

# Spaces: Towards using In-Game Data for Smart In-Game Sponsorships and Advertisements

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# What is Spaces?

Spaces provides **data-driven, smart, in-game advertising and sponsorships** for **live gaming streams**.

## Introduction

What is advertising (ads) in video games?

According to Wikipedia,

*Advertising in video games is the integration of advertising into video games to promote products, organisations, or viewpoints.*

In common man's terms, it basically means slapping some logo somewhere in the video game.

Jumping down the rabbit hole, there are different categories of advertising in video games with in-game advertisement being the most popular out of all of them. In-game ads are basically advertisements that are displayed within video games. These ads can further be categorised into,

- **Banner ads:** These are static or animated images that are displayed at the bottom of the screen or in other non-intrusive locations.
- **Video ads:** These are short videos that are played before, during, or after gameplay.
- **Interstitial ads:** These are full-screen ads that are displayed when the player pauses the game or completes a level.
- **Native ads:** These are ads that are designed to blend in with the game environment. For example, a native ad might appear as a billboard in a racing game or a product placement in a role-playing game.

In-game ads are a popular way for game developers and gamers to generate revenue. They can also be used to promote new products or services, or to target specific demographics. But if not executed properly they can be disruptive to the gaming experience. Some people find them to be annoying and disruptive, while others are more tolerant of them. By carefully considering the needs of each audience, companies can create ads that are effective and engaging. Ultimately, the success of in-game ads depends on finding the sweet spot that balances interests of various actors in the ecosystem. But it is clear that as the gaming industry continues to grow, it is likely that in-game ads will become an important part of the landscape.

Moving on, in-game ads in live gaming streams are even more important for companies, developers, players and gamers for a variety of reasons.

- **For companies**, ads in live gaming streams can be a way to reach a large and engaged audience. Live gaming streams audiences are a valuable demographic, and they are often more receptive to ads than other audiences and more likely to pay attention to ads that are relevant to their interests.. Additionally, live gaming streams

offer a unique opportunity to target ads based on the game being played, the streamer's audience, and even the streamer's own preferences. Also, it is relatively easy for advertisers to measure the effectiveness of their ads by tracking the number of impressions, clicks, and conversions.

- **For developers and players**, ads in live gaming streams can be a way to generate revenue from their games.
- **For gamers**, ads in live gaming streams can be a way to support their favourite streamers. Additionally, some ads offer rewards, such as in-game currency or items. Additionally, ads can sometimes be humorous or entertaining.

The development of new technologies, such as virtual reality (VR), augmented reality (AR), blockchain, and access to in-game data, is opening up new possibilities for in-game advertising. These technologies allow for more immersive and interactive advertising experiences, which can be more engaging for gamers and more effective for advertisers. For example, VR ads can place players inside a brand's virtual world, while AR ads can overlay brands' products or messages onto the real world. The metaverse, or virtual world, is also a promising new frontier for in-game advertising. The metaverse is still in its early stages of development, but it has the potential to create a completely immersive and interactive advertising environment. These new technologies are giving advertisers new ways to reach gamers and engage them with their brands. As these technologies continue to develop, we can expect to see even more innovative and effective in-game advertising in the future.

While many companies like Anzu, Bidstack, Frameplay, and Gadsme have mastered placing in-game ads, none have yet found a way to quantitatively measure the optimal placement and relevance of these ads, especially in live gaming streams. This is a major challenge for advertisers, who need to know how to effectively reach their target audience and measure the effectiveness of their advertising campaigns.

When deciding where to advertise, companies typically consider three factors:

- **Target audience**: Who are they trying to reach? Where do they spend their time? For example, a company targeting young adults might advertise on social media platforms like TikTok or Snapchat.
- **Budget**: How much money are they willing to spend? This will affect the size and reach of their advertising campaign.
- **Goals**: What do they want to achieve with their advertising campaign? Do they want to increase brand awareness, generate leads, or drive sales?

Once a company has considered these factors, they can select the advertising channels that are most likely to be effective. However, it is important to track the results of their advertising campaigns so that they can make necessary adjustments. This can be done by measuring metrics such as website traffic, conversion rate, and sales volume.

While the latter problem might seem simple to solve, the former that is deciding where to advertise their product, pose a problem for in-game ads as comparing them to other ad channels is close to impossible right now.

However, we can use in-game data to help advertisers make data-driven decisions about placement and relevance of ads inside the game. This will help them optimise their ad campaigns and achieve their marketing goals.

## Market Outlook

In-game advertising is a rapidly growing market. The global in-game advertising market is projected to reach US\$46.06 billion by 2027, growing at a CAGR of 9.10% from 2023 to 2027. This growth is being driven by a number of factors, including:

- The increasing popularity of video games: The number of gamers worldwide is expected to reach 2.7 billion by 2023, providing a large and growing audience for in-game advertising.
- The rise of mobile gaming: Mobile gaming is the fastest growing segment of the video game market, and this is also driving the growth of in-game advertising.

The games live streaming market is also rapidly growing. The global games live streaming market is projected to reach US\$17.39 billion by 2027, growing at a CAGR of 10.44% from 2023 to 2027. This growth is being driven by a number of factors, including:

- The increasing popularity of live streaming is providing a new type of content for gamers to watch and enjoy.
- The growth of esports is also driving the growth of games live streaming, as people are increasingly interested in watching competitive gaming.
- The increasing use of social media is a major driver of games live streaming, as it allows gamers to connect with each other and with their favourite content creators.

The global esports market is growing rapidly as well, with the audience expected to reach 532 million in 2022 and 640 million in 2025. Esports enthusiasts—those who watch esports content more than once a month—will account for just over 261 million.

Esports is generating over \$1.38 billion in revenues globally, and China accounts for nearly a third of this. The two fastest-growing revenue streams for esports are digital and streaming, with CAGRs of +27.2% and +24.8% respectively.

The growth of the esports market is being driven by a number of factors, including the increasing popularity of video games and the growing availability of high-speed internet. Growing awareness around digital assets and NFTs will likely boost this as fan interest in acquiring in-game items of esports IP.

Overall, the esports market is a rapidly growing and expanding industry, and it is expected to continue to grow in the coming years. Here are some additional details about the growth of the esports market:

- The Asia Pacific region is the largest market for esports, followed by North America and Europe.
- The most popular esports games include League of Legends, Counter-Strike: Global Offensive, and Dota 2.
- Esports is becoming increasingly mainstream, with major sporting events such as the Olympics considering including esports competitions.

The growth of in-game advertising, games live streaming and esports is a trend that advertisers should take advantage of. By understanding the factors driving this growth and the advantages that these channels offer, advertisers can reach a large and engaged audience with their marketing messages.

## Problem

In-game data is of immeasurable value to advertisers, sponsors, streaming services, players, teams, and game developers. Using in-game data, advertisers and sponsors can find the best people to target, streaming services can make their content more appealing, players and teams can refine strategies through performance analysis, and game developers can improve gaming experience.

But while companies like GRID esports provide the infrastructure to access and distribute in-game data just having this data stored in databases isn't enough. The stored data alone falls short. Advertisers, sponsors, streaming services, players, teams, and game developers don't really know how to dig into the data and understand it. They lack the skills to query, analyse and expertise to delve into its depths of data, leaving them unable to extract its value.

This is where a helpful solution like Spaces comes into play.

Imagine a service that does the hard work for them. They don't have to grapple with data analysis pipelines or hire specialist engineers and scientists anymore. Instead, imagine a sophisticated tool that crafts insights effortlessly. This tool processes data and distils it into invaluable insights. It's akin to summoning a dedicated team of data experts at will. In a world where gaming and data go hand in hand, having this kind of support could make a big difference.

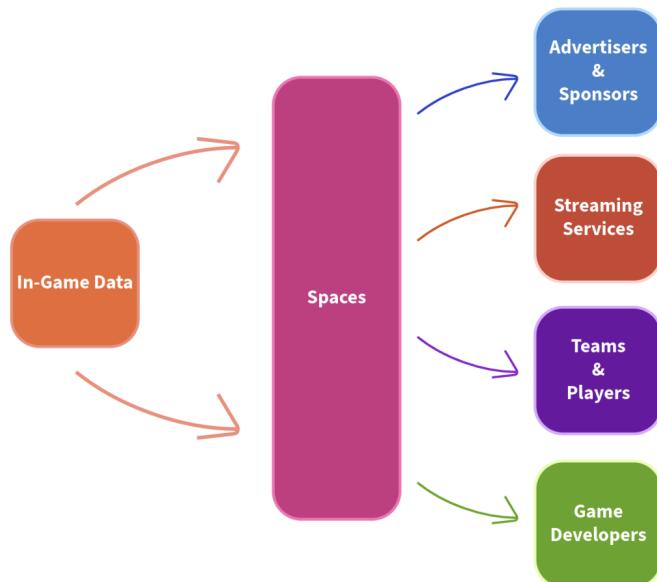


Fig 1. Spaces processes in-game data and distils it into invaluable insights for advertisers, sponsors, streaming services, players, teams, and game developers .

To start, we decided to build something that helps sponsors leverage in-game data for sponsorships in live esports gaming streams.

We want to take esports from where it is today, which is football in the early 20th century to where it is today. From simple attire, plain balls and mundane stadiums to branded and sponsored players, jerseys, balls and stadiums.



Fig 2. On the top, an early 20th-century match with players in plain attire chasing a simple leather ball in a modest stadium. Fast forward to the bottom, a 21st-century game with players adorned in branded shoes and jerseys with sponsors logos, chasing a ball stamped with sponsors logos in a stadium surrounded by sponsor and advertiser logos. Red boxes highlight advertisers and sponsors logos.

Please note that advertising and sponsorship are typically used interchangeably because sponsorship is a form of advertisement, but there are subtle differences. Advertising implies that a payment has been made to place an ad with specific messaging in place. A sponsorship, on the other hand, implies a much deeper, often ongoing relationship between two parties. For now, we have decided to start with player sponsorships but we can extend whatever we have talked about till now or will talk from here onwards to other forms of blended in-game ads.

Also note that we will focus on CS:GO in this document but we can extend whatever we have talked about till now or will talk from here onwards to other games.

Coming back to in-game sponsorships, right now, to execute in-game sponsorships, a lot of collaboration and work is required from the side of game developers, esports event organisers, sponsors and players.

Even if game developers are ready to take on hard work, esports event organisers, sponsors and players lack the knowledge, skills and tools to make in-game sponsorships a reality.

Sponsors currently lack tools to:

- Visualise historical player performance data and identify top performers.
- See how their in-game logo placements will look in real time.
- Flexibly add or update branding content from one match to the next.
- Bid for in-game digital spaces and seamlessly sponsor players.

Event organisers need to manage in-game custom assets and integrate them. We can easily automate the complete process thanks to the digital nature of games. As no one has done it, it presents a unique opportunity to build such a valuable tool.

Players don't have a platform to easily monetize their in-game space and secure sponsorship deals.

A tool that streamlines the sponsorship process from start to finish would be a valuable asset for sponsors, event organiser and players, especially now, as the gaming industry continues to grow and such tools are needed for sponsorships to evolve and come into play.

Making in-game sponsorships a reality will revolutionise the way brands reach gamers, opening up new revenue streams for sponsors, players, game developers, and event organisers.

# Product

## Platform

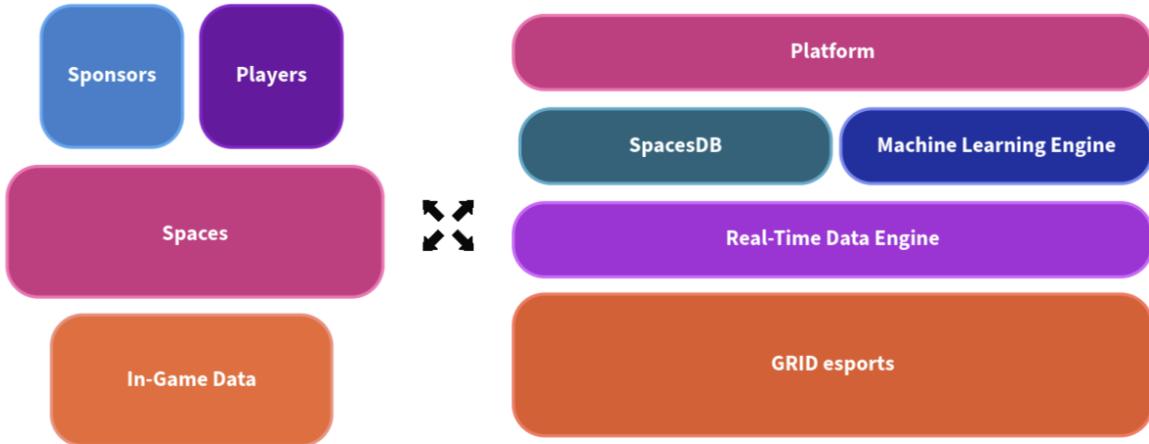


Fig 3. Spaces, a platform for data-driven, smart, in-game sponsorships for live gaming streams.

Spaces is a platform that provides a data-driven interface to sponsors, players and event organisers for smart sponsorships in live esports gaming streams.

Spaces provides,

1. Sponsors,
  - a. Access to players performance metrics, accumulated view time and details on past sponsorships.
  - b. Auctions for bidding on in-game digital spaces and seamlessly sponsor players.
  - c. Tool to add or update branding content from one match to the next and visualise how the in-game blended sponsorship will look like with their assets.
2. Players,
  - a. Auctions to monetise their in-game space and secure sponsorship deals.
3. Event organisers,
  - a. Tool to manage in-game custom assets and easily integrate them.

## Player Cards and Profiles

We use in-game data to create player cards and profiles, and showcase historical player performance data and identify top performers.

To further help sponsors decide which players to sponsor we have designed metrics based on the following ‘key moments’ hypothesis,

*Players who generate key moments, moments that would be featured in esports live streams and repeatedly shown across social media and short media platforms, such as replays, best plays, and reels, will accumulate most view time.*

This hypothesis aligns with sponsors' interest in increasing brand awareness, generating leads and driving sales.

Please note that we use GRID esports services to get in-game data for esports events.

### Player Performance Metrics

We use the following metrics to track player performance and accumulated view time.

1. **Total Number of Rounds:** The number of rounds a player has played.
2. **Total Number of Matches:** The number of matches a player has played.
3. **Total Number of Kills:** The number of kills a player has secured across rounds played.
4. **Total Number of Headshots:** Total number of headshots a player has secured across rounds played.
5. **Overall View Time:** Overall view time for a player is the sum of the estimated view time of a player across all rounds played.  
Estimated view time is the time shared between a player and his teammates across a round. It is defined as follows,

For example, let's say a round lasts for two minutes, and there are two players. Now, if player 1 dies after 45 seconds since the round started and player 2 played till the end of the round, then the estimated view times of players for this round are,

$$\text{Estimated Time Player 1} = 45 \text{ seconds} \times (1 / 2) = 22.5 \text{ seconds}$$
$$\text{Estimated Time Player 2} = 45 \text{ seconds} \times (1 / 2) + 75 \text{ seconds} \times (1 / 1) = 97.5 \text{ seconds}$$

We take the sum of the estimated view time of a player across all rounds played to give the final value of the overall view time for a player.

6. **Average Estimated View Time:** Average view time for a player is the average estimated time across all rounds played.
7. **Average Tournament Coverage:** Average number of tournament stages covered by a player across all tournaments played.

For example, let's say a player is playing in a knockout-style tournament, and they cleared round of 16 and quarter-finals but got knocked out in the semi-finals. Then, the tournament coverage of the player in this tournament is equal to  $3 / 4 = 0.75$ .

We take the average of this number across all the tournaments a player has played to give the final value of average tournament coverage.

8. **Overall Key Moments Count:** Overall key moments a player has generated.

We define key moments as follows,

- A. **Damage Kill Key Moment:** Damage over a period of time followed by a kill.

For example, let's say player one damages player two, followed by killing them. The damages that player one has dealt to player two in a round is contained in the set D, where D is,

$$D = \{ (d_1, t_1), (d_2, t_2), \dots, (d_k, t_k) \}$$

where  $d_i$  is damage dealt at time  $t_i$  for every  $i$  and  $t_k$  is the kill time.

Now, we calculate the set T as follows,

$$T = \{ t_k - t_{k\_min\_1}, \dots, t_3 - t_2, t_2 - t_1 \}$$

For each element in set T, starting from the kill time, wherever it becomes less than some predefined delta threshold, we mark it as the end of the key moment.

We can do this for all kills a player has secured across all rounds played to find all the damage kill key moments and also calculate the total time of a damage kill key moment by summing up all the deltas before the end mark of the key moment.

- B. **Kill Kill Key Moments:** Multiple kills over a period of time.

Let's say kills that a player has done in a round is contained in the set K, where K is,

$$K = \{ t_1, t_2, \dots, t_m \}$$

where  $t_j$  is the time of kill j for every j and  $t_m$  if the final kill in the round.

Now, we calculate the set T as follows,

$$T = \{ t_m - t_{m\_min\_1}, \dots, t_3 - t_2, t_2 - t_1 \}$$

For each element in set T, starting from the last kill time, wherever it becomes less than some predefined delta threshold, we mark it as the end of the key moment.

We can do this for all kills a player has secured across all rounds played to find all kill kill key moments and also calculate the total time of a kill kill key moment by summing up all the deltas before the end mark of the key moment.

We count the damage kill and kill kill moments a player has generated across all rounds played to give the final value of the overall key moments count.

9. **Overall Key Moments Time:** The accumulated time duration of all key moments generated by a player.
10. **Total Number of Aces:** Total number of aces a player has secured across rounds played.
11. **Total Number of Clutches:** Total number of clutches a player has secured across rounds played.
12. **Average Last Man Standing Time:** Average last man standing time for a player is the average clutch time across rounds played.

For example, let's say for a round that lasted for 2 minutes, a player is the last man standing in their team starting at 45 seconds since the round started and he continued to play till the end of the round. Then, the last man standing time for the player in this round is 75 seconds.

We take the average of this value across all the rounds a player has played to give the final value of average last man standing time.

13. **Average Percentage of Opponent Team Killed:** Average fraction of opponent team killed by a player across rounds played.
14. **Average Round View Percentage:** Average fraction of total round time occupied by a player across rounds played.
15. **Player Damage Kill Information Index:** This metric is designed by us to find players who generate key moments of damage over a span of time followed by a kill.

For example, let's say player one damages player two, followed by killing them. Let's say the damages that player one has dealt to player two in a round is contained in the set D, where D is,

$$D = \{ (d_1, t_1), (d_2, t_2), \dots, (d_k, t_k) \}$$

where  $d_i$  is damage dealt at time  $t_i$  for every  $i$  and  $t_k$  is the kill time.

Now, we calculate the set T as follows,

$$T = \{ t_1 - t_k, t_2 - t_k, \dots, t_k - t_k \}$$

Now, we calculate the mean,  $\text{mean}_T$  and standard deviation,  $\text{sd}_T$ , over this set and compute the player damage kill information index as follows,

$$\text{Player Damage Kill Information Index} = \text{sd}_T / \text{mean}_T$$

Motivation for this formula comes from analysing the key moment it is trying to identify: damage over a span of time followed by a kill. We want damages player one

has dealt to player two before killing to span over some time before the kill and ignore the damage dealt way into the past that didn't lead to the kill. Thus, we want the mean of the set T to be small and the standard deviation to be big. Let's analyse different cases to see how the metric behaves,

<b>mean_T</b>	<b>sd_T</b>	<b>Player Damage Kill Information Index</b>	<b>Information about the Event</b>
Big	Small	Small	Player dealt damage in the past over a very short span of time and not before the kill.
Big	Big	~	Player dealt damage in the past and not before the kill.
Small	Small	~	Player dealt damage over a very short span of time before the kill.
Small	Big	Big	Player dealt damage over some span of time before the kill. <b>(Key Moment)</b>

From the above analysis, we can conclude that the higher the value of the player damage kill information index, the more probable a kill done by a player is a damage kill key moment.

16. **Player Kill Kill Information Index:** This metric is designed by us to find players who generate key moments of multiple kills over a span of time.

Let's say kills that a player has done in a round is contained in the set K, where K is,

$$K = \{ t_1, t_2, \dots, t_m \}$$

where  $t_j$  is the time of kill j for every j.

Now, we calculate the set T as follows,

$$T = \{ t_1 - t_2, t_1 - t_3, \dots, t_1 - t_j, t_2 - t_3, t_2 - t_4, \dots, t_2 - t_j, \dots \}$$

Now, we calculate the mean, mean\_T and standard deviation, sd\_t, over this set and compute the player kill kill information index as follows,

$$\text{Player Kill Kill Information Index} = \text{sd}_T / \text{mean}_T$$

Motivation for this formula comes from analysing the key moment it is trying to identify, kills over a span of time. We want multiple kills that span over some time and ignore kills that are far apart. Thus, we want the mean of the set T to be small and the standard deviation to be big. Let's analyse different cases to see how the metric behaves,

<b>mean_T</b>	<b>sd_T</b>	<b>Player Damage Kill Information Index</b>	<b>Information about the Event</b>
Big	Small	Small	Player kills are usually far apart.
Big	Big	~	Player kills are far apart.
Small	Small	~	Player kills are usually very close to each other.
Small	Big	Big	Player kills are close to each other. ( <b>Key Moment</b> )

17. **Average Damage Dealt:** Average damage a player has dealt rounds played.

$$\text{Average Damage Dealt for a Player} = (\text{Total Damage Dealt across Rounds Played} / \text{Total Number of Rounds Played})$$

## Auctions

We have implemented an anonymous english auction, which is an open-outcry anonymous ascending dynamic auction. Throughout the auction, the bidders remain anonymous to avoid transmitting information to bidders in real-time and the following adversarial effects. It proceeds as follows.

1. The auctioneer opens the auction by announcing a suggested opening bid, a starting price for the space on sale.
2. Then the auctioneer accepts increasingly higher bids from the floor. The auctioneer usually determines the minimum increment of bids, often making them larger as bidding reaches higher levels.
3. The highest bidder at any given moment is considered to have the standing bid, which can only be displaced by a higher bid from a competing buyer.

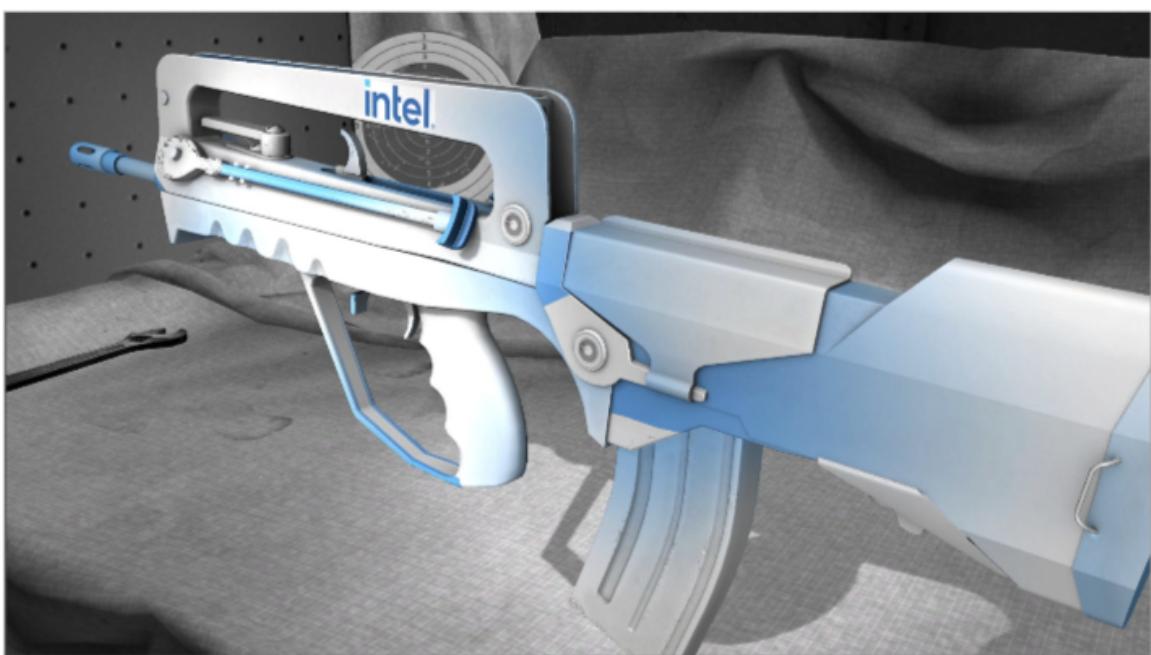
4. If no competing bidder challenges the standing bid within the time allowed by the auctioneer, the standing bid becomes the winner, and the space is sold to the highest bidder at a price equal to their bid.
5. If no bidder accepts the starting price, the auctioneer either begins to lower the starting price in increments, or bidders are allowed to bid prices lower than the starting price, or the space is not sold at all, according to the wishes of the seller or protocols of the auction house.

## Brand Customization of In-Game Space

After an auction is complete, all the in-game spaces that were up for grabs in that auction will be branded to the specifications of the winning sponsor.

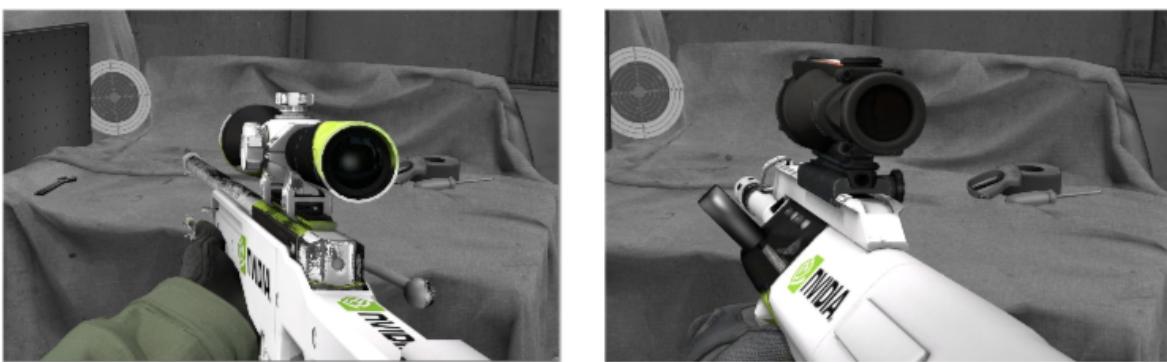
The following images give a glimpse of what in-game sponsorship will look like for CS:GO.















## Vision

We envision a future where in-game data is used to deliver data-driven, smart in-game advertising and sponsorships for live gaming streams. We believe that this will create a more engaging and immersive experience for gamers, while also providing sponsors and advertisers with a more effective way to reach their target audience.

To make this vision a reality, we are building a machine learning engine that will automatically build insights over in-game data and provide it to different stakeholders. This engine can be used by anyone - sponsors, advertisers, streaming services, players, teams, and developers to leverage the power of in-game data and work on next-gen use cases and applications in live gaming streams like smart esports betting apps or smart streaming to enhance the viewer experience.

This submission is just a first step towards our long-term vision. We are excited to see how this technology can be used to improve the live gaming experience for everyone involved.