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Metagaming and metagames in Esports

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Abstract

The metagame is an overloaded term with no unified definition despite its importance and its common occurrence across different fields such as game design and behavioural economics. In our research we provide a unified and compact definition of the term metagame and metagaming by firstly highlighting their historical evolution. Although the original definition of metagame meant multiple things such as the environment surrounding the game, it has come to mean a perceived optimal or dominant playing strategy that is usually popular within an esport at that specific point in time. Metagaming as a verb is distinct and refers to a number of ways, external to the game's environment, a player can affect the outcome of a game. We focus on how these terms crystallised in the world of digital entertainment (esports) by providing multiple examples of metagames and metagaming in competitive settings. We additionally highlight the benefits of metagame shifts from the point of view of game developers. Finally, we provide a theoretical framework on the life cycles of metagames, as well general guidelines for understanding the current metagame of League of Legends and Dota 2. We conclude that by understanding the highly fluctuating metagame(s) of an esport at specific points in time, researchers will gain a better historical context of that game's space. This in turn will give them insight into the decision making of professional esports players, game developers and tournament organisers. Additionally, this work will help researchers create better analytics tools and machine learning algorithms.

Keywords: Metagaming, metagaming, League of legends, Dota 2

Highlights

- We define what a Metagame is and what Metagaming means in the context of esports, which has evolved from how it was originally defined.
- We explore a series of examples of the metagame and metagaming in various settings of esports
- We have created a theoretical framework of understanding a metagame's life cycle.
- We explain the metagame from the game developer's point of view.
- We provide some general guidelines for helping researchers understand what the metagame is in League of Legends and Dota 2.

Introduction

The word “meta” is of Greek origin and can have multiple meanings. The ones most relevant to the term metagame in its current use are, “among/between” and "higher or beyond” (*Merriam-Webster*, n.d.). Following its variable etymology, the term “metagame” has been given multiple definitions with some characterising it as a ‘game played within the game’, while others define it as a game that utilises information that goes “beyond” the confines of the game environment (Boluk & LeMieux, 2017; Elias et al., 2012). An example of the first definition would be a minigame, such as card collecting, that is contained within the borders of the main game but ultimately does not relate to the main story. The second definition of metagame has nuance; it can have multiple meanings such as inferring an opponent’s moves based on their previous history, acting based on what the other player is thinking about one’s own actions or using real life information that would not normally be accessible within the bounds of the game to gain an advantage. As such, the terms “metagame” and “metagaming” are overloaded and can appear opaque to researchers that are not familiar with esports and are only aware of this term from game design. In the context of esports, the term metagame has diverged from both definitions, coming to mean perceived optimal or dominant playing strategies that are most popular. This incongruence in the definitions might create semantic problems, dissuading researchers from pursuing this highly important topic in the world of esports.

Before delving deeper, it is important to highlight the differences between the metagame and metagaming in esports. Metagaming, in the context of esports, is ultimately about selecting or creating an optimal playing strategy using means outside of the game itself to affect the outcome of a game. This requires strategizing and is directly linked to higher level decision making as influenced by one’s understanding of an esport, which in turn is mediated by one’s performance, knowledge and innate biases about how the game is meant to be played and how their opponents in turn will behave. Metagaming is dynamic and the strategies that are created are never in isolation, but rather they are part of a shifting ecosystem of highly public competitive play. The metagame, or the “meta” in esports is any popular grand strategy, set of popular strategies or overarching way of play that appears optimised for an individual player or team based on both their perceived strengths and weaknesses as well as those of their respective opponents, using information contained both in and outside the game and its surrounding environment (e.g. tournament structure).

Thus, by understanding the metagame or strategies that surrounded an esport at a past point in time we can provide additional context of players’ higher-level decision making e.g. Were players fatigued and made poor decisions (blunders) in the finals in a best of 5 (essentially deviating from a “perceived optimal” metagame) or did they play as it was expected of them. An example of this can be found in Chess, whereby examining game patterns, Moul & Nye (2009) identified that the Soviets might have colluded in tournaments by drawing with each other while playing normally against westerners; this was reflected in the number of moves that Soviet players took, which was lower than what would be expected in terms of optimal playing, in order to obfuscate that there would be a clear victor on the chessboard. A second example directly from the world of esports comes from “Oscar Night” where two teams wanted to lose in order to dodge a stronger opponent. To make their loss more believable, they played an unconventional, or 'off-meta', strategy' (we will expand on this in a later segment). Therefore, understanding an esports’ or videogame’s dominant strategies or metagame provides historical and behavioural context about players’ higher-level decision making and the factors that influence it such as fatigue, personality, intelligence, risk tolerance and game knowledge.

Besides giving context to case studies and cross-comparisons, understanding a game's meta has direct consequences on game analytics, esports casting and any machine learning that relates to that game. In many video games, such as League of Legends (LoL) or Dota 2, certain in-game characters can be played in multiple manners, for instance, as a supportive healing character or as a damage dealing character which is defined by the game's metagame. Knowing the game's meta is imperative so that a researcher or an analyst does not conflate or mislabel characters with multiple uses, for instance, if a player picks a character that used to be played as a support, then the same metrics, guides or machine learning models will not apply to them if they play that character as a damage dealer or as a disabler (Demediuk et al., 2019). As Demediuk and his colleagues (2019) point out: *"To make a comparison to traditional sports, in football(soccer), "goals scored" could be a good metric for the performance of a striker, and spectators know this. On the other hand, it would not be a useful metric for a goalkeeper or defender. Therefore, knowing a player's role on a team is an important prerequisite when trying to perform many kinds of sports and esports analytics, such as ascertaining whether the player has performed well."*. Similarly, with game updates and patches rules can change. For instance, the amount of resources available could be reduced, so the knowledge of the metagame could help esports casters to create meaningful comparisons and analytics by standardising the metrics from previous metagames. Thus, understanding the game's environment and metagame is critical because it has a direct impact on all analytics produced.

In the following sections, we will conduct a literature review on the origins and development of the term metagame over time. Moreover, we will provide multiple examples of how players have taken advantage of the rules or the structures that surround a game. We will additionally provide analytics that will help researchers identify what the metagame is in the context of Multiple Online Battle Arenas (MOBAs). Finally, we will provide an overall theoretical framework about the lifecycle of a metagame across time, how the game developers alter it and why.

Literature Review

Origin of the term Metagame in Game Theory

According to Boluk & LeMieux (2017) and Kim (2018), the first substantive use of the term can be found in Howard's (1971) 'Paradoxes of rationality: theory of metagames and political behavior.' where he tackles solving the Prisoner's Dilemma; although a similar but underdeveloped idea appears in the writings of Rapoport (Howard, 1988). In the prisoner's dilemma two prisoners that have been caught are put in separate rooms and they are given a choice of either cooperating with each other and remaining silent or defecting and admitting their guilt to the police (Howard, 1988). The outcome of this game not only relies on their own choice but their partner's choice as well. If they both defect, they will both receive higher sentences than if they both stay silent. However, if one defects and the other does not, the individual that defected will receive no penalty thus making defecting an optimal strategy. In his work, Howard (1971) focuses on solving the famous Prisoner's dilemma not through economic rationality (where agents act in a perfectly logical manner to maximise their utility or expected gain i.e. always defect) but rather through what he calls the metagame. This is the game that would occur if both participants took account of the other person's potential choices. As Howard (1971) puts it: "*A metagame is the game that would exist if one of the players chose his strategy after the others, in knowledge of their choices.*".

The Prisoner's Dilemma and metagaming analysis do not only extend to the theoretical problems of individuals, but to real world situations as well (Dutta & King, 1980; Fraser & Hipel, 1980). The agents and the outcomes of a decision could influence policy makers, multimillion dollar companies or even whole countries. Dutta and King (1980) provide an explanation: "*metagame analysis models the 'mutual anticipation' process, starting with a hypothesized set of specific strategy choices by the 'players' in a competitive situation and examines the stability of the situation from the point of view of each firm…"*. This recursion can create certain paradoxes as evidenced by the literature; "thinking about what the other person is thinking" can become recursive (Koppl & Barkley Rosser Jr, 2002).

Metagaming analysis has a rich history in behavioural economics and has been applied to multiple real-world situations. This application usually occurs through the exploration of possible solutions or equilibria that are derived through more abstract economic games that partially resemble the aforementioned situations. Although understanding a game's agents, range of choices and outcomes is important, there exists an additional critical meta layer. This layer relates to how an agent will act based on the perception of the other agents about their own actions and what the end result will be.

Metagame in leisure games

The term metagame has continuously evolved since it was first used in the context of older games and videogames. It should not be conflated with its current usage of the term in esports, to which we have dedicated a separate section. Esports are *competitive* video games, that are usually played in stadiums by highly skilled players and watched by millions of people, with their broadcast following the structure of a normal sport event (Kokkinakis, et al., 2020). Thus, not all video games are esports titles. There are three prevalent definitions of metagaming which we will discuss. The first is that of metagame as the environment surrounding a game (e.g. tournament money, prestige around winning or losing a tournament), the second is a game contained within the game such as achievements and the third is using information that is not normally available within the game space.

The first important definition in the context of games comes from Richard Garfield, a mathematician and creator of Magic the Gathering, one of the most popular card games of all time (Edwards, 2020). Garfield noticed that during a game of Diplomacy his friends would distrust him due to previous iterations of the game where he would backstab them (Garfield, 2010). He came to the realization that even though individual matches of Diplomacy were supposed to be separate, they were in truth connected. He noticed that for him to win more Diplomacy games overall, he had to be trustworthy, which in the short term may have cost some individual game losses where a betrayal would be profitable (Garfield, 2010).

In a later essay he tries to describe metagaming more thoroughly based on his experiences from Magic the Gathering (Garfield, n.d.). According to Garfield the Metagame can be:

1) What the player brings to the game such as their equipment or their personal skill.

2) What the player takes away from the game such as the prize pool or the social status which is linked with winning a tournament.

3) What happens in-between games such as strategizing or preparation.

4) "What happens during the game other than the game itself". For example, trash talking or other environmental variables which could be of relevance.

As one can see, Garfield's taxonomy is broad, including physical aspects that surround the game such as equipment or tournament prizes. However, the third point still shares some resemblance with the original usage of the word metagame since strategizing or preparing for your opponent prior to a tournament may help one understand their opponents' actions and how they might react in different scenarios.

In a later published book by Elias, Garfield and Gutsera (2012) the term metagame acquires a more general definition as *the game outside the game*. According to their definition, the metagame *"…includes all the activities connected with the game that are not part of playing the game itself, such as tournament programs, online forums, magazines about the game, training and preparation players might do before the game, or even daydreaming about the game or staring lovingly at game equipment."*. One can see, that according to that definition, outside media such as forums or physical magazines are considered part of the metagame. They are using the word metagame to reference an ecosystem and all actions that surround the game.

A different usage of the term metagame are minigames or side games within the main game. The player is playing the actual game, however, within other minigames where different mechanics may be embedded, an example would be a First-Person Shooter (FPS) which has a fishing activity embedded within its separate mechanics. Perhaps the most popular example of this definition of metagaming is that of trying to acquire as many *achievements* as possible. Achievements are awards given to the player for completing a certain action, and often permanently accessible and tied to the player's account. Achievements may not be a part of the main story and it is not imperative to collect the achievements to complete the game. As Kim (2010) puts it: *"Achievements have changed the way many people play games…"*. As an example, in Assassins Creed: Brotherhood the feature of fixing and establishing enterprises in ancient Rome is considered a metagame according to Carter and their colleagues (2012).

In the following section we are going to discuss how players may "break" or bend the rules to their favour in order to maximise their performance. We are going to provide examples of how this can be achieved with tournament structures as well as provide real life examples where losing or tying was actually advantageous for the loser in the long run.

Metagaming and structures that surround the game

One of the most common occurrences of metagaming occurs in Roleplaying Games (RPGs). In RPGs the individual that is "metagaming" is using information that goes beyond or exists outside the game and therefore their character would not normally have access to (Boluk & LeMieux, 2017; Salen & Eric, 2004). In the game of Dungeons and Dragons for example, if a player notices that the Dungeon Master (the individual that leads the session and sets the scenery and fights of the fictional world) tries to reach for their dice, the player can infer that an action, perhaps an enemy encounter is possible. Thus, the player may use this outside knowledge to guide their actions within the actual game. In a normal environment the in-game character would have no knowledge of an enemy encounter and they would have been ambushed.

An interesting example of metagaming that is often overlooked is non-participation or losing, which can be part of a dominant strategy. Our first example comes from the world of chess. As mentioned in a paper from Zak and his colleagues (2019), many average players will

perform better if they dodge high level chess tournaments where they know strong grandmasters will flock to in favour of less known and smaller tournaments. Effectively, the better play is dodging elite opposition by participating in a lower stakes tournament: a low risk – low reward play rather than the alternative (almost certain loss-high reward). This is echoed by Stapczynski (2020) who states that the chess grandmaster Alekhine dodged Capablanca to preserve his world champion title. This could be adapted to the world of esports with the Major and Minor tournaments of Dota 2 (*Valve*, 2017). Strong teams will attend Major tournaments which award more prize money and more DPC points (similar to championship points for a major tournament, The International). It would be more beneficial for a weak team to try and attend a Minor tournament rather than a Major tournament due to the lack of strong contenders; these strong contenders would in theory prioritise Major tournaments and may not attend lesser tournaments in fear of revealing strategies against lesser opponents or because they want to prevent their players from burning out.

Dodging the opposition and losing to "win" can also be seen in LoL. For a player to advance to a new rank in LoL they need to accumulate 100 League Points by winning matches. If they win or lose the game a large chunk of League Points is rewarded/extracted from their score. However, if they terminate the LoL client before a match starts, they still score a Loss albeit the League Points deducted from them are much less and they are only penalised with a time delay until the next match. This allows for a new metagame to be created where the player can assess both his and the enemy team's draft and decide whether they can win the game or if it is a complete "outdraft" (superior champions picked) (*Dodging -> Climbing. Is This a Good Thing?*, n.d.; *Queue Dodging | League of Legends Wiki | Fandom*, n.d.; *Strategic Queue Dodging*, n.d.) . If a player has been outdrafted they can choose to dodge by terminating the client and taking a smaller loss but a net gain in terms of League points extracted from a sure loss. Moreover, the player has the advantage of receiving only a small time ban from dodging which is less than the actual game played (allowing for a player to play many games thus allowing the player to maximise their gains for a given amount of time in-game). This is frowned upon by some players although others think it's a valid meta strategy for achieving a higher rank (*Strategic Queue Dodging*, n.d.).

A second not commonly discussed part of the meta is losing. Tournaments have different formats, and they can sometimes be abused. A famous historical sports example is that of how Bristol City and Coventry City avoided relegation from the First Division by inducing a tie between them. By preserving their tie, they surpassed Sunderland who eventually got relegated (Jenkins, 2017). A secondary example comes from Sumo Wrestling where Sumo wrestlers tend to lose a lot more (75%) after they have acquired their necessary wins for them to progress in ranking; this progress is also accompanied with an increase in salary (Levitt & Dubner, 2006). This is a tit-for-tat strategy with the winning wrestler repaying the favour when a matchup is due. Finally, one of the most famous examples of losing to win comes from the Philadelphia 76ers. Their general manager, Sam Hinkie, realised that the NBAs drafting system that was set to preserve competitive balance can be abused; weak teams would get an early draft, strong teams would draft late while mediocre teams were on a state of limbo (Kopf, n.d.; Rappaport, n.d.). By sacrificing games on the short term and losing intentionally his team would tank in the scoreboards temporarily but over the long term he would be able to have an early pick in the NBA's player draft due to the rules of the last teams having earlier picks. This would help the team obtain top notch talent which would later help them become a contender. Supporters of the team were hesitant, after all who wants their favourite team to consistently lose, but they were told to "trust the process" as this strategy required a sustained period of poor performance before the benefits were realised (Kopf, n.d.; Rappaport, n.d.).

In the business world another example appears when examining asymmetric duopolies, where a major company is leading the market while the second company has a smaller market share (Hovenkamp & Salop, 2020). If the leading company completely eliminates the smaller one and seizes its market share converting the system to a monopoly then it will collect higher income temporarily, yet in the long run it will become subject to antitrust laws and get broken up. Thus, taking a small loss of income in order to keep the "competition" around may be a much better choice.

One of the most famous examples of two teams trying to take advantage of the rules is that of Oscar night (theScore esports, 2019). Team Invictus Gaming (IG) fought against Team LGD-Gaming in the League of Legends Pro League (LPL) in 2015 with the winner facing the favourite EDG. EDG was considered extremely strong having previously won a title vs the Korean world champions (theScore esports, 2019). Whichever team won would play EDG in the playoff bracket while the loser would not directly face EDG until the finals. Understanding that the optimal play was to lose, both teams started picking off meta champion picks with the intent to lose. This was additionally reflected by the casters who kept expressing their disbelief for each team's decision making and game knowledge. Eventually, after a lengthy series and a referee intervention who may have threatened them with fines, IG won looking extremely disappointed. IG subsequently went to lose 3-0 to EDG after that, while LGD made it to the grand finals before they lost to EDG.

In modern esports a common tournament type is double elimination which can be seen in Figure 1 below:

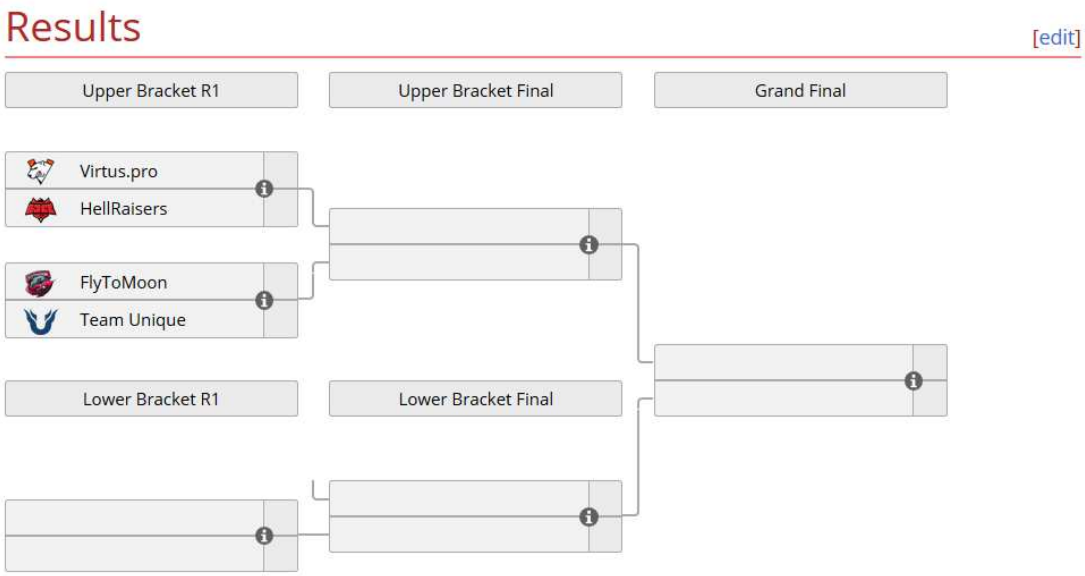

Figure 1 - Dota 2 tournaments have a lower or a loser's bracket which allows for a team "to climb back up" to the Grand Finals by playing a best of 1 or a best of 3 elimination series.

In theory, if a team has a limited number of strategies that they want to keep secret from upper competitors by not using them, they could intentionally lose and attempt a lower bracket run if they know that the lower bracket teams are more manageable (similar to Oscar Night). This could in theory allow for stronger teams to fight each other in the upper bracket with them disclosing their strategies, facilitating a potential win further down the line.

Moreover, famous players have been felt targeted with reflections such as, "winning can put a target on your back drawing unnecessary attention from dominant teams" (*"Reflections" with Ppd*, 2017).

Similarly, sacrificing a couple of games in a smaller or less important esports tournament in order to test the viability of new strategies or honing them in a high-pressure situation and possibly losing is still an important and valid metastrategy, similar to how a sports team would sub in rookies in friendly matches risking a loss so they can improve (*Hodgson*, 2016). This is perhaps what happened in 2014 when the highly rated Team Liquid lost to the lesser-known Union Gaming after they had succeeded to qualify for a major tournament. According to the casters, their drafting and their playstyle was unconventional and it could have been an intentional loss (*Union vs Liquid - The International 4 Dota 2 Qualifiers*, 2014). Note that this is an extremely rare scenario. A parallel of this phenomenon can be seen in in any tournaments with groups and brackets, for example, the FIFA World Cup where position in group stages determines opponents in the knockout rounds.

In the following section we will discuss the metagame or the "meta" as it is commonly referred to in the context of esports and how it evolves and diverges from previously established definitions. Different videogame genres and titles will be used to illustrate various subtle aspects of the meta that researchers should be aware of, for instance divergence of metas (the current popularity or dominance of certain strategies) in different geographical areas.

Focusing on the Metagame in esports

Starcraft a prototypical esports example

Starcraft was one of the first widely popular esports (Lewis et al., 2011). Due to the infancy of esports at that time the term "metagame" more closely shared similarities with some previously established definitions from other (physical) games. Citing Liquipedia, Carter and their colleagues (2011) defined metagame in StarCraft as having the following three categories:

1. "Preparation done before a match to exploit current trends in Starcraft.

2. Preparation done specifically to exploit an opponent's or map's style of play.

3. Strategic decisions designed specifically to exploit a player's reaction or weakened mental state in the future. These are also known as 'mind games' or 'psychological warfare'."

We note that these categories closely resemble Garfield's definition (strategizing/preparing as well as what happens in-between games/trashtalking). However, these categories do not align with the definition of the word metagame as it is used in esports currently.

A more modern definition comes from Donaldson (2017) who describes the League of Legends metagame as being defined by the most popular strategy or type of champion, saying: *"Players will refer to a particular metagame as an "assassin metagame" or "split-push metagame" to indicate which type of champion or strategy is currently most popular".* Donaldson (2017) and the players are partially correct. One needs to focus on what drives the popularity behind the strategies in order to understand the metagame. If there's a 50% chance of winning a game and a specific choice/action elevates that chance to 55% then that action

will define the metagame and possibly receive a nerf (it will become weakened by the game's developers). As the developers of Magic Online have said, they nerfed the card Lurrus of the Dream-Den because the win rates of decks that used that card had surpassed 55% "*and collectively decks using Lurrus are representing too large of a portion of the metagame with no indication of a shift away from this trend"* (*Duke,2020).* As we have previously stated in metagaming analysis the metagame may not necessarily be defined by the strength or optimality of the strategy (win percentage) but by the perception of strength and optimality which might not be reflective of reality.

The act of metagaming is subtly but importantly distinct from the metagame as defined previously. As with previous definitions of metagaming, we would define the act of metagaming in esports as using means outside of the game itself to affect the outcome of a game. This can take several forms which we will enumerate below:

- Metagaming by joining or fine-tuning pre-existing popular strategies.
- Metagaming by attacking the metagame: developing a strategy which is strong against currently popular strategies.
- Metagaming by strategising against your opponents: knowing a specific opponent's playing history, for instance by reviewing their replays, and using this knowledge to exploit their weaknesses.
- Metagaming by innovation: this is similar to attacking the metagame but relies more on your opponent's being unfamiliar with your strategy. Occasionally, called "cheese" if the strategy can only be applied once.
- Traditional metagaming: using means completely outside of the game to affect a game: trashtalking before the game online.
- Rules Lawyering: taking advantage of the rules of a game/tournament in order to gain an advantage as we have mentioned previously.

In the following sections we are going to discuss how the metagame (popular and dominant strategies) is used into its current form by the player communities in various esports titles from various genres such as Dota 2, League of Legends (LoL). Moreover, we are additionally going to discuss how some aggregate statistics websites may be used to discern what the metagame is in an esport.

The Metagame in League of Legends and DOTA 2

In this section we will focus on the metagame in two distinct esports titles that belong to the same video game genre (action Real Time Strategy (aRTS)/MOBA), LoL and Dota 2. We will showcase analytics from commercial websites as well as analytics that researchers or game analysts can use on their own through a game's API. In both LoL and Dota 2, when a match starts, two teams of five find themselves in the opposite corners of a square shaped map (team bases), which are connected through three lanes. At the start of the game, the teams compete for resources in these lanes by killing A.I. generated weaker units named minions or creeps and stronger units controlled by enemy players called champions in LoL and heroes in Dota 2. Each lane has 3 buildings that are typically stronger than user-controlled units called towers. Each team will try to sequentially destroy the other team's towers in order to reach the enemy's base where they can destroy the team's main structure called a Nexus or a Throne.

The meta, in these games, is the popular and dominant set of heroes or champions that have high win rates and are superior to other available choices. The first common way of identifying the meta is through websites that aggregate tons of video game metrics from various skill levels. One of the most popular ones that has information about multiple video

game genres is op.gg. An example of their own classification of what constitutes a meta champion i.e. a Tier 1 which is better than a Tier 2, can be seen in Figure 2 below:

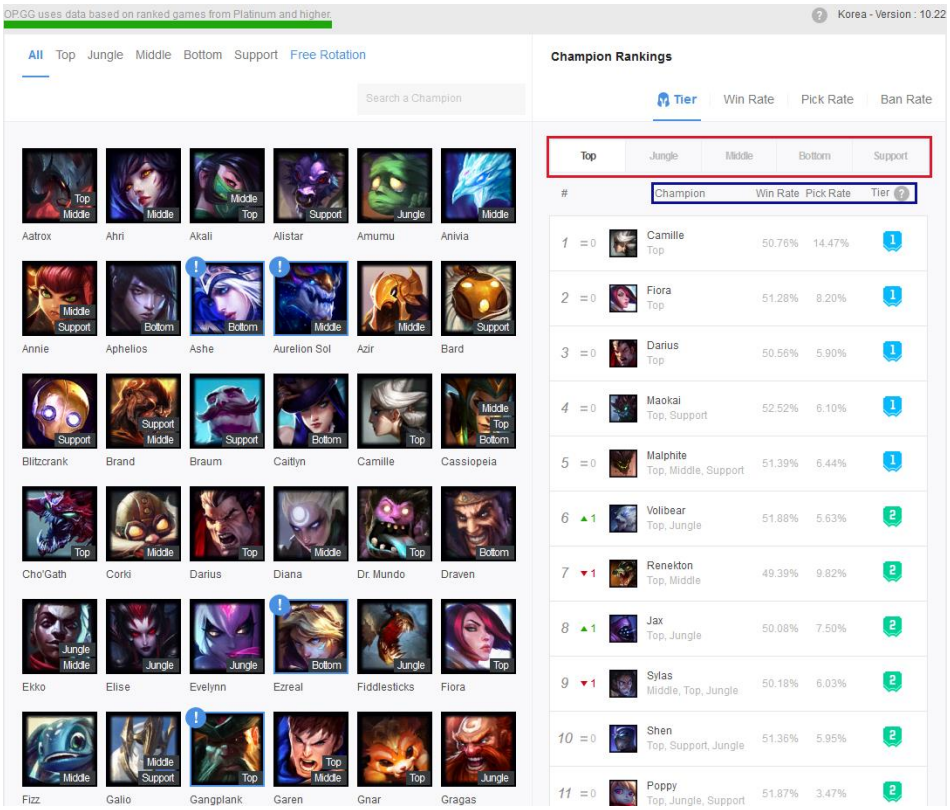

Figure 2 - A statistics website that shows what the League metagame is. Note that they specify that when performing their analysis, they take into account skill level (underlined in green), the lane or hero role (red square) and other key statistics such as win rate & pick rate (blue square).

In Figure 2, op.gg states the specifics of their sample since different skill levels or brackets may have different metas. In our definition, we highlighted that the meta is highly dependent on one's own skill and/or the skill of their opponents. This can more clearly be seen in a similar website that also shows win rates from different skill brackets from the game Dota 2. An example of a statistics website that focuses on Dota 2 can be seen in Figure 3, below:

Hero	Pick %	Win %	Pick %	Win %	Pick %	Win %	Pick %	Win %	Pick %	Win %
Death Prophet	3.31%	46.97%	2.85%	48.76%	2.61%	49.64%	2.73%	49.74%	**5.59%**	**68.03%**
Bane	3.79%	50.59%	4.26%	50.46%	4.68%	51.77%	6.00%	52.90%	**9.38%**	**61.35%**
Faceless Void	18.96%	48.69%	18.18%	49.14%	18.34%	50.42%	18.59%	50.86%	**21.49%**	**56.10%**
Pangolier	4.17%	46.14%	6.18%	47.45%	7.90%	48.23%	9.57%	48.90%	**12.15%**	**56.01%**
Phoenix	5.88%	50.10%	8.20%	50.37%	10.55%	50.34%	12.69%	48.78%	**18.98%**	**55.16%**
Clinkz	**10.17%**	54.88%	9.01%	**57.52%**	8.99%	56.64%	9.20%	56.94%	5.53%	55.10%
Chen	0.85%	50.00%	1.03%	46.88%	1.19%	49.15%	1.34%	50.48%	**2.61%**	**55.08%**
Broodmother	2.55%	52.39%	2.27%	54.11%	2.24%	55.52%	**2.68%**	**56.86%**	2.57%	54.25%

Figure 3 - The Dota 2 hero meta according to the website Dotabuff.com. The medals on the top of the image signify different skill brackets. Take note of the three heroes highlighted (orange, white and red) and how their statistics fluctuate with each skill bracket. Win rates over 50% usually indicate overpowered heroes and show which heroes dominate the metagame (Tier 1).

Several insights into understanding the metagame can be drawn from Figure 3. The first is that each Rank bracket, denoted by medals, has its own strong and weak heroes as indicated by the variability in the win rates and thus its own unique meta; a hero in a low bracket may not be strong in a higher bracket and vice versa. This occurs because the hero mechanics or the way a hero is supposed to be played are highly dependent on a player's individual skill as per our definition. The second conclusion is that meta heroes can take all shapes and forms and are not limited to one lane or one role as indicated by the variability of the heroes in the above list. The first hero (Death Prophet) is conventionally played as a middle lane hero while the second hero is played as a support in a different lane. The final conclusion is about the importance of elevated hero win rates (>50%) and their combination with pick rates. In this scenario Death Prophet (Orange Box) has a 68.03 % win rate at the highest brackets (far left). Thus, it is tempting to classify Death Prophet as a meta hero, after all 68 % is too far from the ideal and balanced 50% limit. However, if one looks at Death Prophet's pick rate they will notice that it is low (approximately 5.6%). This could denote that Death Prophet is not necessarily overpowered but it is only picked in super niche situations which more likely guarantee a win.

A second possibility is that the hero is so complex only a small minority of the Dota 2 player base has allocated enough time to master it and thus, obtain a high win rate. Two much better contenders would be Faceless Void (white) and Phoenix (Red) due to their high pick rates (21.58% and 18.98 % respectively). This indicates that these heroes are commonly played whilst having a high win rate. Moreover, if a hero is picked earlier in the draft such as Phoenix or Bane (Supports), this indicates a much higher strength than their current state since the enemy team has a chance to counter it but fail to do so. Hero/champion win rates should never be looked at in isolation to understand or define the meta but in conjunction with pick rates, ban rates and skill brackets.

Non-commercial data analytics

The advent and the wide availability of Representational State Transfer Application Programming Interfaces (REST APIs) can provide billions of videogame data points in accessible file formats such as jsons or csvs. Their analysis can help researchers to identify the metagame, independent of 3rd party websites, which was not feasible at the infancy of videogames and sports (*API Documentation - Riot Games API*, n.d.; *Meta - OpenDota - Dota 2 Statistics*, n.d.; Kokkinakis et al., 2020).

Here we provide an analysis that uses OpenDota's API to showcase some elementary analyses that researchers can use in their own work; note that Valve's API can also be used if one needs to access data from the source. We scraped over 35 thousand matches for the Immortal and high Divine brackets. These are the top heroes picked and banned across different time periods.

Table 1 - Most commonly Picked and Banned Hero per patch (Immortal and High Divine Bracket).

	Patch 7.20	Patch 7.21	Patch 7.22	Patch 7.23	Patch 7.24	Patch 7.25
Most Picked and Banned	Phantom Assassin Magnus Lich	Mars Bounty Juggernaut	Pangolier Lina Ember Spirit	Snapfire Void Spirit Puck	Snapfire Void Spirit Slark	Phantom Lancer Void Spirit Snapfire
Least Picked and Banned	Omniknight Warlock Enchantress	Clinkz Dragon Knight Chen	Underlord Dragon Knight Medusa	Sniper Dark Seer Dragon Knight	Tidehunter Luna Visage	Visage Sven Arc Warden
Fano Factor (Dispersion-Variance Measure)	*1298.44*	*632.46*	*423.5*	*907.42*	*874.82*	*945.01*

The first thing a researcher can do is to focus on the most picked and the least picked heroes or champions which are mostly associated with high or low win rates. By identifying commonalities between the heroes' tools or the way/roles in which they are played they can identify the potential metagame e.g. do the most picked heroes have defensive or offensive abilities? Are they all strength or agility heroes? Are they played in a similar manner? (Demediuk et al., 2019; Donaldson, 2017).

A secondary inference about how variable the metagame is through the Fano Factor. The Fano Factor acts as a measure of how spread out the distribution of picks and bans is or as an elementary "viability index" about players' available choices. A smaller Fano Factor means that there is less variability of potential choices (less viable choices) while a larger Fano Factor means there are many viable options and strategies.

In this segment we will showcase a graph of how various DOTA 2 pick and ban rates change after a patch is introduced. Although we focus on Dota 2, this methodology should apply to other MOBAs or games of different genres e.g. pick and ban rate of guns in an FPS.

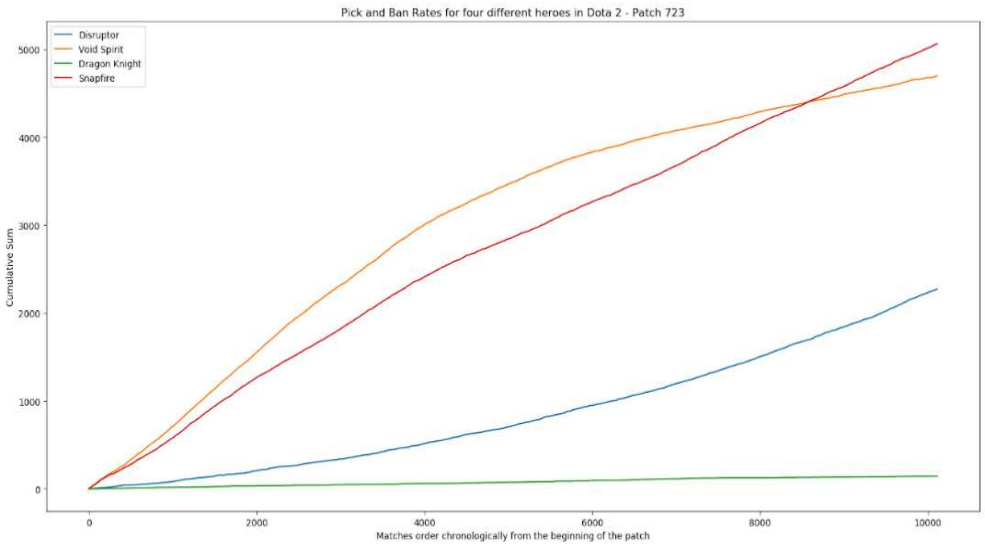

Figure 4 - The cumulative sum of times a hero was picked or banned, for 4 Dota 2 heroes, since the introduction of patch 7.23. The highest two counts belong to the two newly introduced heroes: Void Spirit and Snapfire.

This type of analysis can help us understand when during a patch's timeline a hero started becoming more, or less popular, and whether there were possible shifts in the metagame. For instance, one can see that Snapfire overtook Void Spirit in terms of popularity, possibly because Void Spirit was more heavily picked and invited more critical nerfs from the developers. We can also see how less popular heroes (Disruptor and Dragon Knight) behave in this meta. A sharp almost parabolic line would indicate a complete meta reinvention i.e. players would discover that a hero or a strategy is overpowered and the picks and bans would increase tremendously.

Properties of the Metagame

Metagame as a Circle

In the original experimental game we introduced, the Prisoner's Dilemma, we highlighted how defecting may be considered a viable choice or an equilibrium for the two participants. As time passes even individuals who initially cooperated would learn that defection is the optimal play in one off scenarios. This creates a stagnant or stale metagame where everyone knows that defect is the only "real" option available if one wants to win. These staleness effects can also occur in video games with players slowly learning what is the

(perceived) optimal way of playing. That staleness or stability can be disrupted in two major ways: a) by the introduction of patches that change the game's rules or mechanics and b) by the players discovering a new strategy that overthrows the previous dominant metagame. In the following sections we are going to discuss these two cases in more detail and provide a theoretical framework about how meta develops across time, so researchers can identify its different stages.

Video games, when compared to normal or experimental games, have tremendous added complexity. Increased game complexity can make a video game near impossible to "solve", since for every action or strategy there is a counter action or strategy, with the search space being ever growing. Even Open A.I., which created bots that famously beat Dota 2 champions did so under multiple limitations (OpenAI et al., 2019). The bots practiced against themselves by playing the human equivalent of over 10 thousand years. Thus, it is impossible for humans to fully solve such a complex system. Consequently, players experiment heavily in the beginning of a patch but converge to metas due to their own or their teams' strengths and limitations, combined with the added restriction that strategies require allotted time for players to hone them through practice. Due to this complexity, there is a cost to switching up strategies and even though many "optimal" strategies exist in the beginning they usually start to converge after some period of time. This is called metagame stability or meta staleness. The metagame is said to be disrupted or revolutionised if a new strategy (new meta) appears that can outperform the previous one and thus taking its place (Harizin, *2020*; Shifting the tides, 2016).

The second critical difference between normal games and videogames is the constant game design updates called patches. Patches can change both a game's core mechanics, such as the strength of weapons or heroes but also the environment surrounding the game, such as coach communication or tournament format. These newly introduced changes "shake up" previously established rules (KawaiSocks, 2016). As an example, a Prisoner's Dilemma patch that awarded more points if participants cooperated would lead to a new metagame (always cooperate). The changes introduced by patches usually lead players to experiment in order to identify the new strengths and weaknesses created by the game developers and how they interact with each other. Moreover, they need to identify how they can be the first to shape these new changes into a valid strategy specifically tailored to their team's strengths and weaknesses, also known as defining the meta (*Dager*, 2017). This metagame understanding leads to metagame stability until it is disrupted by the game's developers or the players themselves, usually occuring in a circular manner (*Duke*, 2020a; *Duke, 2020b)*. We have created Figure 5 below to illustrate how it progresses across time:

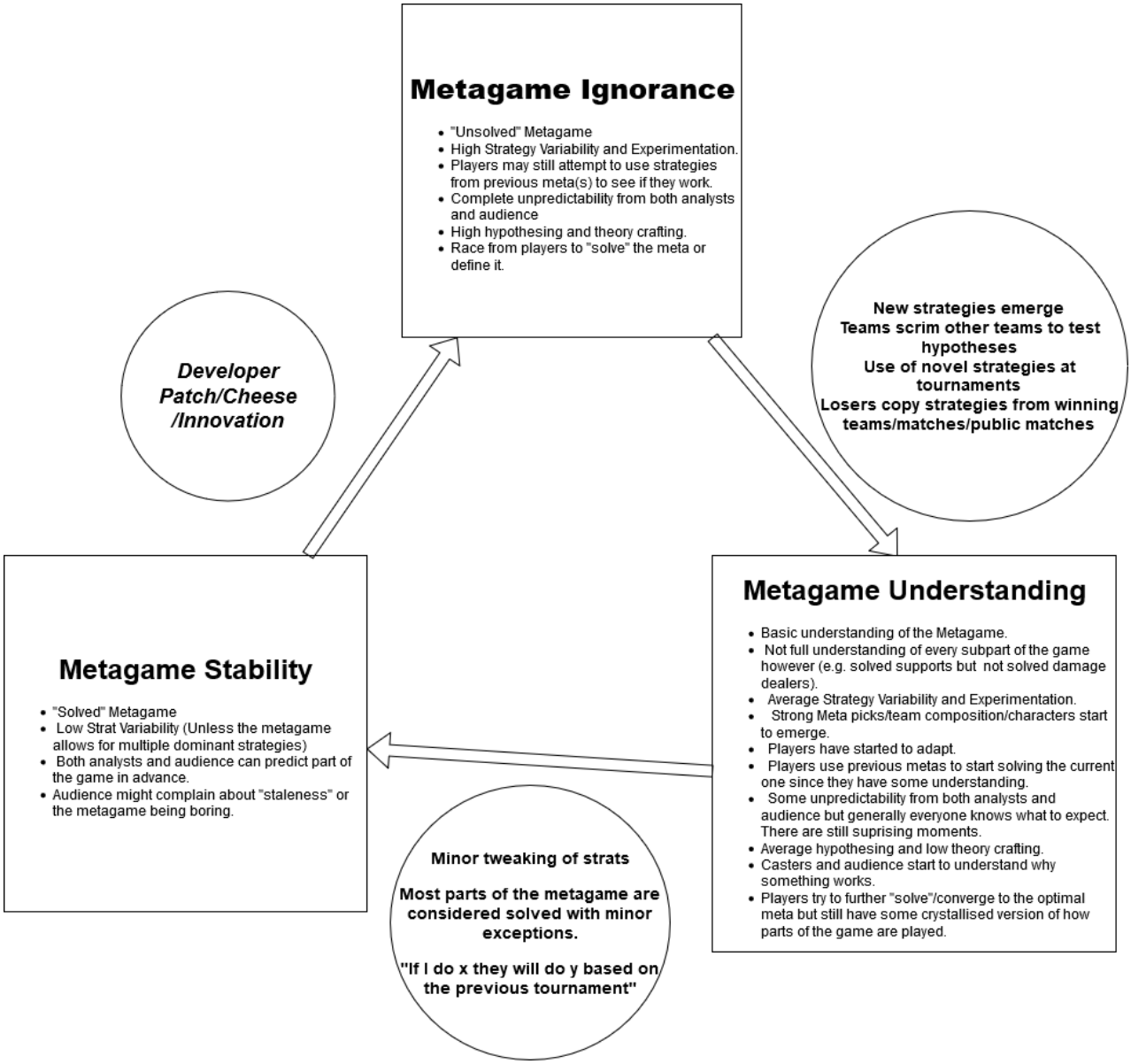

Figure 5 - The metagame cycle in esports and videogames. The bullet points are indicators and not all of them may happen before the progression to a later stage.

The duration of each phase is not fixed, and the players try to solve the meta across multiple tournaments. In fact, in certain complex genres such as MOBAs, due to the various lanes that can exist, different sub-metagames for different lanes or parts of the map e.g. bot lane meta or top lane meta. These specific metas, within the grander metagame, can be solved much earlier or much later than the rest with players reaching tournaments without crystallised or stable strategies.

Identifying at what stage the metagame is can help provide a historical context to players' decisions. If a previously unseen choice or combination of choices occurs after the introduction of a patch, then a researcher can assume that it is not an unorthodox pick but the metagame has reset after an incurred disruption. This in turn would mean that the players believe that it is a strong metagame pick and they have a competitive advantage over their opponent by performing that action. If an unorthodox choice occurs after a patch has been applied to the game for over 6 months, then a researcher could infer that the unorthodox pick

is a deviation from the metagame. This could in turn lead to many new research avenues, for instance, was this deviation an attempt to disrupt the previous meta or was it a mistake that stemmed from the players' lack of knowledge or anxiety.

Metagame and geography

An important quality of the metagame is that it is influenced by geographical proximity since it can be viewed as an initial seeding of the aforementioned optimisation process that will influence the final result. Each region has its own understanding of the game so when a patch is introduced different ways to play the game will be created. Moreover, because many teams are "server" or location bound due to ping or convenience; they are effectively playing with other teams in their region that will not be directly exposed to different metas (EskayDota, 2018; *The 7.27 Chinese Metagame Explained*, n.d.). Note that, although streaming has eliminated many informational boundaries that have allowed for optimal playing styles to proliferate beyond their own respective servers, there is still the issue of scrims. Scrims are internal/in-house games between different teams which they use to practice. In those games, teams hone their strategies or explore different things. These scrims are not public knowledge and disclosing the strategies of the teams involved is frowned upon.

Scrims partially explain why different geographical teams diverge in their metas, they have been interlocked in antagonistic processes with other local teams. This means that we can have highly niche or specialised metas per region and they may look completely different from each other. One famous example is the "Chinese Farming Dota Meta" which differed from the western style of play; although the Chinese innovated many metas and used multiple strategies, this was the most famous example (*A Brief History of Chinese DotA, Part 1*, 2013; *The 7.27 Chinese Metagame Explained*, 2020; Beyond the Summit, 2021).

Similarly, in LoL, certain regions such as Korea are considered superior with many teams boot camping there in order to increase their chances of winning (*How teams (and Riot) are recreating the Korean boot camp, n.d.).* This would mean that they would scrim or practice against Korean teams or they would just play solo games on the Korean server so as to be exposed to different ways of thinking about the game and thus, metastrategies (Kang, 2018). South Koreans were also considered more skilled at LoL than their peers, thus, aside from the exposure to other regions, playing against a superior opponent was considered fundamental to one's own improvement. By the end of their boot camps, teams would imitate or improve the Korean meta, and import strategies back with them giving them an advantage over their home teams that remained in a stale environment.

Metagames from the point of view of the developer

An important part of metagame shifts or changes incurred by patches is that they do not always just happen because of the player base. The game's developer may actively choose to apply them, through patches, as a response to the stabilisation or the "staleness" of the metagame, as mentioned previously with Magic the Gathering developers who nerfed overly powerful cards. However, these changes often go beyond the game's balance.

The first is for economic reasons. Games have a complex economy that needs to be stimulated and maintained. This economy may use loot boxes, battle passes or any other type of product to increase revenue (Hardenstein, 2017). By introducing scheduled changes, for instance through the introduction of a new hero/character, a company is able to increase its revenue by selling both the character as well as cosmetics relating to that character. Similarly, buffing older characters that were not seen in play would in theory increase revenue from pre-

existing cosmetics, since some competitive esports may act as advertisements for that character and its cosmetics, thus revitalising its sales. This has led some people to believe that game devs may buff old characters or release new characters that are purposefully imbalanced (favoured to win) in order to motivate people to buy them (giantZorg, 2019; Petrovskaya & Zendle, 2021; PriagDE, 2019); note however, that results are mixed although their analysis focused on the buffs characters that are already in the roster receive and not on new releases.

The second reason can be attributed to players' motivation. Note that there are many theories behind motivation and interpreting the changes applied from developers through all lenses is beyond the scope of this paper (Barrett & Morgan, 2018; Morgan et al., 1990). Thus, we are mostly going to interpret it through a psychological theory called mastery motivation which is "a psychological force that stimulates an individual to attempt independently, in a focused and persistent manner, to solve a problem or master a skill or task which is at least moderately challenging for him or her" (Morgan, Harmon & Maslin-Cole, 1990, p. 319). Each time a new meta shift is created by the game developers or a new demanding game mechanic is added to the game a new challenge is created. These new challenges may help in keeping competitive individuals or individuals that feel a need to overcome challenges to keep playing the game. It should be highlighted that for certain individuals the mastering of a technique or video game mechanic for themselves can be an end-goal by itself and achievements such as winning or reaching a higher rank (where they are compared with others) might be secondary (Barrett & Morgan, 2018).

A side effect of introducing a new patch that keeps the meta fresh is that it can also weaken anxiety. If there are multiple changes and no one knows what they are doing, that can prevent performance anxiety or anxiety created from a loss i.e. rather than linking their loss to their lack of game knowledge or ability, a losing player may feel good about it because they experimented or they were defeated with an innovative way they could use in their own matches (Barrett & Morgan, 2018; Isen, 2001; MacTurk & Morgan, 1995; Sideridis, 2008; Van Yperen et al., 2009). The end goal of performance/achievement becomes less important and the process of mastering or figuring out the meta replaces it. Thus, the intrinsic motivation of becoming better at some aspect of the game can be key in preventing player loss.

Another reason is much simpler and is that of under stimulation. If a player is under stimulated and forced into repetition, regardless of the level of mastery they have achieved in a task, they can still be lead to boredom, which will ultimately lead to the player leaving the game (Raffaelli et al., 2018; Vodanovich, 2003). An example is Riot's URF, which is a specific game mode with almost no skill cooldowns. After this mode was out for a couple of weeks URF ceased to be this novel, "fun" mode where the player can explore multiple options instead becomin more competitive and repetitive which ultimately lead to decreased play rates for both URF and the main game (*Ask Riot*, n.d.). Thus, creating new challenges, and new obstacles to overcome can be a highly important way to retain a player base. Of course, game developers should not change the game in too major ways because it might alienate their player base.

Finally, developer changes are not always about their player base but sometimes meta changes are introduced in order to preserve their esports ecosystem. An ever shifting metagame promotes competitive balance by not letting a single team become too good at the game. A common argument of team owners and tournament organisers is that there needs to be some uncertainty about who is going to win (Rottenberg, 1956). A rich club may be able to hire better players or talent which in turn will lead to more winning which might hurt the league's income by creating an imbalanced allocation of skilled players; ironically, this can hurt the team itself, also known as the "Yankee Paradox" (Vrooman, 1996). Thus, some regulations need to be applied to preserve the competitive integrity and balance of a league. Another example comes from drafting in the NBA, where lower level or losing teams get to have the first pick of the draft as previously discussed. Here, a game developer may be able to

preserve competitive balance, not by forcing the reallocation of players (shuffle) but by changing some aspects of the game. By altering parts of the game, the game developer may directly "depose" a team that has distinct strengths. As an example, if a team has won 5 tournaments in a row with a hero called "Spectre", a dev might answer with a direct nerf to the hero or with a direct buff to heroes that counter "Spectre". This should, in theory, level the playing field and stop the dominant team from cornering the tournaments. A real-life example comes from Dota 2 and the hero Io. Only one team, OG, could successfully play Io in a specific role (core). Even when other teams attempted to emulate their style, they could not make Io core work. This gave them a tremendous competitive advantage since a team would have to ban it (wasting a high value ban) or pick it and use it sub-optimally (*Gilroy, 2019).* After OG won a second TI tournament using Io, Io core was heavily nerfed due to its success, with it currently mostly being played as a support.

Conclusions

The term metagame in esports has greatly evolved across time and has partially diverged from its definition in other fields. It can be briefly summed up as an optimised strategy based on the game and the game's surrounding structures. In our paper we have provided historical examples as well as some websites which can help researchers identify the metagame in Dota 2 and in League of Legends. Before conducting research in a particular esport, researchers should try to explore, quantify and familiarise themselves with that esport's metagame. From a game analytic point of view, it will help researchers create better tools, whether that is psychometric scales or machine learning models (Chitayat et al., 2020). Moreover, understanding the metagame can help create a unified context across history which in turn will help avoid many invalid comparisons that arise through biases. Additionally, understanding the metagame can help researchers understand the decision-making processes of many players and what influenced them. Finally, due to the circular nature of certain aspects of the metagame, there is a possibility of predicting future trends by revisiting past metagames that shared similarities with the dominant metagame. We recognise that we only briefly touched upon this extremely wide topic, but we believe that this was an important primer that will help new researchers access this space; we have additionally included additional references for researchers that wish to delve into this topic beyond this review.

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The authors declare no conflicts of interest.

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