The global revenue of video games market in 2016: $99.6 billion. The prize pool of “The International 2016” (a Dota 2 tournament): $20.7 million. The number of monthly active accounts in League of Legends: 60 million. Total number of viewers in League of Legends World Championship 2015: 334 million, with an average of 4.2 million tuned in at the same time. So video game industry is huge (and rapidly growing) and deserves some attention from academic researchers. Here is a list of market design problems that I find interesting.

1. Match Making:
In competitive games like League of Legends (Overwatch, Dota 2, Hero of the Storms etc), the match making system is very important. Most such games use the ELO system to measure players’ skill level (some games show players what their ELO ratings are and some don’t). To make each game fair and not one-sided, the match making system needs to find players of similar ELO for each game session. This can be problematic in high ELOs, especially in team games like League of Legends, where 10 players (5 vs 5) of similar skill level are needed for each game. Imagine now you are rank 1 in League of Legends, then the match making system has to match you with 9 other extremely skilled players, say from top 100. But it is highly likely that when you queue up for a game, there aren’t enough top 100 players who are also looking for a game, so you have to wait. In fact the queue time for high ELO players are usually around 20-50 mins (with a single game lasts on average 30ish mins). Situation goes worse when there are role selections. In League of Legends there are 5 roles, so each player from each team picks exactly 1 role in each game. This makes match making in high ELO even harder. Also, one role (support) is particularly unpopular, meanwhile each game needs 2 supports. So the match making system really struggles when finding support players. The current League of Legends matching system (Dynamic Queues) asks players to list their 2 most preferred roles and matches them to one of these 2 roles. Unfortunately somehow their matching algorithm is neither efficient, in the sense that two players may want
to trade roles, nor strategy-proof (never put support as your secondary role, unless you are fine with playing support 80% of the time; also if you are a support main, then you should list support/mid as your preference, you will get support 97% of the time.). So the question is can we create a better system? We know there is always going to be a trade-off between waiting time and match quality at high ELO, so a good matching mechanism should aim to find a balance between them. Two more minor points: 1. Queue time problem can amplify itself: a lot of high ELO players don’t want to wait 20 mins for a game, so they create their smurfs (second accounts) and eventually some of them have multiple accounts in the top rankings. This shrinks the match making pool of top players even further, since each of them only plays on 1 active account each time. 2. A match making system potentially provides incentives for playing unpopular roles. For example the old random serial dictatorship matching system in League of Legends would force the 5th pick to play support in many cases. Knowing that, some players may have incentive to practice support role and start playing support to rank up. Here is the reasoning: knowing that there is a high chance that the support in the enemy team does not know how to play support, then if I am half-decent at support, I should play better than him, assuming we are at a similar skill level. Therefore my team has a better chance of winning and I should be able to climb up to a ELO that is higher than my actual skill level. (In season 3 I know it is a free win for me when seeing enemy 5th pick playing support) On the other hand, systems that respect people’s preferences on roles would match support mains against each other, so such incentive no longer exists.

2. Last Minute Bidding:
In many non-competitive games, some form of trading mechanism (usually auctions) exists. Popular examples being World of Warcraft, Diablo 3, FIFA series etc. Some players see it as a bad thing: 1. it’s p2w (pay to win) 2. a lot of times playing the auction house is (much) more efficient than playing the actual game, so people lose incentive to play the game. On the other hand, trading is very important. Let me first explain some basics. In a video game of such type, players play the game (kill monsters etc) to earn two kinds of resources: 1. items that directly improve your game play 2. gold/coins that serve as a virtual currency. The key point is that usually item drops are random (good items generally have low drop rates), so players will keep playing the game for a long time in order to get the best items possible. Clearly this would generate the demand for trading. Of course, whether trading exists or not depends on game developers’ decisions, which can go either way. For example, Diablo 3 had two auction houses at the release, but two years later both were shut down. The main disadvantage of not having a trading mechanism is that, the item drop rates have to be high in such games, otherwise players would complain about the grind and quit after seeing no hope of getting what they want. But with high drop rates players quickly farm what they want and get bored
of the game really quick, which is also unhealthy for the game. (One commonly used method to overcome this is to periodically reset/release new items that are more powerful than old ones (i.e. power creep).) Another problem of not having an official trading mechanism is that, people might just trade in black markets, which could be an unsafe and unregulated market place. So many games set up official trading places and auction is the most commonly used format.

The specific form of auction of course depends on the specific game, but they are mostly like other Internet auctions such as those in ebay and old amazon. A seller first choose whether he wants to sell his item in the real money auction house or the in-game gold auction house (some games can only trade with in-game currency). Then he sets a reserve price and a buy out/buy-it-now (bin) price and chooses how long he wants to list his item. Then the clock starts to tick. Potential buyers then either bid based on auction rules (proxy or not, fixed ending time or flexible ending time etc) or buy out items at buyout prices. Here are some major differences between auction houses in games and online shopping sites: 1. an item can have multiple identical copies and typically the market value of an item can be inferred from buy-it-now prices. 2. there is no shipping cost, and transactions are instant, so one can immediately resell items he just won. (usually some proportional transaction fee is charged) 3. auction house may or may not be profit maximizing- it might just be a tool to improve gaming experience. 4. buyers are young and may not be very experienced with trading.

Just like in any other online auction houses, last minute bidding is a prevalent issue here. No one wants to sit in front of their computer, staring at the countdown timer in the auction house, instead of playing the game. But last minute bidding provides so much advantage. In fact, from my experience, it is almost impossible to get a good deal unless you do the last minute bidding. You reveal your value if you bid early, even if the auction uses proxy-bidding (in the proxy setting, usually the minimum increment between two bids has some pre-specified value, unless this increment would exceed the current maximum amount set by the proxy bidder, in which case the new bid will be set to this amount. Therefore bidders, including the seller can exploit this feature. In ebay some sellers use this method to make sure the final price is just below the proxy bidder’s maximum value). If there are naive bidders around who bid below their true values, then it is better to bid in the last minute and leave no reaction time for them. Also auction houses usually show potential buyers the auctions that are close to the end first on the search page, so near the end each item receives more attention from buyers, therefore is more likely to receive bids during that period (This is perhaps the most “natural” reason for last minute bidding). On the other hand, a value of an item usually depends on the market popularity of that item, so staying and seeing a lot of last minute bids
may change your evaluation of that item, which means staying around until the last minute is a good idea. Roth and Ockenfels conclude from their data that a soft ending method like amazon would reduce the amount of last minute bidding. But FIFA uses a very similar soft ending mechanism, although without proxy, and the amount of last minute biddings is formidable. Perhaps the search method mentioned above has a lot to do with this. Designing a mechanism that minimize the amount of last minute bidding would be such a quality of life improvement for gamers (and it would be pretty hard).

3. Overbidding:
   In these auctions, a rational buyer should not bid on an item with a price that is higher than the current lowest buy-it-now price for that item. But seems like that is not what happens in real life (especially when there is a heated last-minute bidding war going on). There are many reasons why people overbid: maybe they like to win, or maybe they are just too lazy to check what’s the current lowest buy-it-now price. There is also another possibility that might be specific to this kind of market: maybe bidding with a virtual currency makes people more reckless/aggressive. When bidding with a virtual currency, people may have trouble figuring out exactly how much money they are bidding on, which might cause differences in bidding behaviors, comparing to say directly bidding with dollars. Another thing is that, video game companies like to use large numbers, so 1 dollar usually corresponds to a large amount of in-game gold (many are at the scale of $1=1 million gold). Therefore people are dealing with very large numbers that they are not familiar with in these auctions, which might be another reason why they sometimes overbid. This could potentially be an experimental project.

4. Auction Caps and Transaction Fees:
   For practical reasons, most game companies put caps on the maximum amount one can bid. If a buyer buys an item for $1 billion and later regrets, the game company could be in trouble. A more realistic version is that kids sometimes steal their parents’ credit cards for in-game transactions, so game companies often have to deal with charge back problems. Then how to set the cap becomes an interesting question. When Diablo 3 was released in 2012, it had two auction houses, one for real money and one for in-game gold. The caps for transactions were $250 (in the North American server) and 2 billion gold respectively. When the game was just released, no one had gold, not even those gold farmers, so 2 billion gold was worth much more than $250, and top gears were sold mostly in the in-game auction house. A few months passed, the situation was reversed, the market was inflated with gold and selling in the real money auction house became a better choice for real high end items. The caps can cause problems. Many god-tiers items were bid for 2 billion gold almost instantly after they were up for auction and the buyers of these items (usually professional traders) then proceed to black markets and sell the
items for much higher prices. There were easily deals at $3000 scale in Diablo 3. So legitimate players who do not wish to participate in black markets are put in great disadvantage when they find an item worth more than the cap (of course it is an extremely rare event). In Diablo 3, the auction caps were fixed; in other games, it may be dynamic. For example, FIFA games evaluate items periodically based on the trading prices and update the auction caps from time to time. We can ask a lot of questions here: What would be an optimal way of setting auction caps? Should it be dynamic? Should it depend on the currency between real money and in-game gold? Would the answers to these questions change if the primal goal of auction houses are to improve players’ gaming experience instead of maximizing profit for game companies?

Another thing that game companies have control over is how to charge transaction fees. The current popular method is to charge a fixed proportion of the transaction amount, although the exact proportion is different from game to game (like 5%-15%). Having a high transaction fee could potentially increase game companies’ income by a little bit, but it discourages players from trading, which is against the intention of setting up auction houses. However, low transaction fee not only encourages trading, but also welcomes flipping, which is bad for majority of the players. So finding a balance is the hard question here.

5. **Price Fixing:**
Imagine you come to an auction house and search an item that you want to buy. The first result is listed as: min bid 1300 gold, buy it now 1400 gold, time left 5 min 23 sec. You want to see if you can find better deals, so you switch over to the second one on the menu, and it is the exactly the same. So you go on and check the next. After wasting 5 minutes of your life, you realize that, the first 50 items on the market are listed for exactly the same amount, at exactly the same time. Then congratulations, you just witnessed one of the most prevalent and notorious trading method in these auction houses: price fixing. Hardcore flippers massively bid on/ buy out copies of one item at a pre-set (low) price and later put up all the items he won, at a price that is slightly lower than the current market value. Legitimate buyers can’t (or hard to) find items at lower prices and are forced to (or tricked to) buy items from this one seller. Most sophisticated players hate price fixing and they think price fixers are ruining the market. (Of course, many players can’t even recognize this..) But on the other hand, it makes the market more stable and arguably helps the sellers who are too lazy to set up reserve prices properly. I think how price fixing influences markets (and maybe how to get rid of/ regulate them) deserves some study from market designers.

6. **Market Stability:**
One feature of in-game markets is that, the value of items can change dramatically
within a short amount of time. A patch from game company can easily resurrect useless items from trashcan and it can also destroy previously god like items completely. When game company releases promotional packs, the supply of items goes up and prices drop. Same thing happens when game company releases rewards for events. I think some game companies are learning from their experiences and trying to smooth out the market. For example, in FIFA 17, EA used to release weekend league rewards at a time which most players were active. Then the market took a huge hit from these rewards and prices dropped dramatically each time. Now they release rewards at a time which European people are asleep, so players spread out their sales and market has more time to react to the imbalance between supply and demand.

In these markets, belief based crashes are also common. FIFA series have market crashes around Black Friday every year. Therefore when a new title comes out, every experienced player expects a Black Friday market crash, so they try to sell their items sometime before Black Friday, which causes a pre-crash of the market. Then other players see the prices drop, and start to panic sell their items. Then the market crashes even harder. So even EA is only releasing some promotional packs that are only arguably worth the cost during Black Friday in FIFA, each year FIFA market has a huge crash around that time, and prices never recover fully afterwards. So it is worth thinking about how to improve market stability and prevent self-fulfilling crashes. (Actually, are crashes bad for the market? What happens in equilibrium if every player expects a crash?)

7. Bidding Dilemma:
This is a small game theory question. Imagine you want to buy a particular item, and there are two auctions ending at the same time. You also notice that the current prices of the auctions are much lower than its market value, so if you buy both of them, you can probably resell one and make a profit. Now the question is, should you be greedy and bid on both? The dilemma here is, if there is another buyer who only wants one item. Then you two will bid each other up, if you bid on both; while bidding only on 1 item has a chance for you guys to be perfectly coordinated and both get the item for a low price. Of course, you don’t know how many other buyers are out there, then your belief kicks in, and everything gets complicated.

8. Optimal Selling Time/ Economy Growth:
Here is a macro style question. When a new game is released, there is literally nothing on the market. No one has gold or items. Now imagine you get the best item in day 1 and you don’t want it. Then should you sell it immediately, or should you wait for the market to grow? Clearly on day 1, you won’t sell it for much, but the items you want are also cheap; if you wait, you will get more coins but everything else are getting expensive too. So you need to understand how the market grow.
As an example, FIFA series release a new game each year and its markets have a rough pattern as follows: when the game is just released, everything sells, the price differences between high-end and low-end items are small. As time moves on, low-end items become cheap and mid/high tier items become more expensive. A few months past, only high-end items remain high prices. And at the end of the year, everything becomes dirt cheap and most players quit and play the next game in the series hence complete the cycle. (Clearly prices reflect players’ demand pattern over the whole year.)