227).

“This unpredictability is addictive: behavioral psychologists have long understood that gambling uses variable reinforcement schedules – unpredictable intervals of uncertainty, anticipation and feedback – to condition players into playing just one more round” (Mason, 2018, p. 27). Gamification works, it is a powerful tool, an addictive one in some, and a fully embraced concept by the TNCs. What follows is a review of Uber and Lyft’s smartphone app manipulations to boost productivity and shepherd drivers towards locations of the TNC’s choosing. Additionally, the drivers’ manipulation of the TNC is discussed.

#### 4. UBER

Uber manipulates its drivers in the service of its corporate growth. "Employing hundreds of social scientists and data scientists, Uber has experimented with video game techniques, graphics and noncash rewards of little value that can prod drivers into working longer and harder – and sometimes at hours and locations that are less lucrative for them" (Scheiber, 2017, p. 1).

Uber actually refers to its algorithms as "decision engines." These "decision engines" track, log and crunch millions of metrics every day, from ride frequency to the harshness with which individual drivers brake. It then uses these analytics to deliver gamified prompts perfectly matched to drivers' data profiles. (Mason, 2018, p. 1)

"One recently implemented technique relies on the use of a 'binge-driving algorithm,' similar to Netflix's continuous play strategy, which encourages binge-watching. The algorithm connects the driver to their next ride before their current one ends, leveraging button size and placement that makes it much easier to accept the ride than turn it down" (Braude, 2017, p. 1). "In Uber's case, this means sending drivers their next fare opportunity before their current ride is even over" (Scheiber, 2017, p. 1). The feature is so successful that many drivers have complained that they don't have time to take a bathroom break for fear of missing the next fare. After so many complaints against the frequency of back to back driver requests, Uber finally introduced a pause button.

Because Uber drivers are considered independent contractors, there is no salary and thus every fare is important; the more fares you pick up the more money you make. However, the reality of the situation is that drivers do not make much of a living driving for Uber. "The Uber driver "wage"—comparable to the wages (reported for employees on federal tax Form W-2) earned by regular W-2 employees—averages \$9.21 an hour" (Mishel, 2018, p. 2).

However, Uber is not immune from drivers' pressure. In May 2019, two days before Uber's Initial Public Offering (IPO) of its stock, drivers went on strike. This was seen not so much as a protest of driving conditions but as a way of getting the company's attention and reducing the IPO value. (Hawkins, 2019b, p. 1) In June 2019, when California introduced legislation which would reclassify drivers as employees rather than independent contractors, thus requiring Uber to

pay a salary, Uber added additional features which drivers had been asking for.

The new scrollable "top opportunities" feed is probably the most significant change to the app. While it won't show crucial information like surge zones — the hexagonal grid areas are still found on the navigational map within the driver app — it will present an easy display of all the promotions, bonuses, and 'quests' that can earn them more money. (Hawkins, 2019c, p. 1)

"Over the past 20 years, behavioral economists have found evidence for a phenomenon known as income targeting, in which workers who can decide how long to work each day, like cabdrivers, do so with a goal in mind – say \$100 – much the way marathon runners try to get their time below four hours or three hours" (Scheiber, 2017, p. 1). However, through the gamification of the Uber app, drivers are compelled to go past these goals; driving longer than they first planned to and to places they might not have wanted to go to.

Uber has introduced feedback to drivers which quite literally makes it feel like they are playing a game.

Like players on video game platforms such as Xbox, PlayStation and Pogo, Uber drivers can earn badges for achievements like Above and Beyond (denoted on the app by a cartoon of a rocket blasting off), Excellent Service (marked by a picture of a sparkling diamond) and Entertaining Drive (a pair of Groucho Marx glasses with none and eyebrows). (Scheiber, 2017, p. 1)

Because Uber mediates its drivers' participation through an app, they can gamify as much of the experience as they want. All of these elements combine to remove much of the conscience decision making out of the drivers' hands.

The gamic elements of behavioral engagement tools, such as surge pricing, the conflation of real-time and predictive demand, and blind passenger acceptance, illustrate the multifaceted ways that Uber influences the relationship between supply and demand. (Rosenblat & Stark, 2016, p. 3771)

Uber is by no means the only service which manipulates its drivers. As we have indicated before, Lyft also uses many of the same techniques and theories to motivate their drivers.

## 5. LYFT

Lyft uses similar techniques to elicit driver's behaviors by providing immediate performance feedback. "Like the HUD, or head-up display in a first-person shooter game, the Lyft stat meter is always present, always showing you what your acceptance rating is, how many rides you've completed, how far you have to go to reach your goal" (Mason, 2018, p. 25).

Lyft also has an "Accelerate Rewards" program which encourages drivers to jump to the next level by completing a certain number of rides per month in order to unlock special rewards. These rewards are in the form of fuel discounts from Shell (Gold Level) and free roadside assistance (Platinum Level). (Mason, 2018, p. 26)

Drivers get very specific feedback on their performance.

Every week, Lyft sends its drivers a personalized "Weekly Feedback Summary." The summary includes passenger comments from the previous week's rides and a freshly calculated driver rating. It also contains a bar graph showing how a driver's current rating "stacks up" against previous weeks, and tells them whether they've been "flagged" for cleanliness, friendliness, navigation, or safety. (Mason, 2018, p. 18)

This report incentivizes good behavior from the driver and pushes many to provide a better riding experience for the riders: buying little snacks, candy, bottled water and such. Lyft does not require these items nor do they pay for them. This all comes out of the drivers' pockets.

Lyft also uses a heat maps to graphically represent areas where surge pricing are located. The surge areas are indicated using pink hues, the color Lyft originally used to differentiate it from Uber. Lyft cars had previously used a pink mustache affixed to the grill of the car, then used a small pink mustache on the dashboard. Drivers following these surge priced areas call it "chasing the pink." "The pink appears and disappears, moving from one location to the next, sometimes in a matter of minutes" (Mason, 2018, p. 27).

The same type of repetitive motions, chasing the pink to the next location, picking up the next fare, driving to the next location not knowing where until the rider gets to the car can cause a driver to lose track of time and distance. One driver noted "It gets to a point where the app sort of takes over your motor functions. It becomes almost like a hypnotic experience" (Mason, 2018, p. 28). Many times by the end of your "shift" you

are in an area which is on the other side of town from where you planned to operate and unless you are able to get another fare which wants to go where you started, the return trip is all on the driver. Lyft doesn't pay for that mileage.

Lyft drivers also protested before Lyft's IPO was introduced in March 2019. (Glaser, 2019, p. 1) Lyft tried to avert the strike by offering incentives to its drivers such as: "no-fee bank accounts, an expanded rental car program, and discounts on vehicle maintenance and repairs." (Hawkins, 2019a, p. 1)

Lyft is also more and more frugal in its reimbursement of its drivers. This leads to even more frustration and resentment. One driver explained, "Uber [dropped] their rates down from 80 cents a mile to 60 cents a mile. And to give context, the IRS says it takes about 58 cents a mile to operate a vehicle, so Uber is handing down basically a two-penny-a-mile profit to their drivers. No one can buy a decent life with only two pennies a mile in profit." (Glaser, 2019, p. 1; IRS, 2018, p. 1)

Drivers know they are being manipulated but it is still a powerful feeling to fight. One driver noted, "[t]his is the thing that is so brilliant and awful about the gamification of Lyft and Uber: it preys on our desire to be of service, to be liked, to be good. On weeks that I am rated highly, I am more motivated to drive. On weeks that I am rated poorly, I am more motivated to drive. It works on me, even though I know better" (Mason, 2018, p. 32).

## 6. CONCLUSIONS

The use of game theory, in and of itself, is neither entirely a good thing nor a bad thing. Game theory can be used to make the most mundane tasks fun and enhance the user's interactions. The use of it through smartphone apps with Uber or Lyft where drivers are being manipulated to chase after surge pricing areas, drive well beyond what they originally intended to go, keep goals just out of reach while providing variable rewards, is at best problematic. While it might be that drivers know they are being manipulated by game theory apps, that coupled with the low rate of pay for operating their own vehicles at their expense shows each company's disregard they have for their drivers' safety and well being. By keeping fares low and the use of independent contractors as a model for reimbursement shows how little regard the TNCs have for those who work for them. All these issues show that game theory through smartphone apps is just another way to game the system and further diminish the

participatory model for drivers and by extension, riders too.

## 7. FURTHER RESEARCH

This subject deals with a number of scientific disciplines: psychology, sociology, game theory, addiction to name a few. There is research possible in understanding smartphone use and abuse as well as cultural differences. Smartphone use among new users verses those who have grown up without the devices should be examined for differences in use rates and types of apps used. Finally, manipulator apps should be better understood. As smartphones and rides-sharing services are both less than fifteen years old, there is much which should be examined.

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When we browse the web through Google Chrome, for example, a dizzying array of companies follow us. Such is the Wild West of our modern web, but you still remain in control of which sites you visit and which social networks you log into. The shift to native apps changes this equation, however. Suddenly you're no longer in full control of what's loaded, nor of who is tracking you, and you must trust app developers to do the right thing. There are a dizzying array of companies you've never heard of invisibly tracking your habits in apps you use every day. Networks like Vungle, Apps Flyer, and Applovin all call themselves "advertising and analytics" platforms. They help developers monetize their apps, and all of them track data to sell to other partners behind the scenes as well.