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Mestrado em Data Science and Advanced Analytics

Master Program in Data Science and Advanced Analytics

**Report Internship :
Dashboards to increase data-driven
decision-making based on player's
behaviour**

FRVR Gaming Start-Up

NOVA Information Management School
Instituto Superior de Estatística e Gestão da Informação
Universidade Nova de Lisboa

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DASHBOARDS TO INCREASE DATA-DRIVEN DECISION-MAKING

BASED ON PLAYER'S BEHAVIOUR

FRVR GAMING START-UP

by

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Internship report presented as partial requirement for obtaining the Master's degree in Advanced Analytics, with a Specialisation in Business Analytics

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November 2022

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledge the Rules of Conduct and Code of Honour from the NOVA Information Management School.

Li-lou Dang-Thai

In Lisbon, August 2022

ACKNOWLEDGEMENTS

ABSTRACT

The gaming industry has seen a massive increase over the last decade, having also seen an important boom during the COVID-19 Pandemic. The growth of the game industry has led to a huge increase in the number of new players and a rise in the popularity of Free to Play (F2P) games. As a result, there has been a shift in the gaming industry from a flash game to an online game that is attracting a lot of players everyday. This new model of gaming has proven to be a successful way to gain revenue. This report will detail a clear roadmap through my journey as a Junior Data Analyst and how BI reporting tools such as Dashboards are the foundation of data literacy which leads to understanding player's behaviour and to data-driven decision around improvement and game innovation.

Keywords : Business Intelligence, Data Visualisation, Data Transformation, Dashboards, Data Literacy, Data-Driven, Gaming Industry

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List of abbreviations

ARPDAU	Average Revenue Per Daily Active User
ARPPU	Average Revenue Per Paying User
ARPU	Average Revenue Per User
BI	Business Intelligence
DAU	Daily Active User
DBT	Data Base Tool
DNU	Daily New User
ELT	Extract Load Transform
eCPM	Effective Cost Per Mille
FB	Facebook Instant
FPS	First Person Shooter
FTUE	First Time User Experience
F2P	Free to Play
GSD	Game Studio Dashboard
IAP	In App Purchases
KPI	Key Performance Indicator
SIP	Samsung Instant Play
2SIP	2nd Session Install Point

I. Introduction

The gaming industry has had a massive increase over the last decade, having also seen an important boom during the COVID-19 Pandemic. There are over 2 billion players across the world, accounting for 25% of the world. In terms of revenue and money, this upcoming industry is bigger than the movie and the music industry combined[1]. Another noteworthy development has been a scramble by big tech companies to acquire and consolidate companies with massive Intellectual Property in terms of video games into their products, ecosystems and business models and strategy.[2] For example, Microsoft recently purchased the massive games publisher Activision Blizzard for 75 billion dollars.[3] This development is comparable to the competition seen in the streaming industry, such as Amazon acquiring studio MGM for 8 billion dollars.[4]

Going beyond the scope of video games as an industry and deeper into the scope of video games as a product, there is a lot that goes into the creation of games. The process of developing a game spans technical, creative and business. In addition to programming a video game, there are style and fantastical elements that go beyond the scope of a programmer and more into the scope of a game designer or artist. Furthermore, there is also the business aspect of it. Monetisation of games has evolved massively and, with it, so have the business models of the video games industry. Working for FRVR allowed me to learn and discover more about the creation of functioning games.

The key to success in the gaming industry doesn't solely rely on quality games, and super-powered developers. Community is highly important[5], the success of this industry depends on the communication between the gaming companies and the players.

FRVR is a start-up that on the verge of becoming a scale-up. As the company is growing and gaining more daily players everyday, it is essential to understand what is the key to success in this case. How to know if you have a happy community ? They are baseline key metrics that every gaming company are using to analyse and understand player behaviour[6]. Like every product, a good game needs ownership and tracking of the key metrics and working with key stakeholders, in this case game studios, game producers and FRVR leadership.

There are numerous steps between the collection of data and the decision-making. In order to understand the players behaviour, there is a need of business intelligence and data literacy. As mentioned, their is a high competitiveness in the gaming industry, which makes it very important

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[1] "The video game sector is immensely large. In fact, it is larger than the movie and music industries combined, and it is only growing."
Andrew Beattie. (2021) How the Video Game Industry Is Changing. https://www.investopedia.com

[2] "The biggest tech companies have powerful incentives to take the next step and develop full gaming operations"
Richard Waters. (2021) Why gaming is the new Big Tech battleground. https://ft.com

[3] "Microsoft's audacious $75bn move on games publisher Activision Blizzard has detonated a bomb under the games industry."
Richard Waters. (2021) Why gaming is the new Big Tech battleground. https://ft.com

[4] "Amazon has closed its deal to acquire film studio MGM after US and European competition regulators declined to block the move, despite growing concern over the ecommerce giant's size."
David Lee. (2022) Amazon closes $8.45bn deal to acquire film studio MGM https://ft.com

[5] "The key to success in the gaming industry today, sadly, is not solely dependent on how much developers know but about the "community"
Protocol, F. (2017) How player behaviours affect the gaming industry. https://medium.com

[6] "That's why the proper tracking of mobile game metrics matters the most."
Mihovil Grguric. (2022) 15 Key Mobile Game Metrics That Developers MUST Track. https://www.blog.udonis.co

for companies to have permanent access to analytical reports regarding their day-to-day activities[7]. BI has become indispensable for every companies across the world, it is defined as the main support to data-driven decision-making[8]. It has become critical for gaming companies to understand their own data and how to use it to their advantage. Which brings me to the second need : data literacy - the ability to understand and use data effectively to inform decisions.[9] BI is the backbone of reaching data literacy and to move towards it we are using the famous BI reporting tool : dashboards. They should support a higher a level of data awareness than conventional reports.

Dashboards created by the data team are made with the BI tool : Google Data Studio[10]. **Appendix 1 : Dashboard Listing** is an index for the whole company to find all available dashboards. We currently have 11 dashboards in total made available to members of the company as well as some external contractors – as is the case with 2nd and 3rd party studios – who may have access to limited, relevant data. For an example of a dashboard accessible to external users, we have the Game Studio Dashboard.

In addition to these dashboards made widely available for anyone in the company, there are also specific, tailor-made dashboards created by specific request for specific teams or projects, or with a limited scope. Every dashboard created all have the purpose of improving and facilitating data-driven decision making. In partnership with Business Intelligence and Dashboards is Data visualisation. It is vital for designed dashboard, to have appropriate visuals that are understandable and leads the users to focus on the important metrics.[11] For the creation of dashboards, I followed the main principles of data visualisation according to Stephen Few, a leader in the field, and I tried to take full advantage of data visualization's power. Visual communication is as important as verbal language, there are rules, and semantics to understand.[12] If they are not followed, dashboard can quickly become obsolete and useless.

1. Academic Context

I am a Master's student at Nova Information Management School studying Data Science and Advanced Analytics. This course includes a major in Business Analytics. Throughout the year, I had the opportunity to approach data in various and many ways in order to learn new skills and techniques to be applied in real-life scenarios in projects within FRVR.

The master program taught me these fundamental skills : Programming in Python, Data Mining (Python), Machine Learning (Python), Storing and Retrieving Data (SQL), Big Data Management

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[7] "In today's competitive market situation, it is extremely important for small business and large corporations to have permanent access to analytical reports regarding their business activities."
Dmytro Orlovskyi. Andrii KoppA. (2022) Business Intelligence Dashboard Design Approach to Improve Data Analytics and Decision Making

[8] "BI has become indispensable for strategic decision-making in companies and governments around the world."
Carlos Andrés Tavera Romero. Jesús Hamilton Ortiz. Osamah Ibrahim Khalaf. Andrea Ríos Prado. (2021) Business Intelligence: Business Evolution after Industry 4.0.

[9] "The ability to understand and use data effectively to inform decisions."
Wolff Annika. Gooch Daniel. Montaner Jose. Rashid- Umar. Kortuem Gerd. (2016). Creating an Understanding of Data Literacy for a Data-driven Society.

[10] Google Data Studio is an online tool for converting data into customisable informative reports and dashboards introduced by Google on March 15, 2016.
https://datastudio.google.com/

[11] "It is extremely vital for designed dashboards, since inappropriate visuals may mislead users and shift their focus to wrong things."
Dmytro Orlovskyi. Andrii KoppA. (2022) Business Intelligence Dashboard Design Approach to Improve Data Analytics and Decision Making

[12] "Visual communication involves semantics and syntax, much like verbal language. You must know the rules to communicate effectively with graphs."
Stephen Few. (2007) Data Visualization - Past, Present, and Future

(NoSQL), Statistic (A/B testing), Data Visualisation and Business Intelligence. Each one of these courses was crucial for my internship and allowed me to add value to the data team.

2. Organisational Context

FRVR is a gaming company focused on the democratisation of games and finding a distribution model that goes beyond the current app store based model. Their purpose is to build and publish games that can be played on any device, as long as it can access a web browser. The company was founded in 2014 by Chris Benjaminsen, who built FRVR's first game - Solitaire FRVR - as an experiment with new forms of game distribution. He was then joined by games industry veteran Brian Meidell as co-founder and CEO in 2016.

As stated previously, FRVR's goal is first and foremost to democratise access to games. To achieve this end goal, they have built an ecosystem of games that have been replicated in billions of devices and user-agents to date. These games are built to size on FRVR's proprietary technology stack that allows games to be developed and published in a wide variety of platforms. As a result, millions of players enjoy FRVR games every single day. As a tech start-up, FRVR has a robust operating model and is backed by world class investors such as Hiro Capital and the Makers Fund. Headquartered in Lisbon, FRVR has built itself as an international company of the 21st century having a physical presence in Malta, Spain, the United Kingdom, Denmark and even China.

One of the keys to the company's success and business model are the availability to make over hundred games available across its partners channels. What this means is that a user browsing Facebook or a user browsing Samsung's device ecosystem, for example, are likely to come across FRVR games. It should be noted that not all of FRVR's games are available on every single platform, although the games that are made available should be equivalent.

Because the market for Instant and HTML5 games is relatively new and niche, FRVR has invested into the creation of its own games – these have been worked on either by outside game developers or studios which can operate independently from FRVR or in-house. This investment has allowed FRVR to position itself in a brand new market as they paved the way for a proof of concept of their own viability.

Despite this, FRVR sees itself essentially as a publisher. Even though it employs studios directly or indirectly, the ideal scenario would be for FRVR to offer self-service products for studios to publish their games to FRVR's established audience. Nevertheless, we can consider these two studios to be owned by FRVR and – therefore – first-party studios:

- Worlds: a team of 7 people working full time on a flagship title called Worlds FRVR, which may be viewed as the Minecraft of Instant Games
- Yendis: a team of 12 people with a well established product, a shooter called Krunker, which itself may be viewed as an instant games crossover between Counter-Strike and Call of Duty.

The following two studios work under FRVR and are owned by FRVR in some way or manner but retain full independence - in other words, they may be seen as 2nd party studios:

- FRVR Studio Ursus
- FRVR Studio Spelunca

Both of these studios have published a wide array of HTML5 instant games with Javascript readable code, having produced titles such as Yahtzee FRVR, Minigolf FRVR and Golddigger FRVR.

The work arrangements for these studios differ, and so do their business models. A first party studio will be a lot more strategic to the company's overall goals. Furthermore, the level of support given to a studio or game also depends on the product's complexity and quality.

Finally, we have third party studios and developers such as OriginX, Betapilot, Enter the Studio, among others. Overall, FRVR counts with a network of 20 outsider studios who develop and monetise their games through the audience FRVR has cultivated.

The reason why the studios are noteworthy is because they are key to their strategy. The democratisation of games is not simply a matter of making games available to be played on any device. It is also a matter of quality. During the start of FRVR's life as a company, it was only able to create hyper casual games with very simplistic mechanics that are likely to be a copy of some other well-established titles made in the last 30 years. As the company scales up its capabilities and investment – and as devices become increasingly more powerful – FRVR aims to create gaming experiences far beyond what it currently offers, something beyond what you would expect in a flash[13] game from the turn of the century.

A good portion of the funding secured by FRVR during the first quarters of 2022, over $76 Million in funding[14], is to be invested in Mergers & Acquisitions to turbocharge FRVR's catalog of games. This was the express intent behind the acquisition of Studio Yendis and their already established Shooter and Sandbox Game Krunker.

FRVR is an already established and maturing tech startup taking its first steps into losing its startup title. When I first joined FRVR, the company had around 70 members. As of right now, it has invested heavily in recruitment and now has a team reaching 120 individuals. The Data and Business Intelligence team, of which I am part of, also saw a big increase in this period; it used to be composed of 5 people, including myself, and now has 11 members including two Data Engineers. My daily work is developed with Data Analysts of various seniority levels, the aforementioned Data Engineers and until recently a Data Scientist.

The Data and Business Intelligence team serves essentially as support, offering vital tooling, reporting and dashboarding to people and teams within the organisation. Within the company, I have come to work with many teams:

- **Games Team** : composed of game producers and business developers. Game Producers function is to support and be the middlemen between FRVR and the Game Studios.
- **Channels Team** : FRVR's success and business model is dependent on the Channels teams and its ability to create strategic partnerships with platforms (known as channels) to distribute and monetise its catalog of games to their audiences. The most popular channels so far are Facebook and Samsung. FRVR games are also made available through more traditional channels

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[13] "Flash® games are interactive media created for online and mobile applications using the Adobe-owned, Macromedia-developed Flash® software."
Carmelo Spatazza (2022) What are Flash® Games? https://www.easytechjunkie.com

[14] Marie Dealessandri (2022) Frvr raises $76m to expand casual games platform. https://www.gamesindustry.biz

such as app stores (Android, iOS) and also experimenting with newer and less conventional channels such as Snapchat and TikTok. There are a total of (...) different channels.

- **Engineering Team** : the backbone of FRVR, composed mainly by Software Developers, Front and Back-end software developers and DevOps engineers. Engineers are split according to their specialty in regards to the technology they use and at which point of the data stack they work in.
- **Product Experience And Design Team** : composed of artists, product managers and designers. So far unmentioned in this report, this team also serves as one of the backbones of FRVR and its strategy to develop high quality products and experiences for anyone to access as long as they have a device to access the internet with.

These teams are the pillars over at FRVR, and each one of them has different needs regarding tooling, reporting and dashboarding. I have developed work in some way with all of these teams, be it on a regular basis or through ad-hoc requests and projects. Some teams that I have not developed work, but depend on the Data team, include Finance and C-level executive reporting.

3. Goals of the Internship / Organisation of the report

As previously stated, the Masters in Advanced Analytics includes a series of courses and projects that are vital for developing work as a Data professional. Some of these courses, namely, Data Analysis, Business Intelligence and Data Visualisation have proven themselves as essential for the work I developed as a Data Analyst. As a first-time experience in the field, my goal was to employ skills such as scripting and high-level programming languages in regards to data preparation, analysis and visualisation. Furthermore, the video games industry is a natural fit for a Data Analyst and these new tools have quickly become essential in the toolbelt of nearly all Data professionals.

This report will detail a clear roadmap through my journey as a junior data analyst and how BI reporting tools such as Dashboards are the foundation of data literacy which leads to understanding player's behaviour and to data-driven decision around improvement and game innovation.

I will approach the writing of this report by going into detail on the inner workings of FRVR and the view and approach it uses as a gaming start-up. A second part of this report will go into detail on the tasks, projects and activities I developed as a Junior Data Analyst on a day-to-day basis. For the last part of this report, I will talk about what I consider to be the most consequential project I have been involved in at FRVR.

It is expected that this report will provide a clear picture on how to approach player's behaviour through the use of data visualisation and dashboards.

II. Start-up Effect
1. FRVR verse

The main driver behind FRVR is to democratise games. For games to be accessible for everyone, and everywhere. Regardless of device and regardless of the digital space of our choosing or where we choose to play our games. All games should be free to play and optimised to a point where they are playable on a "potato" - a device with poor specifications. Indeed, this is already the case

according to our telemetry as people from India are accessing our games through browsers of Jio phones featuring 512MB RAM and a processor clock speed measured in MHz.

Most games built by FRVR are also available on the website: frvr.com. Some channels may feature platform-specific or exclusive titles, but the expectation is that games offer a similar experience no matter what the platform.

Everyone that joins the firm goes through an onboarding of each section. In those sessions you learn what FRVR stands for and what every department is working on and how they contribute to the goal. My first onboarding was led by the Chief Executive Officer. The vision of company is to create an FRVR verse accessible by everyone.

The concept of FRVR-verse inserts itself into a wider trend known as "Metaverse" that has gained wider attention ever since Facebook rebranded its company to Meta. The Metaverse, in essence, talks of a one stop virtual world with aggregated services or experiences. The logic for it is the more time we spend online, and the more time we spend on a single platform, the more sense it makes for both the online space and the platform as a whole to aggregate more experiences and services.

The FRVR-verse would therefore be a one-stop solution for all of people's gaming needs. It should be mentioned that when people talk about the Metaverse they usually envision an "integrated network of 3D Virtual Worlds.[15]" Metaverse and the FRVR-verse, however, are deeper than simply Virtual Reality. The device most abundant in people's possession are smartphones, and it is likely that most people in the future will be accessing metaverses with smartphones. A metaverse being virtual-reality enabled is a component and not the single truth.

In that sense, the CEO spoke of his vision of the metaverse applied to games and his vision of creating an instant connection between players, with a single application that would cover all needs. Anyone with a computer, smartphone, smart television, VR headset or even a smart car would join in on the FRVR-verse. Games would feature a digital in-game economy that would span and support all games and would be able to be spent on any game from the catalogue. For instance, a Basketball FRVR user could earn coins that could be spent on Minigolf FRVR. For this and other reasons, Brian envisions FRVR, the FRVR-verse and the FRVR mission to create a sort of 'Netflix' of games for everything free-to-play available in a single space.

2. Data Team within the company

On the figure 1 below you can see a more the organigram of the Data Team.
The behaviour of start-ups is different from other companies, this difference is also felt in the data team. Every member of the team was encouraged to speak up and to bring new ideas to the table. As a junior data analyst, I had the opportunity to work on a lot of different projects, such as data analysis, a/b testings, data visualisation, transformation and modelling.

III. Daily Mission of a Data Analyst at FRVR (à changer)

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[15] https://theconversation.com/what-is-the-metaverse-and-what-can-we-do-there-179200
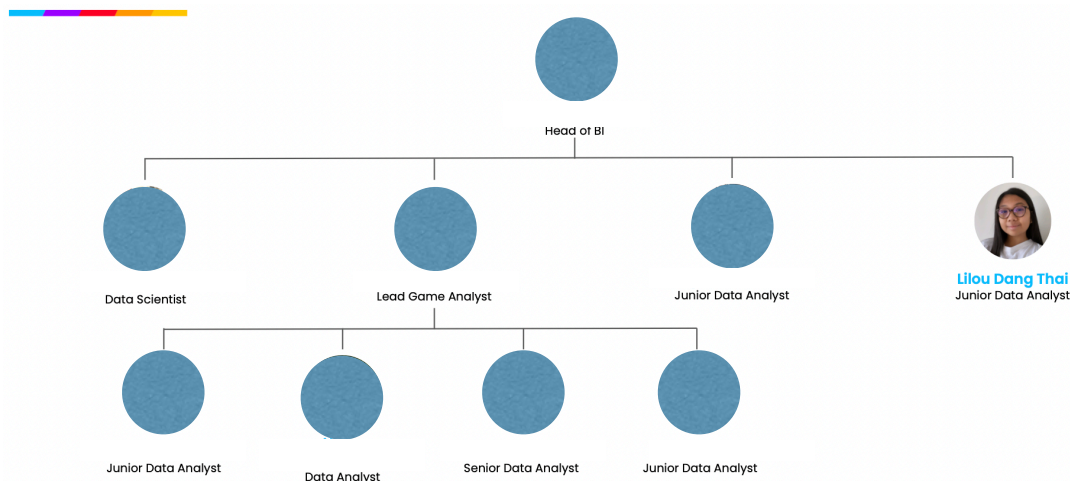
Figure 1 : FRVR Organigram of the Data Team

1. Daily Missioning

The main responsibilities are divided into two big areas: dashboards and all the work that goes into them and analysis, usually stemming from ad-hoc requests. For either one of these tasks, there is the nuanced matter of extracting or having the data we need for reporting and analysis. I will start with a short description of our data pipeline, the tools we use and the main metrics we report with.

We can summarise a data pipeline in 4 main steps: ingestion, warehousing, transformation and visualization. As a Data Analyst, we focus mainly on the visualization layer, although we also work with the transformation layer of a pipeline. For this visualization layer, we use Google's Data Studio that connects directly with our Data Warehouse[16] - a database dedicated to store all of data - on BigQuery[17]. All the collected data is stored into the Data Warehouse to be analysed. Business Intelligence is turning data into information which then transform into knowledge.[18] Another big tool was added to our data stack – Data Build Tool or dbt for short. It potentially serves as the future of Data Analyst work and allows any analyst to transform data directly in the data warehouse[19] in a new ELT[20] - Extract, Load, Transform - paradigm. dbt performs the T (Transform) of ELT, its function is to take code, compile it to SQL, and then run against the database.[21] It supports BigQuery Data Warehouse. It also introduces best practices in software development to the creation of data products and projects.

The main metrics we are tracking across all of our games are :

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[16] "The Data Warehouse is a database dedicated to the storage of all data used in the decision analysis"
Aziza C., Medromi H., Sayouti A. (2013) Actions for data warehouse success.

[17] "BigQuery is a fully managed enterprise data warehouse that helps you manage and analyze your data." Which is owned by Google.
BQ documentation. https://cloud.google.com/bigquery/docs/introduction

[18] "The information is stored in a data warehouse to be analysed by tools for analysis transforming this information into knowing"
Aziza C., Medromi H., Sayouti A. (2013) Actions for data warehouse success.

[19] "DBT (Data Building Tool) is a command-line tool that enables data analysts and engineers to transform data in their warehouses simply by writing select statements."
Stefano Solimito (2019) DBT: A new way to transform data and build pipelines at The Telegraph. https://medium.com

[20] "Extract, Load, Transform is the process of first extracting data from different data sources, then loading it into a target data warehouse, and finally transforming it."
dbt documentation https://docs.getdbt.com/terms/elt

[21] "DBT's only function is to take code, compile it to SQL, and then run against your database."
Stefano Solimito (2019) DBT: A new way to transform data and build pipelines at The Telegraph. https://medium.com

- Daily Active Users (DAU) – a view of our entire audience on a daily basis
- Daily New Users (DNU) – a subset of Daily Active Users that describes how many previously unseen users join or start playing our games. This is important due to discoverability, for example, or the role User Acquisition has in our firm.
- Interstitials Impressions – A type of advertising placement that, like the name implies, occupies an interstitial. Of extreme importance given that we are paid per view.
- Rewarded Impressions – An optional type of placement that can be triggered by the player, whether prompted or unprompted, for a benefit in game. Rewarded impressions tend to be more valuable than interstitial impressions.
- Retention : When are the players coming back. A metric organised by cohort that explains how many players for a given cohort are coming back. This retention metric is an industry standard.
- 2nd Session Install Point (2SIP) : A boolean that allows us to subset players who accessed a game in the catalog for the second time on their first day. This metric is unique and custom-tailored to FRVR to try and find a comparable measure of retention when compared to traditional non-instant games.

These Key Metrics are the most important, and the ones we expect everyone in the company to be familiar with. As stated, retention is also a metric used industry-wide – any market study report aimed at video games will likely mention this metric. These metrics also come up several times throughout this report.

Regarding 2SIP, the way instant games vary from traditional games a player may access by downloading them on an app store is that instant games don't require that additional step. When browsing and getting games on an App Store, a player has to take two actions: one to download the game and another one to open the game. Common sense would dictate that any player that goes through both of these steps will likely come back, as they took the conscious effort to do so. 2SIP is an attempt at emulating this behaviour on instant platforms (like Facebook), in order to obtain a comparable metric.

A lot of different process were created rapidly to accommodate to the fast-growing pace of the company. When I joined FRVR, there was 2 running data pipelines. The old one called 'overview' was created by the Senior Game Lead. As the firm is growing more and more, a lot of changes are made. A second pipeline was created called 'channels_prepped', with more data. The main difference between those two pipelines is how a user is defined. As we are retrieving data from different channels, the most important thing is to have uniform data. Those two pipelines work entirely in BigQuery, and each tables comes from schedule queries created by member's of the team.

At the beginning of the year, the data team was joined by our Data Engineer. Since his arrival, he restructured our whole pipeline, and we are currently moving all of our tables to dbt This change has the purpose to have a more structured data pipeline, but it also aimed at saving money. With 2 running pipelines on BigQuery and many schedule queries running everyday, the spending are increasing every month. The Junior Data Analytics Engineer worked on migrating the whole pipeline onto the new and fresh dbt pipeline.

The main issue which was present before I joined the firm, was the data we received from Samsung Instant Play, on the contrary to the others, was aggregated. We did not have the user nor the session granularity. As a result it was not possible to join the tables with the other channels.

The dashboards were separated in two, one with all channels, another with only Samsung Instant Play. As of August 2022, new contracts were made between the Samsung and FRVR, we are now receiving uniform data across all of our channels, and slowly transitioning all previous schedule queries to DBT tables with Samsung Instant Play and all dashboards as well.

2. Dashboarding

a. Overview

As the company grows, so do the dashboarding and tooling needs of the company. This puts a strain on the data team workload who, despite having its numbers boosted this past year with a wave of new joiners, have limited resources for dashboarding. At this point in time, the existence of too many dashboards has created an issue for the data team. These dashboards, built on multiple pipelines, often display overlapping and redundant visualisations that display mismatching numbers due to the way certain parameters – namely our internal definition of user_id – were defined. Furthermore, because of the importance or familiarity of stakeholders with dashboards built on top of the legacy data pipeline, it makes it very difficult to deprecate or sunset these dashboards.

Attempts at reducing the amount of dashboards are often a balancing act of what is technically possible due to multiple pipeline constraints, what is possible to create using Data Studio itself and stakeholder's expectations. On the revamping of dashboards, I mainly worked on eliminating useless graphs and information, as well as uniforming the templates of the dashboards. Every dashboard should follow the same presentation or structure, in order not to confuse end users. I have also worked towards improving dashboard performance – depending on the size of the tables loaded or the complexity of the SQL query that is wrapped through Data Studio, the performance of the dashboard might slow down as we add more features and visualisations.

In regards to dashboarding, I can say my main responsibilities were to create and maintain dashboards for stakeholders of FRVR.

b. Dashboarding Process

As previously stated, all dashboards are created using Google Data Studio, and our pipeline is running on Google Cloud BigQuery.

The process of creating dashboard was the following :
1. What is requested ? Discuss with product managers, or stakeholder to understand what is needed, which information is required, and when is the expected delivery.
2. Check the internal data : Do we have the means to answer their requests ?
   1. If yes, investigate the existing tables - the dimensions needed could already be available.
   2. If not, organise another meeting to adjust and elaborate the request.
3. If no current tables have the needed dimensions : create a new table using schedule queries (before), or dbt (now) with all the required dimensions and metrics.
4. Finally, create a dashboard with adequate and interactive visualisation.

To query the data and plug it into Data Studio, we are using standard SQL. Any code in this report was written in a SQL Integrated Development Environment or Code Editor.

In this next part, I will present the process with concrete examples of dashboards I created.

a. <u>Games Ranking and Comparison Dashboard</u>

The first important project I took ownership of is the Games Ranking and Comparison Dashboard. It was requested by the Head of the Publishing Team. dimensions were already available on existing tables : *aggr_all_channels_minimal_draft and main_kpis_blabla.* **Appendix 2 : Schedule Query of Minimal Draft Table** is an example of schedule queries that were created. Figure 2 shows the easiest SQL query that can be used to retrieve the data onto the dashboards.

```
SELECT *
FROM daily_updated_channels.aggr_all_channels_minimal_draft
WHERE t1.date BETWEEN PARSE_DATE('%Y%m%d', @DS_START_DATE) and PARSE_DATE('%Y%m%d', @DS_END_DATE)
```

Figure 2 : Basic Simple SQL Query To Add Data Into Data Studio

I then proceeded in creating the dashboard. There are 3 pages available. On the first page, you have five different filters : game, channel, studio, country and date. The channel filter has been pre selected as 'Select a Channel', it is to push people to select a channel (facebook for example) as it doesn't make sense to see the ranking of all games of all channels. Following, there is the ranking of the games depending on different metrics : Daily Active Users (DAU), Daily New Users (DNU), Impressions, Sessions Engagement, and Revenue. As shown on the figure 3, on Facebook the 5 top games based on DAU are : *Basketball FRVR, Hex FRVR, Worlds FRVR, Cricket FRVR and Gold Digger FRVR.*
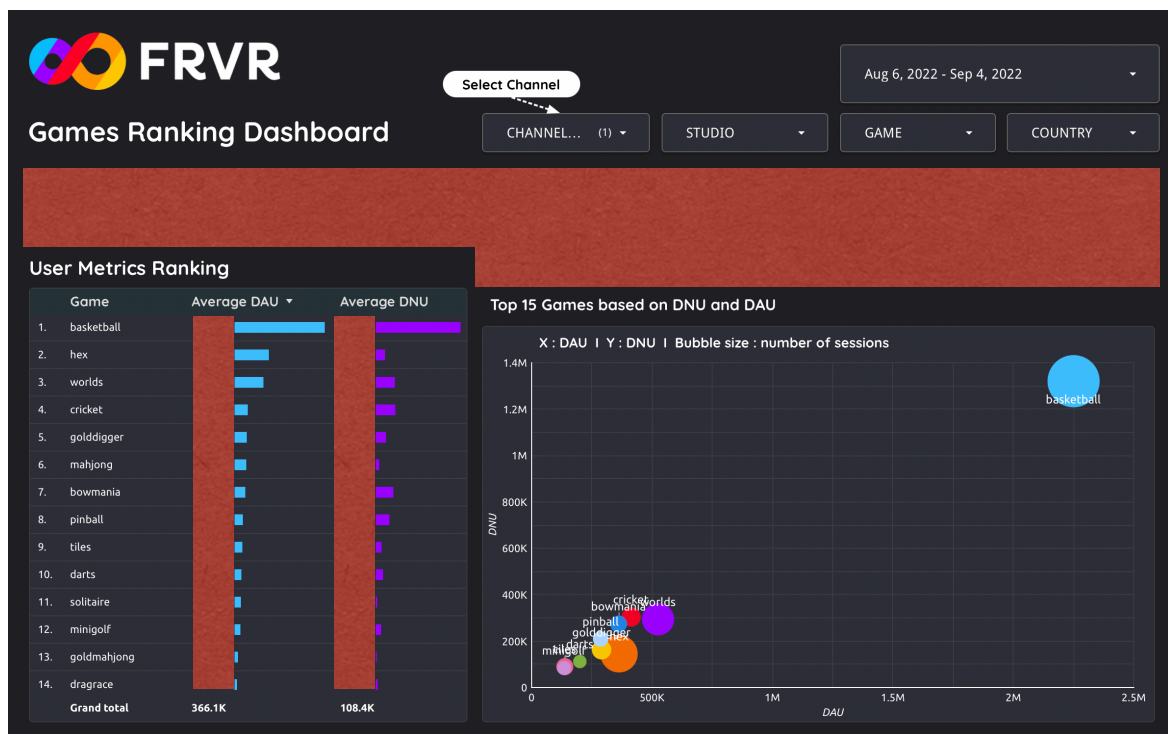
Figure 3 : First Page of the Games Ranking and Comparison Dashboard with Ranking based on DAU

On the second page, the user can compare different games with each other. I chose to display a bar chart on the left that would show the comparison of the metric as a whole. The trend-lines chart on the right, gives a better understanding of how each game behaves throughout time. Below the figure 4 shows the games from the Studio Ursus on Facebook. It makes it easier to see which games are more popular on this platform. Similar visualisations are used on this page to showcase the difference with the other metrics.
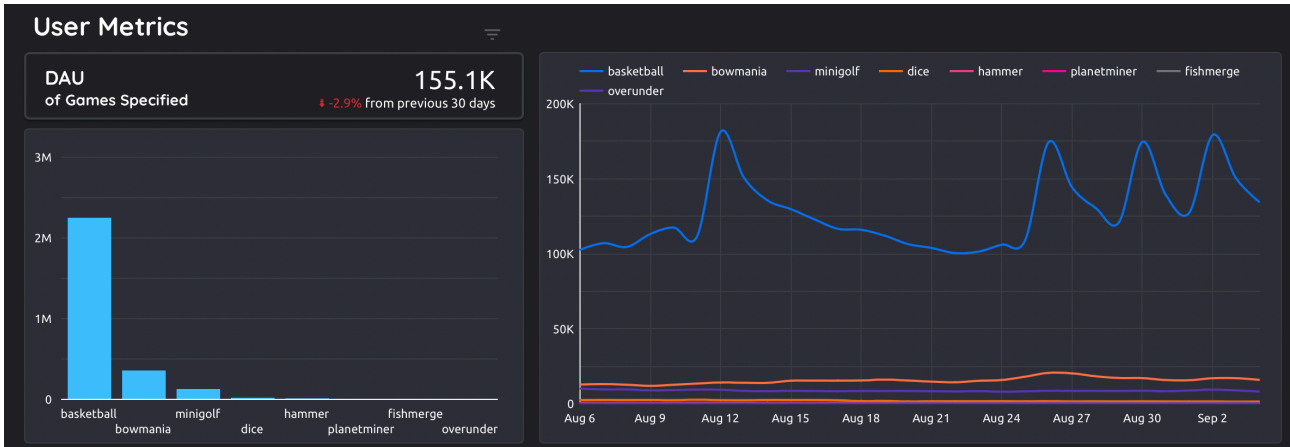
Figure 4 : Second Page of the Games Ranking and Comparison Dashboard

As previously mentioned the Samsung Instant Play data was retrieved differently than the other channels, thus I had to put the same visualisation on a different page focusing only on Samsung Instant Play data. Again as we are only recently starting to retrieve new data from the platform, the dashboards will all be transitioned and merge together.

The Games Ranking Dashboard is being used across the company, mainly by the channels, and the games team.

b. Detection Anomalies

Our Data Scientist had been working on an outlier detection model prior to my arrival. The model would alert when at least 2 metrics (DAU, DNU, Impressions and Revenue) would encounter a major drop or increase. He created a shiny-app for concerned member (mainly the channels team) to use. The app wasn't the most user friendly and that non-data people were not using it as they should. I created an interactive dashboard, that would show all anomalies the easiest way for people to check and to understand.

Figure 5 : Overview Anomalies Detection Dashboard

The outlier detection was made in Python, it would output a table as results, which we connected to BigQuery to be able to query it easily on Data Studio.

Figure 5 shows the first page of the Anomalies Detection Dashboard. First, there is the amount of anomalies each channel has, for the past 3 days. A threshold was put at 5 anomalies, if it were to be higher than 5 it should be considered as a high priority issue. Then, the table gives more explanations on where the anomalies were detected. Moreover on the next page, the user is able to see the time-series trend line where the outlier was picked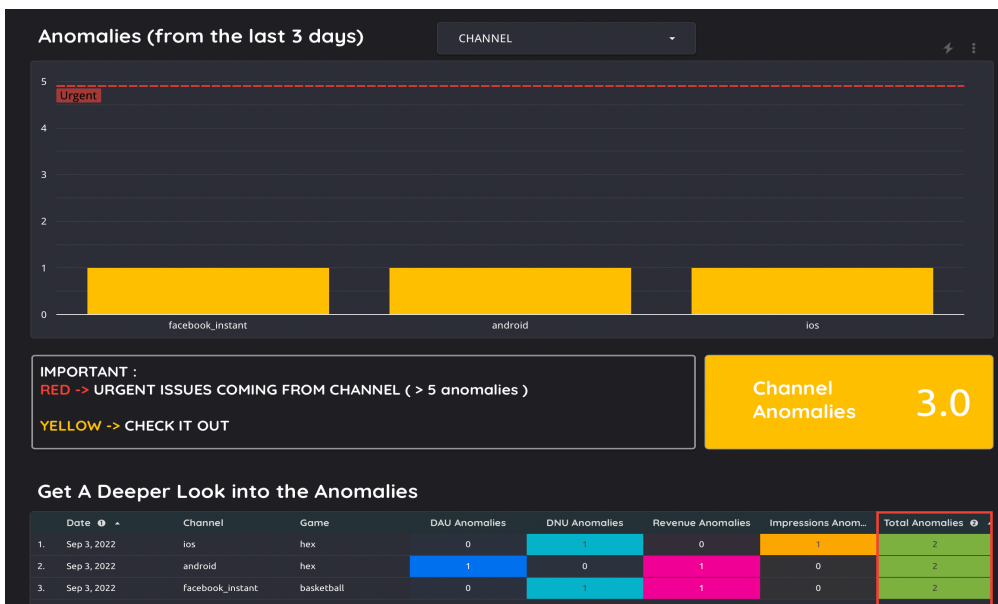 up. Figure 6 only shows the drop of DAU trend. DNU, Impressions and Revenue are also available to see on the Anomalies Detection Dashboard.
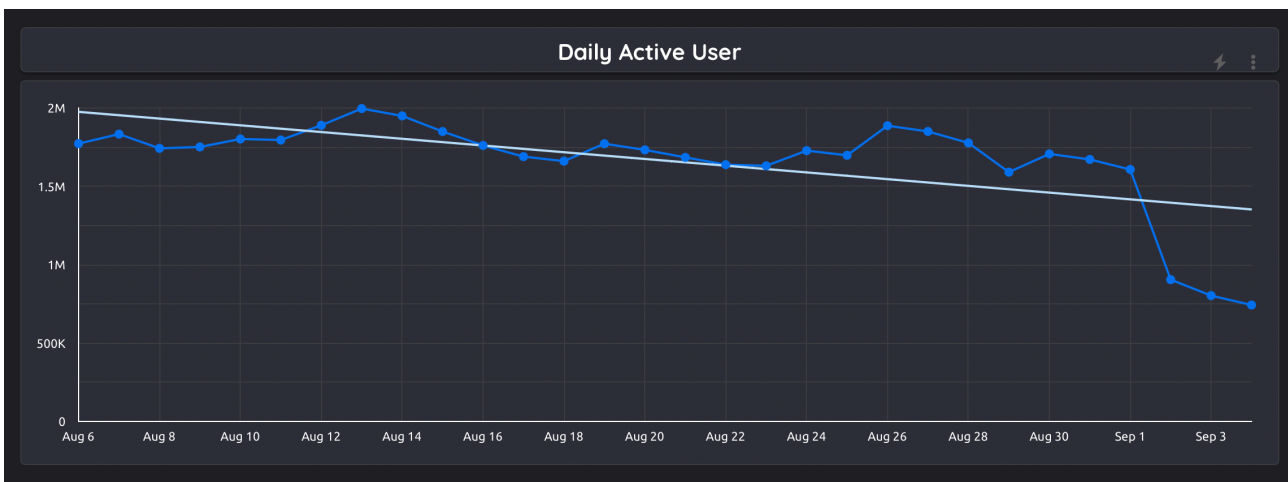
Figure 6 : 2nd Page of the Anomalies Detection Dashboard, Focus on the DAU trend-line

It is mainly being used by the channel's partner, as they are responsible for what is happening on their platform, they know what could cause a drop or an increase. The purpose is for them to check it regularly, and when an issue outside of their scope rises, the data team would then investigate.

In order to make it more user friendly and understandable for non-data people. I created a Handbook Manual on how to use and read the Anomalies Detection Dashboard, which is available to see in **Appendix 3 : User Manual - Anomalies Detection Dashboard** Since then the dashboard has been actively used by the concerned parties and has turned to be efficient.

c. Post Release Health-check

The work that goes into a game can be never-ending with incredibly long life-cycles. Games go through new updates all the time, with new features, fixes, and more. In addition to newer games being released, an important aspect is to make sure that new builds of games work fine – including the telemetry endpoint and a game's tracking script.

With the Release Manager, I worked on a dashboard that would focus on the past month only, and would display a comparison between game builds. A single table that shows the amount of users, impressions per users, errors per users and average duration of a game session. When a new build is released, the dashboard shows if a game's function is working correctly and if it can be released to more platforms.

A recent request came from the Leadership Team alongside Game Producers to create a single dashboard with the main key performance indicators of FRVR's top 6 games: Basketball, Gold Digger, Minigolf, Yathzee, Worlds and Krunker.

This request is an important example of needing to tailor dashboards to specific needs of specific teams. Even though the KPIs are likely to be present in other existing dashboards, the higher level needs of this dashboard is to allow leadership and producers to know quickly and unequivocally if there is an issue. Games Production leads came with a clear vision of what they would like to have.
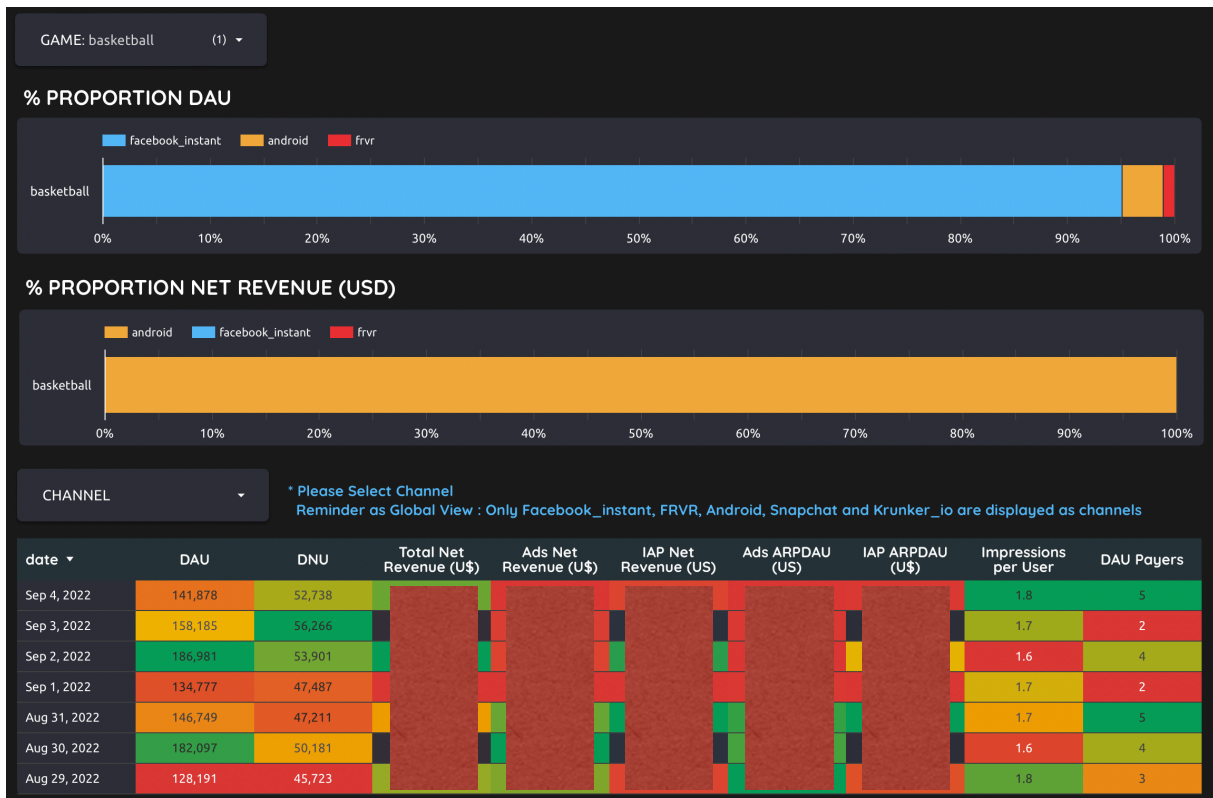
Figure 7 : First Page of KPIs Dashboard - 2nd MVP

During various meetings, we aligned their expectations with what the Data team could deliver. As the project would take a few weeks to be accomplished, we created several iterations and sketches of what the dashboard could and should look like as a Minimum Viable Product, or MVP for short.

As of right now, we are at the 2nd MVP pictured above. The most complicated part of this dashboard is to pivot the table to have the metrics as rows, and the weekdays as columns. Data Studio is limited, and standard SQL does not have pivot functions – although dbt.utils library does offer a function that allows this, as we would discover while writing this report. Regardless, from SQL to Data Studio to dbt, understanding the power and limits of the tools we use is always a challenge.

At this moment in time, and taking into account current limitations, I used a proportion of revenue and DAU in a single bar chart. Because the table with each KPI comes from multiple data sources
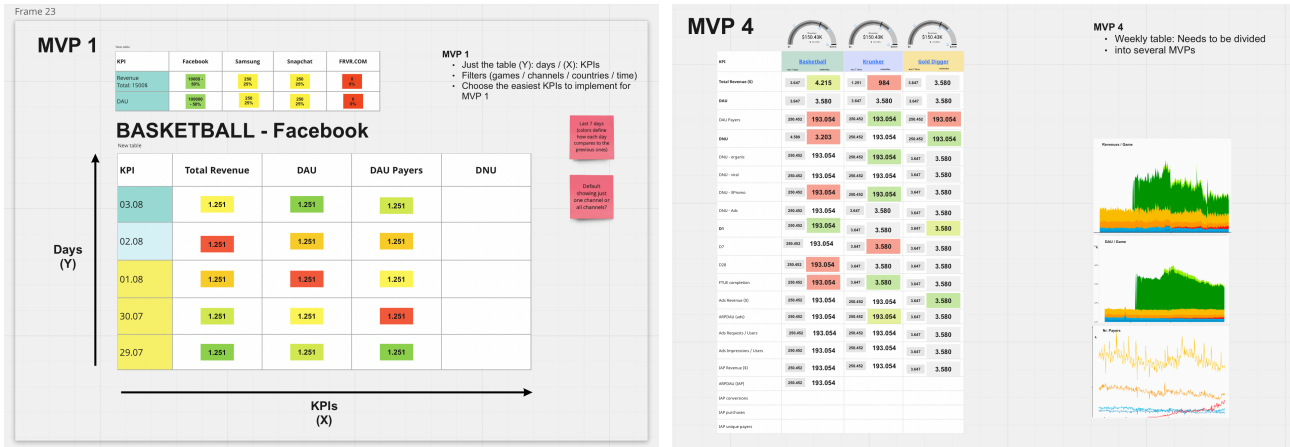
Figure 8 : 1st to Last MVP of the KPIs Dashboard Project on Miro

and multiple models – even multiple warehouse projects – I will describe the SQL query that goes into creating the table.

The number of Daily Active Users who made an in-app purchase (IAP) comes from a table from our old pipeline called aggr_all_channels_all_events_studio_period. This table contains the events we are receiving from games and channels, this allows us to filter players that have made a purchase request. We can filter for these events by selecting the iap_request_payment_success event.

```
with is_payer as (
select distinct date, game, channel,count(distinct user_id) as payers
from frvr-analytics-inhouse.reporting_aggregations.aggr_all_channels_all_events_studio_period
where date >= CURRENT_DATE()-7
      and event = 'iap_request_payment_success'
      and channel in ('facebook_instant', 'frvr', 'krunker_io', 'snapchat', 'android')
      and game in ('krunker', 'basketball', 'worlds', 'golddigger', 'minigolf', 'dice')
    group by 1, 2, 3
),
```

Figure 9 : CTE Table Querying IAP Payers

It should be mentioned that both dataset and table names are nonsensical and poor in quality; they lack basic descriptiveness that is crucial in any warehouse. The name would imply the table is aggregated, but it clearly has event-level granularity. A recurring issue throughout my work and this report are the names of tables and the way they are organised in marts; in the old pipeline, they are wrong or generic and completely fail to clue the reader into what is their function. This issue is to be touched upon in the dbt section of this report.

```
    iap_revenue_sources as (
select str.date, str.game_id AS game, str.channel, 'IAP Net Revenue' as type
    , 0 AS daily_users, 0 AS new_users, 0 AS ads_revenue
    , SUM(CASE WHEN str.date >= '2022-07-01' AND revenue_source = 'paypal' THEN 0 ELSE str.net_revenue END) AS iap_revenue_net
    , SUM(CASE WHEN str.date >= '2022-07-01' AND revenue_source = 'paypal' THEN 0 ELSE str.gross_revenue END) AS iap_revenue_gross
    , 0 AS impressions, 0 AS payers
from `frvr-analytics-production.revenue.non_user_level_revenue` str
where str.date >= CURRENT_DATE()-7
    and str.game_id in ('krunker','basketball','worlds','golddigger','minigolf','dice')
    and revenue_type = 'iap'
    and str.channel in ('facebook_instant','frvr','krunker_io','snapchat','android')
    GROUP BY 1, 2, 3),
```

Figure 10 : CTE Table Querying IAP Revenue

Next, the IAP (In App Purchases) revenue is retrieved from a special table created in our new data pipeline by my colleague Jacques Hervochon. From the non_user_level_revenue_table, we query just the IAP revenue.

```
    daily_users as (
select str.date, str.game, str.channel, payers, 'Ads Net Revenue' as type, SUM(daily_users) AS daily_users
    , SUM(new_users) AS new_users, SUM(ads_revenue) AS ads_revenue
    , null AS iap_revenue_net, null AS iap_revenue_gross
    , SUM(impressions) AS impressions

from `frvr-analytics-inhouse.reporting_aggregations.strategic_objectives_dashboard_users_revenue` AS str
left join is_payer i
on str.date = i.date  and str.game = i.game and str.channel = i.channel
where str.date >= CURRENT_DATE()-7
    and str.game in ('krunker', 'basketball', 'worlds', 'golddigger', 'minigolf', 'dice')
    and str.channel in ('facebook_instant', 'frvr', 'krunker_io', 'snapchat', 'android')
    GROUP BY 1, 2, 3, 4)
```

Figure 11 : CTE Table Querying DAU, DNU and Ads Revenue

The last table to be retrieved is the strategic_objectives_dashboard_users_revenue – from our old pipeline. The existence of this table is due to a single, important channel not having events reported due to a GDPR compliance issue and the need to include the data from that channel for stakeholders who work directly with that channel. This is done by aggregating event level data from our events to date and game level aggregated data reported in that channel's API.

This design pattern – using CTEs to source and transform data from multiple sources before joining it in the final select statement – is the gold standard for creating easy to read SQL code. All code in the new dbt pipeline follows this design pattern.

```
select DISTINCT str.date
    , str.game
    , str.channel
    , sum(str.daily_users) as dau
    , sum(str.new_users) as dnu
    , sum(str.ads_revenue) as ads_revenue
    , sum(str.impressions) as impressions
    , sum(str.payers) as is_payer
    , sum(i.iap_revenue_net) as iap_revenue
from daily_users str
left join iap_revenue_sources i
on str.date = i.date  and str.game = i.game and str.channel = i.channel
group by 1, 2, 3
```

Figure 12 : Final Table Querying all Dimensions for the Dashboard

3. A/B Testing

I had the opportunity to work in an Agile Team following the 2-weeks sprints project structure. The purpose of this team was to push new interactions of FRVR platform experience every two weeks and have a continuous improvement of user experience on FRVR games. As the first sprint team of FRVR, the management goal was to see if this technique of working would be efficient and beneficial. The channel used was Facebook.

a. Agile Team - Sprint Structure

The team was managed by the Facebook Partner, and was composed of 7 people from design, engineering and data. I worked along side our Data Scientist during those 6 months. All organisation management went through Asana[22].

There was a backlog of ideas where anyone from FRVR could put ideas of game and user improvement. We would have fortnightly meetings on Mondays to discuss which project the team would tackle, and what were the deadlines. The 2-week sprints was more for the designers and engineers, they would each have one week to complete their tasks, and at the end of the 2-weeks the game release would go live. As the data team, we would have to wait the correct amount of time to collect the necessary data, and then proceed in creating the report and dashboards with the results. We would make sure as well that the game would not crash in the course of the test. During the time of this experience, we worked on 14 projects, 9 completed, 7 successful, 4 were blocked mid-sprint, 2 with inconclusive results, and 1 stopped due to crashing results.

Here's all the sprints that were worked on :
- Cross-Promotion Between 2 Similars Games
- Cross-Promotion of the FRVR Catalogs
- Rewarded Quizzes
- Redesign of the Burger Menu
- Playable Ads on Non-FRVR Games
- Rewarded Ads
- Shareable Social Link to Post High Scores
- Daily Check-ins
- Chatbots
- New Way of Bookmarking a Game
- Floating Icon of Cross-Promotion
- Rewarded Progressions.

b. Sprints Dashboard and Visualisation

Regarding results, I created a temporary dashboard for each sprints that was used to work on the written reports. At first it was all the documentation we had on the results of the tests. We quickly realised as a team, we would need a more organised way to display this agile-experience to the whole company. To have an organised view of all the Sprints that were finished or still running, I proposed to have a Miro Board that would sum up all the tests. **Appendix 4 : Sprints Overview**. From each tests, you can see if :
- They are on-going or finished,
- Successful or failure,
- A video-demo of what was changed or added,
- The roadmap Arrow Process,
- The percentage Rollout,
- An overview of the tests,
- Link to the report,
- And The Key Results.

---

[22] Asana is a web and mobile work management platform designed to help teams organise, track, and manage their work. https://asana.com

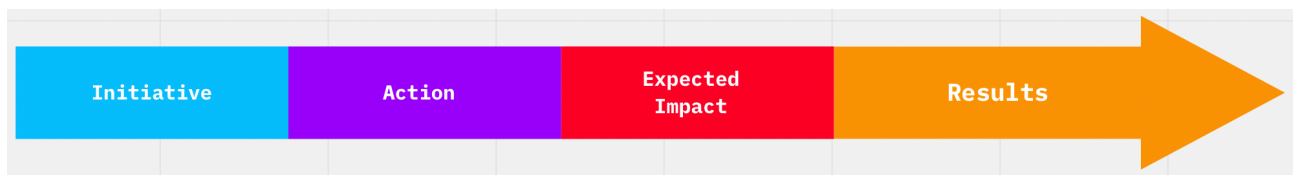Every test followed the Roadmap Arrow Process of the figure 13.

Figure 13 : Sprint Process Roadmap

Next I will discuss one successful, one failure and one inconclusive project.

Figure 14 is a part of the Sprint Overview Results Board and focuses on the test : New Ways of Bookmarking a game. The experience was run on the game Darts FRVR on Facebook. From this A/B test the Control Group was : the user would see a Facebook pop-up that would invite them to bookmark the game, it would happen before the game starts. Versus the test group : the first pop-up is removed, and a floating icon is added on the side of the screen with an indication of bookmarking the game. The original Facebook bookmark is very invasive, it appears every time you start to play the game. With this icon, the goal is to have a 5% increase in engagement from people coming from the new bookmark. The UX Designer worked on the floating icon, which is shown on the test group below.
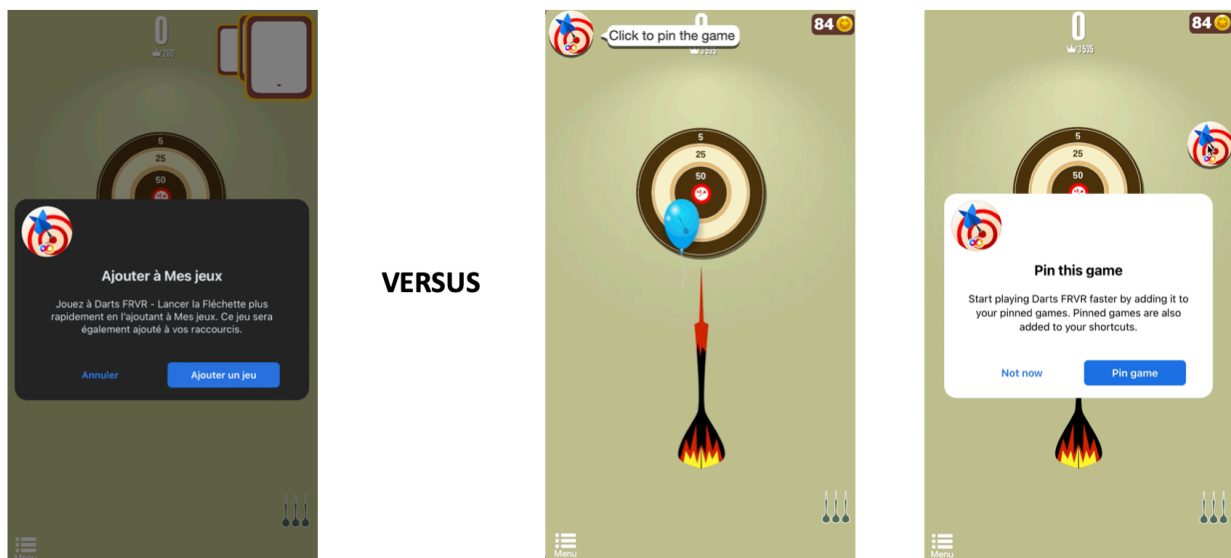
Figure 14 : Control VS Test Group of the Floating Bookmark Icon

The usual rollout of an A/B test on Facebook is 25%. In order to differentiate the two groups, the engineers released a new app build on the game that contains the changes of the test group with the 25% rollout. In this case the control group is made of the previous app build, and the test group is the app build '2.7.4'. From the different app builds, I can retrieve the data for the dashboard. I worked closely with a Facebook Engineer around the implementation of necessary events. For this test, the events that were implemented were :
- '*bookmark_show*' - When the bookmark button is shown to the user
- '*bookmark_click*' - When the bookmark button is clicked by the user
- '*bookmark_install_show*' - When the bookmark prompt popup is shown to the user

- '*bookmark_install_success*' - When the user accepted the bookmark prompt popup
- '*bookmark_install_useraborted*' - When the user dismissed the bookmark prompt popup
- '*bookmark_install_failure*'- When the bookmark prompt popup fails.

Appendix 5 : Dashboard of the results of the Bookmark Test. Figure 15 is taken from the Sprints Overview Miroboard. The results of the Bookmark Sprints were positive. From the dashboard, we see an increase in retention. From a Bayesian analysis, the data sicentist found that the users from the test group were 55% more likely to come back on the third day than the control group. Regarding engagement, from numbers of impressions, to the session duration we had an increase of 11% from the new bookmark users.

From this successful a/b test, we concluded that the way of bookmarking has an impact on the gameplay of users. People no longer get disrupted by the Facebook pop-up bookmark, and they get to play the game and choose if they want to bookmark the game along with their gameplay. Players who really enjoy the game are bookmarking the game when they want to and because they want to, which then makes them more likely to come back to the game. Our goal was to reach an increase of 5%, with an 11% increase, we have a successful test.
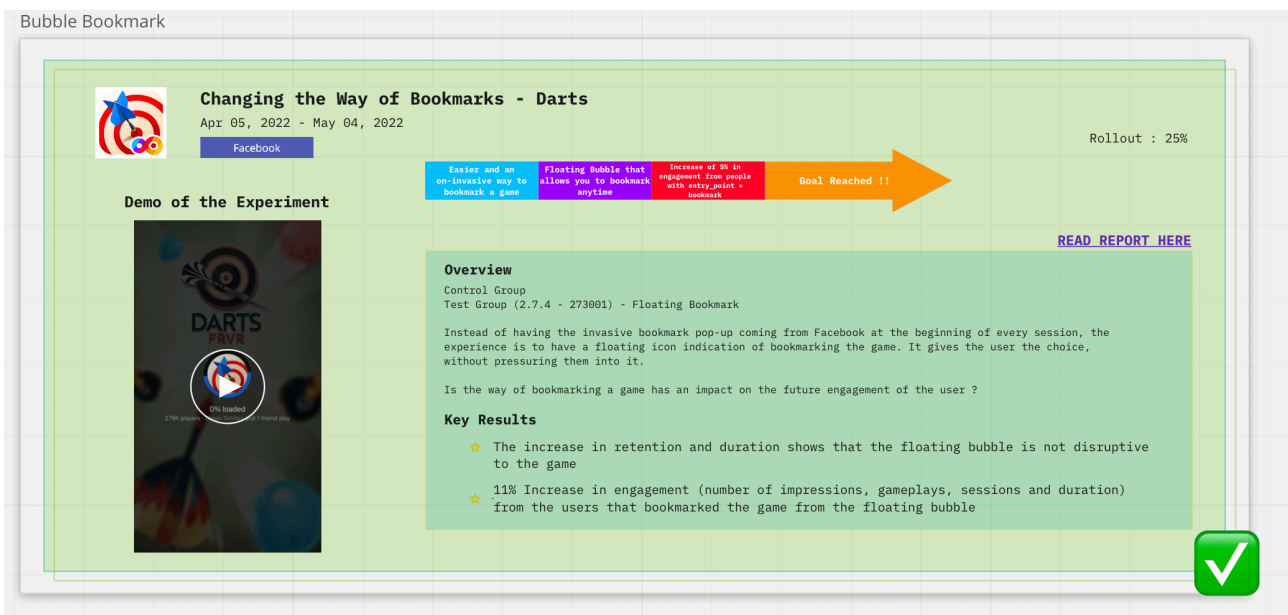
Figure 15 : Overview Results of The Bookmark Sprint

Next, let's discuss the failed experience : The Rewarded Quizzes on *Frosty FRVR* on Facebook. Here we tested if adding a rewarded quiz at the beginning of the game would increase retention and session duration. The control group is the same previous build, and is functioning the same as before. The test group is shown a pop-up quiz at the beginning of the game, if the player answers correctly, he gets an immediate reward : a boost which will multiply his game score. We were testing if a rewarded quiz would engages more users, and makes them want to come back. There were a total of 7 questions, the players had the chance to obtain a boost 7 times. The questions of the quiz were either about the game or the winter season.
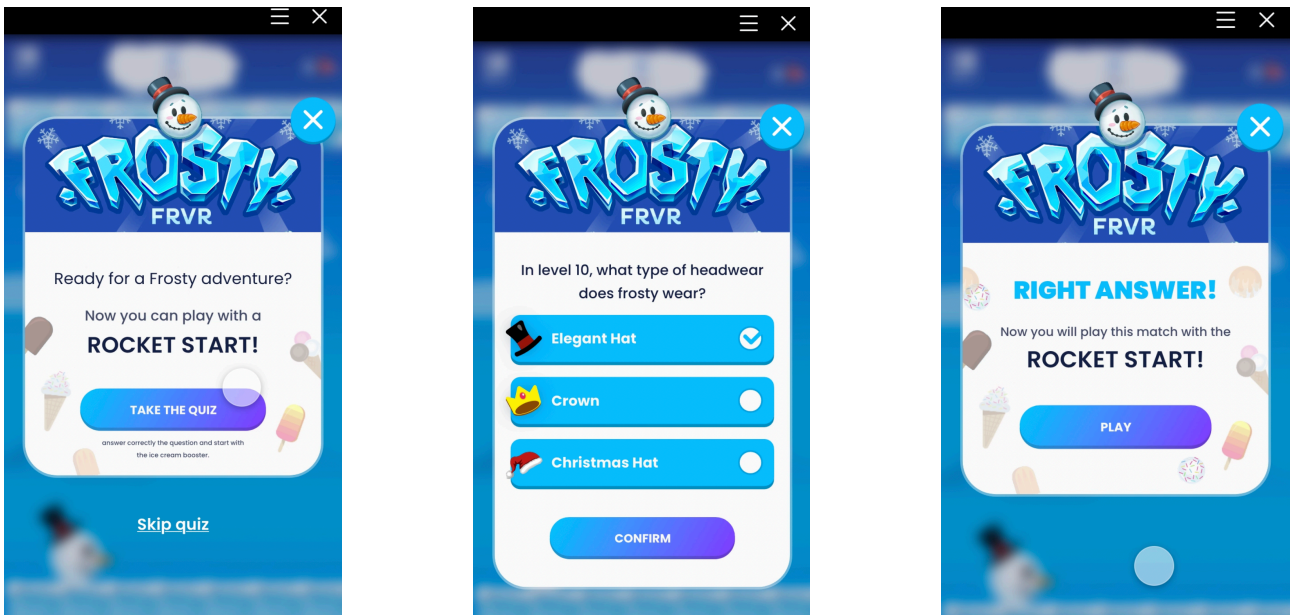
Figure 16 : Test Group Rewarded Quiz on Frosty FRVR

The sprint only ran for 2 weeks, we stopped it abruptly due to the drop in Daily New Users and Daily Active Users (Figure 17). Frosty FRVR is a Snowman game, and is particularly famous during Christmas time. We are not fully sure that the drop came from the rewarded quiz or from the seasonality of the game. As it was the first experience to have a massive drop, we decided to stop the experience right away.
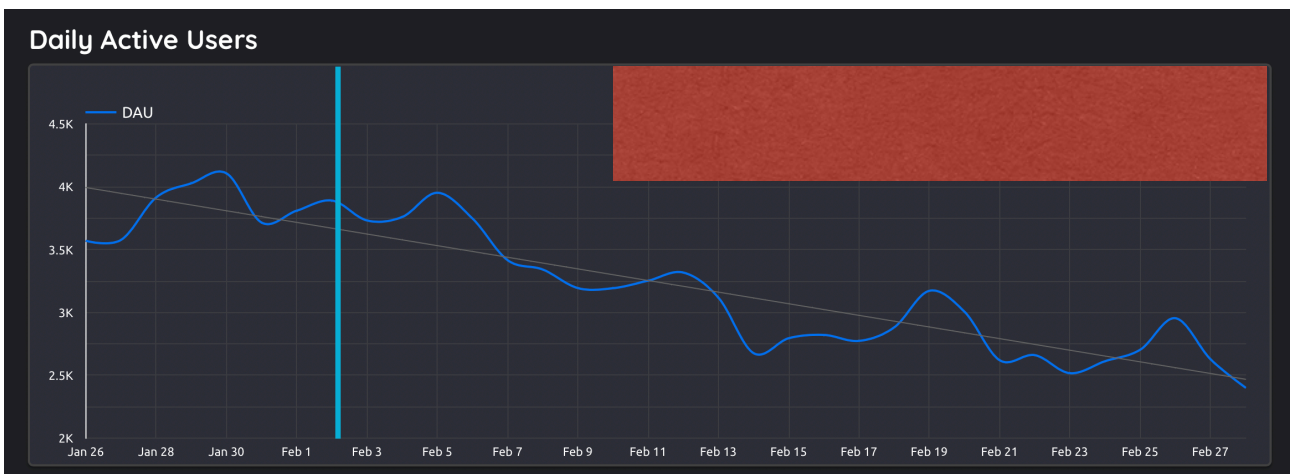
Figure 17 : Drop of Daily Active Users on Frosty on Facebook

From the two weeks of data, the results were negative, very few people were interacting with the quiz, only 15.2%. Many people had wrong replies to most of the questions, this could have come from different issues :
- Questions were too complicated
- Players were not reading the questions
- Bad translation of the questions and answers.

Figure 18 shows the overview of the test.

Rewarded Quiz / Scavenger Hunt in Frosty
Feb 02, 2022 - Feb 16, 2022
Facebook

HISTORY VS NOW
Rollout : 25%

Demo of the Experiment

Rewarded Quizz on Frosty | Quiz rewarded with a Boost at the start | Increase in Retention and Session Time | FAILED ✗

READ_REPORT_HERE

Overview

Control Group (previous app builds)
Test Group (1.6.0-1) Quiz at the beginning which is rewarded with a boost for the run

Quiz doesn't appear before FTUE is complete
There are 7 questions and as they are presented to the player they won't appear again
If no more questions are left to answer or the player has skipped twice, the quiz won't appear again
Correctly answering a question grants the player the 2x score multiplier for the subsequent game

Key Results

- 84.8% of the test users did not engage with the quiz

- Sum of incorrect answers is greater than corrected ones when the questions were meant to be easy

- Drop in DNU (possibly seasonal effect)

Figure 18 : Overview Results of the Rewarded Quiz Frosty FRVR

Finally, the inconclusive test : the redesign of the burger icon on *Basketball FRVR* on Facebook. The idea was proposed by the Design team. Every FRVR game has the Menu button, on Facebook it is placed on the top left. The control group is the Figure 19 on the left versus the test group on the right. The aim of the test was to see an increase in clicks and interaction with the hamburger menu of the game.
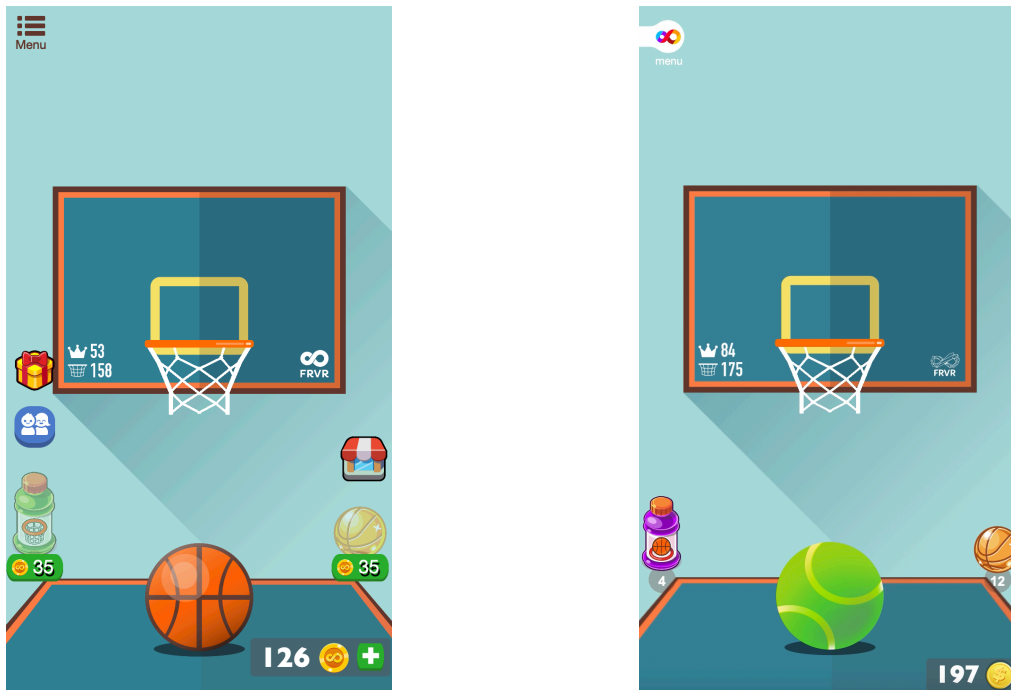
Figure 19 : Control VS Test Group Sprint Redesign Burger Menu on Basketball

After 3 weeks of data, there was a slight decrease in engagement coming from the Test Group, but the test showed that it was statistically insignificant. From the events of the menu button, there was no difference between the two groups.

Figure 20 : Overview Results of Redesign of Burger Menu on Basketball

c. Feedback : Difficulties and Learnings

From the first sprint to the last, we learned a lot as a team. Mistakes were made along the way, and we learned and improved each sprints after the other. Our two first sprints were already set by Leadership, there were cross-promotion between similar games, and to promote the FRVR cata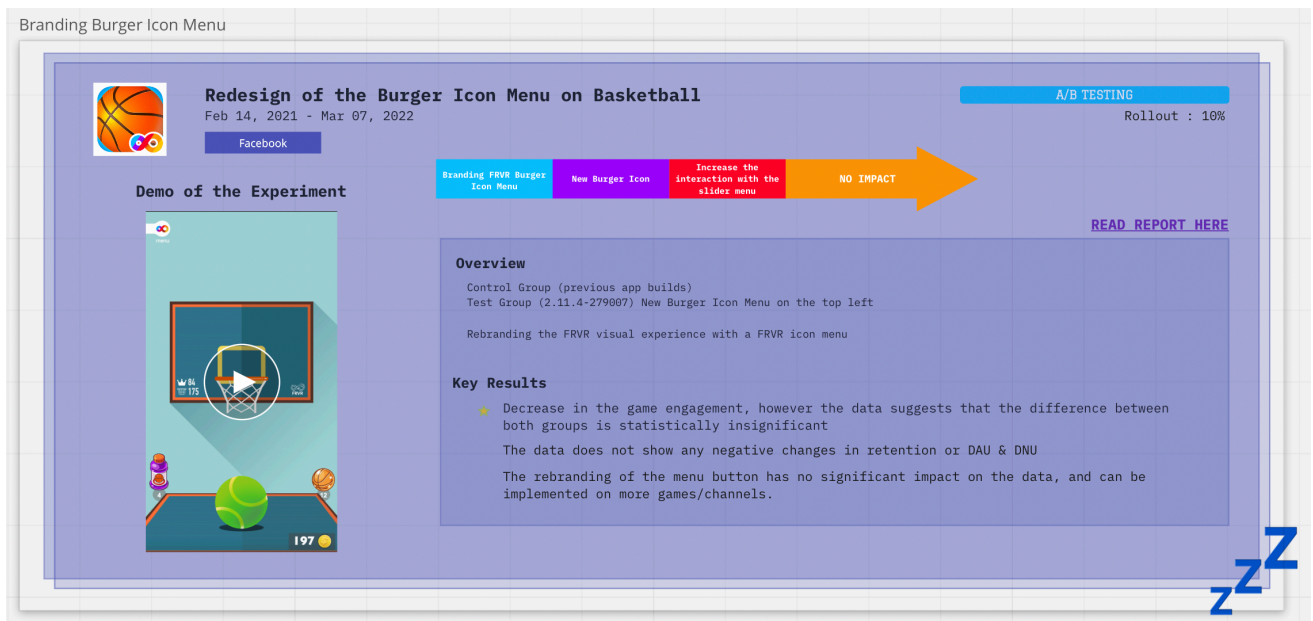logue to current players, both were called a success even though we did not have a clear goal. The A/B test started, and as we saw some positive results, we deemed them as success. From it we learned that it was essential to have a clear goal with a business oriented expected outcome. Most people of the team expected this number to be provided by the data team, when what was asked was a threshold of success from a business product manager's perspective.

At the beginning ideas were mostly coming from the design team, and changes they would like to do. As each sprints worked in 2-weeks, there was a time pressure in finding a new experience for the following week. The timeline of work for the data team was shifted compared to the other teams. When we started to accumulate experiences, the workload increased, and as a result the next tests were chosen very quickly without our input, they weren't based on data. This led to having tests on games that had behaviour seasonality (Frosty FRVR) or games that already had a downtrending DAU and DNU. Following the inconclusive test on *Basketball FRVR*, we started to have meetings focused on data, and which game would have the most potential for which experience. The new process was to discuss as a team the different tests we'd believe would improve experience and decide on viable experience. Then we would focus on the data and pick four to five games which had the most potential. Finally we would all play the games, to see how they functioned, how much time it took to finish a round, how much engagement was required, and based on the feedback of each team member we would pick the game. This process was used for the first test I presented in the first part : New Way of Bookmarking, which was successful.

Another difficulty we encountered was that even though we had two engineers in the agile team, more engineers would work on each experiment as it demanded different specialties. Our mistake was to only check within the team, because of it, four tests were never achieved, due to engineers not having the time, or the task being too complicated. As a result the team wasted time on four

projects for nothing. Before we could update our process of working, all backlog sprints were put on hold due to the arrival of Project K.

IV. Project K

1. Before the Acquisition of Krunker

a. What is Krunker ?

In May 2022, FRVR finalised a high profile acquisition of an established shooter: Krunker. Developed by Yendis, this competitive Free to Play, First Person Shooter and instant game was developed and created on a custom engine that would also allow users to easily create User Generated Content (UGC). Being an instant game, it is fully accessible through a browser without the need to download a native application. In fact, the Krunker application is actually a wrapped instance of the Electron open-source software framework built on top of the Chromium Browser.

The rise of Free to Play (F2P) games started rising in 2000s and have transformed the gaming industry. F2P is very literal, offering the game for free to all players, this new model of gaming is attracting a lot of new players everyday and has proven with to be successful way to gain revenue. F2P games revenue has increase throughout the last decades, through advertisements and in game purchases.[23] On the contrary to FRVR usual games, Krunker main source of revenue is coming directly from in game purchases.

As a game, there are two sides of Krunker, one of them being the traditional shooter game modes where players compete against each other in teams or individually against each other in a wide number of "standard" (e.g. widely conventionalised game modes in shooters) or in more specific Custom Game Modes that anyone can play, create or host.

The second aspect to Krunker is its user generated content – UGC for short – created with the Krunker Editor. This latter part gives players the opportunity to create their own maps, create their own game modes and even create their own entire games and have them monetised through their own advertisement integration. The Krunker Editor and this UGC aspect to Krunker is often defined as a Roblox-style game. Roblox is an online game platform and game creation system. It has been building to one of the most famous platforms in video gaming, with over 100 million monthly active users. Roblox and Roblox-style game Krunker gained the most followers on streaming platforms the fastest in 2019.[24]

In the spirit of an Instant Game, Krunker can be played anywhere and has minimal barriers to entry. This means someone can start playing Krunker as soon as they load the game, without needing to login or to create an account. Doing so, however, opens up a number of features and game progression where users can level up their character and start collecting currency and interacting with the in-game economy.

---

[23] "Offering a game for free and gaining income through voluntary purchases during gameplay have proven to be the most successful way to gain revenue."
Kati Alha. (2020) The Rise of Free-to-Play: How the revenue model changed games and playing

[24] "Roblox and Roblox-styled (Krunker) games gained followers the fastest in 2019."
"Roblox has been quietly building one of the most active platforms in video gaming."
Taylor Hurst. (2020) Streaming: The Next Generation

The in-game skins based economy is also another strong selling point of the game, allowing it to monetise strongly through in-app purchases and not just ads. During a player's journey, they can earn Krunkers (official trading money in the game) and Junks (currency to craft in-game objects). They can then exchange virtual items or currency in the marketplace.

b. Scripting and Event Taxonomy

Krunker was created by a small team with no prior experience in creating games together. Prior to the game's acquisition, Krunker had a very limited amount of user-data being collected, with no real behavioural event data being collected in telemetry. As such, the acquisition of Krunker put in motion a big effort by the Data Team to help Yendis integrate the necessary event taxonomy in its scripting in order to create tools and dashboards for it. This required coordination and technical expertise provided by FRVR for Yendis's engineers to implement the tracking of these events in-game.

Similarly, FRVR had limited experience working with games as complex or feature-rich as Krunker. This would require some adjustments and tweaks to FRVR's own definitions of event for Krunker which, in turn, lead to the creation of Krunker specific dashboards.

A month before the purchase, while the deal was being finalised, the data team started conversations with Yendis to discuss the tracking script and to define the events to be collected. We worked on understanding the mechanics of the game and seeing what data FRVR would need in order to create tools for dashboarding and reporting.

As previously stated, one of the big data challenge was to have a consistent Event Taxonomy across all of our games, so the first step was to apply it to Krunker as well. The goal was to have a clear documentation on which event should be part of the first iteration, and what were the priorities. The process was made through many brainstorms and meetings. The game is very different from anything the data team has encountered before, as it does not follow the usual pattern from most of the mobile games. Player journeys are different, for instance the game Basketball FRVR is following the roadmap below : Figure 21
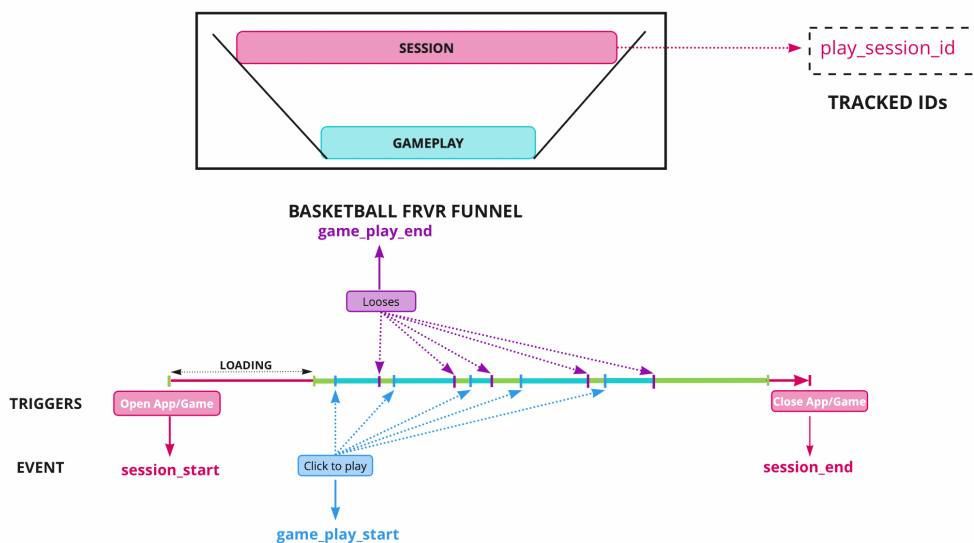

Figure 21 : Basketball FRVR Game Scope Event Flow

While Krunker users will follow this roadmap : Figure 22. Below you can see the final draft, the data team and I came up with. The main difference with the Flow from Basketball FRVR is the game session and game play granularity. In our current games, a user enters a session by opening a game, then start playing then loses and either leave or keep going. In Krunker, the player first enters a session when entering the game, then is automatically connected to a server, to finally start the 4 minutes match. There is 2 more granularity to the game, and the round_id would be necessary in order to see if players would be more engage depending on their level, the game modes, or the map.
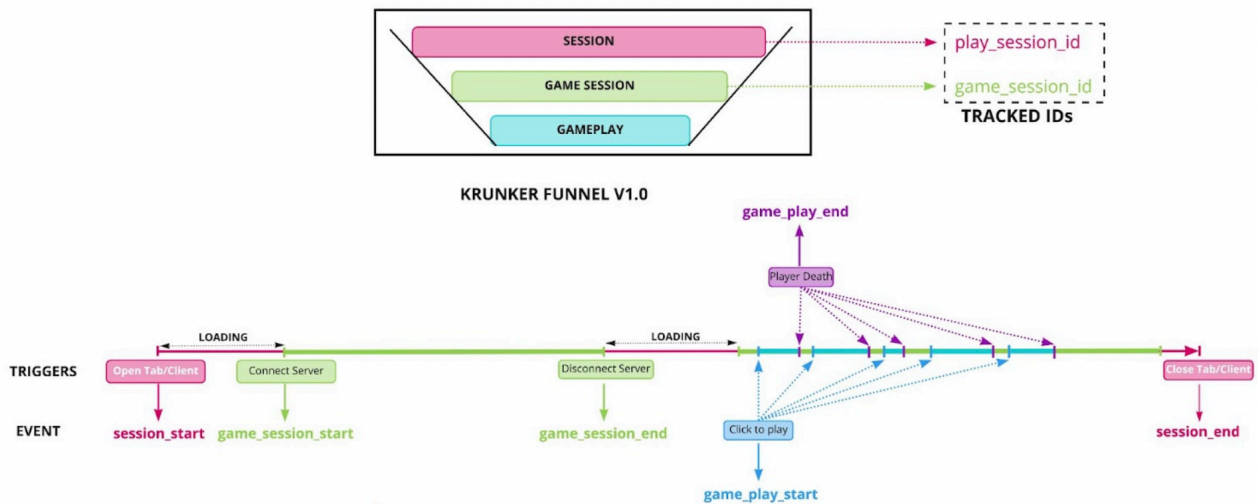

Figure 22 : Krunker Game and Session Scope Event Flow

After various brainstorming with the data team we concluded on which event should be prioritise for the first iteration. The first documentation created around the Data Tracking Details is : Project K Data Collection Documentation.[25] The Figure 23 below shows the mandatory events that are required and their purpose. In the documentation, there is a more detailed approach of each event. When an event is triggered, we are receiving parameters within. For instance, the *session_start* event is triggered whenever a user opens the Krunker tab. This event comes with the *time* and *date*, the *user_id* of the user, the *country*, information on the *device* and the *version* of the game that is being played. In the script of the tracking, we also have the possibility to add the *_params* dimension. Through this parameter, engineers can add multiple information on the events, in this case we asked to have information on :
  - *login_type* : if a user is playing as a guest or as a login account
  - *player_level* : level of the user at the beginning of the session
  - *rank* : level of the rank (competition players)
  - *n_friends* : amount of friends the user has
  - *n_friend_online* : amount of friends that are online at the same time
  - *krunker_wallet* : amount of Krunkers that is available in their wallet
  - *junks_wallet* : amount of Junks that is available in their wallet
  - *language_code* : two letters to identify the language they are using, ex : FR, EN, GE.

Event ID	Purpose
session_start	The user enters the game
game_session_start	The user starts (is connected to?) playing on a server
game_play_start	A round starts (even if the user comes late)
game_play_end	A round ends
game_session_end	The user leaves (when we can register it)
iap_request_payment_success	When IAP is made
item_flow	When KR flows to item and KR flows to wallet
session_end	The user disconnects, leaves (has limited precision)

Figure 23 : Mandatory Events Table From Krunker Documentation

For each of the events, we came up with additional information that would be helpful to stakeholders and Krunker product managers. At first, we only shared the Project K Data Collection Documentation with Yendis, and after many questions and interrogations, we realised we needed a more coherent and direct way of documentation. Following it, I created a visual roadmap of the game using Miro. The main purpose of this visualisation was to be as straightforward as possible towards Yendis, regarding all the events that would need tracking, and to avoid any misunderstanding. From their feedback, it appeared to be successful and the implementation of events began.

The figure 24 shows the first flowchart regarding the *game_play* events of Krunker. There are 4 different main flow events :
 - Game Play,
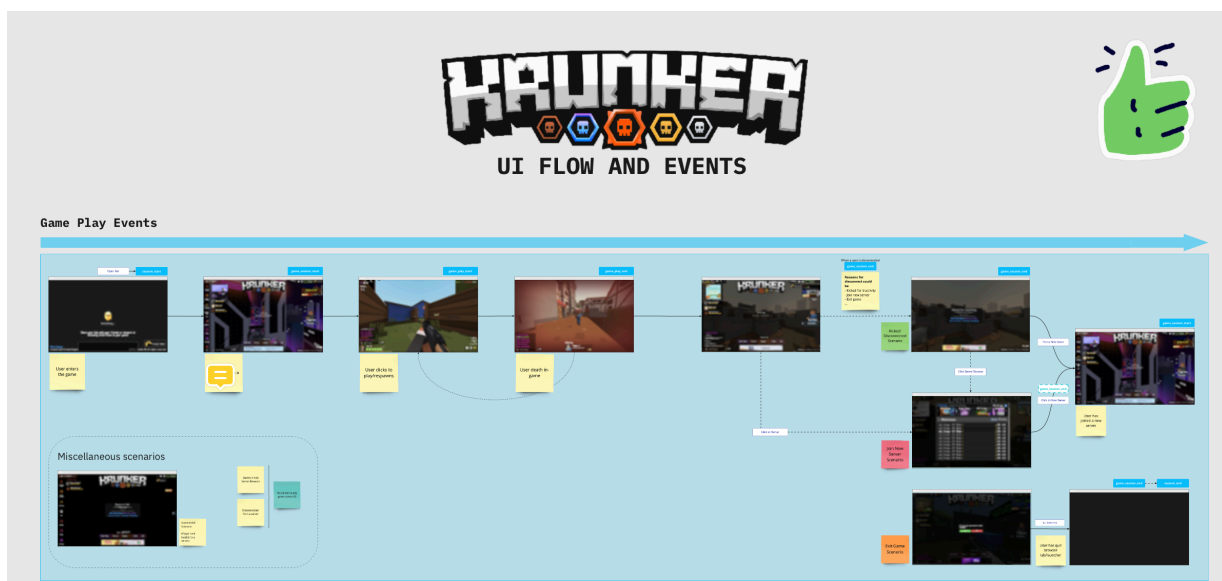 - Advertisment,
 - In-App-Purchases and,
 - In-Game Economy.

Figure 24 : Event Roadmap of the Game Play Flow on Krunker, made in April 2022

The entire first full draft of the roadmap is available to see on the **Appendix 6 : K Flow Event**.
Then we started receiving the first batch of K Data, which I will continue discussing in the second part.

c.   Roadmap to Success, and Christmases

A lot of workforce has been required across all departments to prepare for Krunker's arrival. The Leadership Team (LT) of FRVR created a game strategy to lead Krunker through its best performance. In order to Kick Off Project K to the FRVR Krunker Team composed of members of each teams, they organised a 4-hours meeting. The deadlines put in place by the LT are called Christmases. As Christmas is a never changing date, the purpose is to aim for unchangeable deadlines.

Prior to FRVR, Krunker was available to play on desktop browser : krunker.io, on steam[26], and on Android and IOS App : Krunker and Krunker Client. As FRVR has many partnership with different channel, the main goal for Krunker was to publish the game across the most famous : FRVR Website, Facebook, Samsung Instant Play, and Snapchat.

The game has a lot of potential, and there are a lot of different approach to improve and add-value to Krunker. Most of K Team tested all channels on which the game is available, a lot of insights and idea came from it. A few examples :
-   As a new player to the game, we realise there were no tutorial at the beginning. The game is highly complicated and users are match with random people, this can lead to player level 1 competing against player level 55. It can be very discouraging as first time player, and lead to the loss of many players. The goal would be to create a First Time User Experience (FTUE).
-   From the current channels, the main issue came from the Android and iOS apps. The game was clearly rushed onto mobile and it was not properly made. The user experience was very bad and after some analysis around the apps, we discovered that players were mostly using the app to purchase krunkers. The goal would be to create a new app, with an entirely new User Interface and User Experience Design, to allow a better game experience and to bring more people playing instead of just paying.

From the beginning to the current situation of Krunker, the roadmap has changed a lot. Figure 25 shows the first draft with the first 4 christmases. The main goals were to publish the game on the top channels, and to re-launch a new app with upgraded UX.
As of right now, the current roadmap of K is to prioritise the original web version : krunker.io and to release the game on Facebook.

d.   Divide and conquer : Work-stream

From all the insights that rose prior to the acquisition, four work streams were put in place to tackle each of them.
-   In-Game Experience : make new players fall in love with K by making an experience with an appropriate level of difficulty and desire to replay
-   Channels Integration : make K available to players on all channels by enhancing the experience through channel specific features

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- Go To Market : make all relevant players try K through an appealing campaign
- Monetisation : optimise K monetisation to the strength of each channel by having a more engaging IAP offering and better targeted ads

I was part of the Channel Integration (CI) Work-Stream, lead by the core team : Product Manager, Senior Engineer and Game Producer. As mentioned above, the goal was to publish K on our top channels : instant channels, and native apps. The team was composed of seven engineers (SDK, Back-End, Data, IOS, Android, Facebook and Samsung), two designers, one release manager and me as a data analyst. The organisation of tickets were operated in Jira[27].
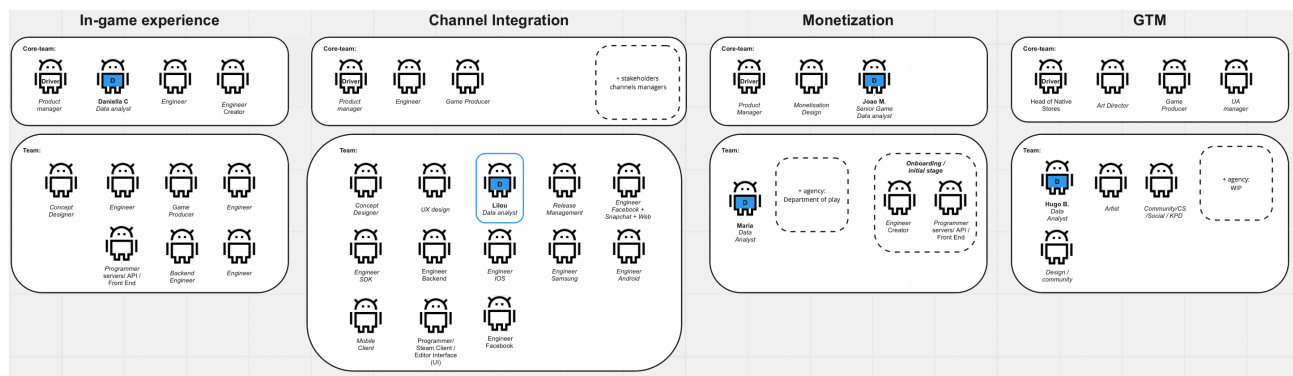

Figure 25 : Organisation of the Workstream Teams - Blue Representing Data Team

Data is central in all the work streams. In CI, I worked on finding the mains KPIs. When implementing the game to a new platform, it is important to evaluate if it is working or failing. Instant channels and native apps have a different ways of working and the user journey is different, which requires different evaluation metrics. In Figure 25 : frvr.com was supposed to be the first channel but due to technicals blockers, the deadlines was postponed for a few weeks, and Native Android App was the first live on the 11th of July 2022. On the CI side, we decided to track Daily Active Users, Daily New Users, Concurrent Users[28], and Retention.

For Facebook instant launch, the approach differs a little bit. The launch is expected for the end of September, as usual metrics we will track DAU, DNU, Concurrent Users, but the main metric would be 2SIP (2nd Session Install Point). This metrics evaluates if the first time experience of the user is good and if the game is attracting enough to make you come back a second time on your first day.

In the following part, I will discuss my involvement in the Project K as a whole.

2.   Fresh K Data

a.   From the Process of Data Validation

As mentioned in the **Scripting and Event Taxonomy** part, there was no clear data prior FRVR. After the first documentation, Yendis started tracking and we received the first batch of K Data. The first step was to validate all the data that was coming in, and to check if all the events were

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[27] Jira is a proprietary issue tracking product developed by Atlassian that allows bug tracking and agile project management.

[28] The number of simultaneous active users logged in to a session at a given time.
https://api.playfab.com/blog/the-metric-that-really-matters-for-user-load

```
select distinct event, count(distinct user_id) as login_users
from `frvr-analytics-production`.krunker.krunker_stream
where date between '2022-05-01' and '2022-06-01'
and event like '%ad_rewarded%'
group by 1
```

	event	⇕	login_users ▲ 1
1	ad_rewarded_show		134122
2	ad_rewarded_response		150559
3	ad_rewarded_request		189191
4	ad_rewarded_finish		219806

Figure 26 : SQL Query of the Broken Ad Rewarded Funnel with Results

implemented correctly. In order to validate the events, I used DataGrip and queried from the raw data. I'd made sure, there was no duplicated, missing, or incorrect data.

From the game play events :

- game_play_start
- game_play_end
- game_session_end
- game_session_start
- session_end
- session_start

The core of the events were properly implemented, and were only missing a few parameters that were fixed quickly.

From the first iteration, there were three major issues. The first one is the rewarded impression event funnel. All our games function on the same funnel : we receive the first *ad_rewarded_request* - player triggers the advertisement by clicking to see an ad for a reward. Then we have *ad_rewarded_response*, the ad is filled by an *ad_provider* such as google ad manager, or freestar. Following it, we receive ad_rewarded_show, the ad spot is filled and shown to the users, and finally we get *ad_rewarded_finish*, as the last event when the player watched the ad and received its reward. On K, the whole funnel was broken, the events were not implemented correctly : Figure 27

- Received more *ad_rewarded_finish* than *ad_rewarded_response,*
- Received less *ad_rewarded_show,*
- Missed the *ad_provider* params in all events.

The second is the in-app-purchase event funnel. It follows the logic as the ad funnel above. The funnel was working perfectly but it was missing important parameters, such as the item that was purchased, the price, the currency code and the platform it was bought on.

The last issue was the item flow event. Item flow are events regarding the in-game economy, the game currency, in this case : krunkers, and junks. The first iteration only recorded transactions of junks.

Every iteration of new data, a few data analysts would work on validating every event. Investigate if old events were still working properly, and if new events were correctly implemented, a tedious but necessary step.

b. Through the Transformation of Data on DBT

As previously mentioned, the data team is currently migrating to a new data pipeline based on a new data stack using dbt for the transformation (or the T in Extract, Load and Transform). The reason why dbt and the ELT paradigm are so revolutionary is because it opens up a whole category of data modelling to data analysts. While previously the transformation of data within a warehouse

might have required noSQL – something that would have created a barrier for most data analysts, would have required upfront costs and is generally within the realm of Data Engineers – dbt functions as a SQL wrapper that allows us to model and transform the data in the data warehouses they are stored with just SQL.

Furthermore, dbt also brings one big revolution; it provides a framework for developing data work according to best practices in software development. Steps such as separating a development environment from a production environment and code/peer review. This turns the development of data products and data projects into an iterative and collaborative process.

When the K project started, all data coming from K was done first-hand on the production pipeline of this new dbt stack. The Data Engineer was in advanced stages of setting up the infrastructure and created a cleaner table from events being streamed from our telemetry. These "cleaner" tables – where a superficial level of cleaning has been applied to eliminate redundancy and unnecessary costs – allows us to incur just 80% of the usual costs when scanning data directly from raw events.

When moving from the staging layer to the "analyst layer" – a layer of tables and views from which Data Analysts build models – the amount of data scanned, as well as resulting costs, are just 10-20% the original raw events. This is a vast cost reduction that allows models to scale up efficiently.

All data coming from K was directly started on dbt. Our Data Engineer created a staging layer with the data from raw events that are to be used by analysts. Based on this staging table, I could access an instance of dbt by creating a virtual instance with Docker and accessing it through the terminal that is integrated in a nifty fashion in the Visual Studio Code IDE.

Prior to the creation of the database tables, I followed an onboarding dbt session by the Junior Data Analytics Engineer. The process of adding a table to dbt is:
1. Creating the table using standard SQL and adding some JINJA templating to pass instructions on how dbt should configure the model
2. Create and test the models within a development environment – where just a portion of the data is loaded, typically 5 days
3. Commit the changes to a branch in Git and initiate a Pull Request in Github
4. Peer review and necessary changes and adjustments to the model
5. Approval, and merge of the Pull Request into the main branch and deployment in a production environment.

The main table used in the dashboard is krunker_daily_users_overview. The name of the model follows the new standards set for names, namely, being explicit. The table shows a user-level information aggregated daily for the game Krunker. This level of aggregation is a cheaper and more efficient way of visualising data and then plugging an event-level table.

I wrote the first draft for the table and worked on it. Since its deployment, it has been worked on and improved on multiple iterations by members of the data team. I will describe the dbt code that goes into creating the table.

```
{% set partitions_to_replace = partition_day_intervals(
    date_type="date"
  )
%}

{{
  config(
    materialized = "incremental",
    incremental_strategy = "insert_overwrite",
    partition_by = {"field": "date", "data_type": "date"},
    partitions = partitions_to_replace,
    cluster_by = ["channel", "game", "country_code"],
    tags = ["krunker", "daily"]
  )
}}
```

Figure 27 : Configuration of dbt tables

partition_day_intervals : a custom made macro (or function) written in Jinja that creates local date variables that will be used to define how partitioning is set in the incremental model.

config : a configuration of the model. dbt comes with 4 set materialisations, namely, views, tables, incrementals and ephemerals. We mainly use tables and incrementals. Incremental models is what allow us to scale our models as we insert each partition at a time.

incremental_strategy : there's two, insert_overwrite basically does exactly what it does based on partitioning and default is unique_key which scans the entire table and adds based on a unique key.

cluster_by : a secondary way of "partitioning" or rather "clustering" results to optimise querying and filtering.

tags : allows you to select models to run with a tag. Useful if when developing a group of related models or when needing to pass the instruction to a scheduler (e.g. airflow) on how to run the data pipeline.

Appendix 7 : dbt Krunker Daily Users Overview table shows the full dbt query that creates the krunker_daily_users_overview table.

c.   To the Creation of the Krunker Exclusive Dashboard

Based on the work streams, and all the tables the Krunker Exclusive Dashboard were created. Along the months of the project, the dashboard grew and became more and more detailed. As of right now it is composed as follows :
- Daily User Metrics
- New Users Cohort Analysis
- User Monetisation
- In-Game Characteristics
- Revenue
- Concurrent Users
- Business Workstream Insights

This has been my main project for the past months, another Data Analyst who was part of the Go-To-Market Workstream, worked along side me on the dashboard. Furthermore, I will go through a few pages.

The Daily User Metrics :
The main reason of the creation of the K exclusive dashboard is the way some metrics are defined. What constitutes a user differs vastly when compared to other games, largely due to the existence of users playing and logging in with an account and "guest" players who play without registering or logging in to their account. An initial focus on just registered users neglected an important number of players, therefore the need to include both. At the top of the first page, we introduce both types with a colour code. When doing the differentiation between users, the same colours are used across the dashboard.
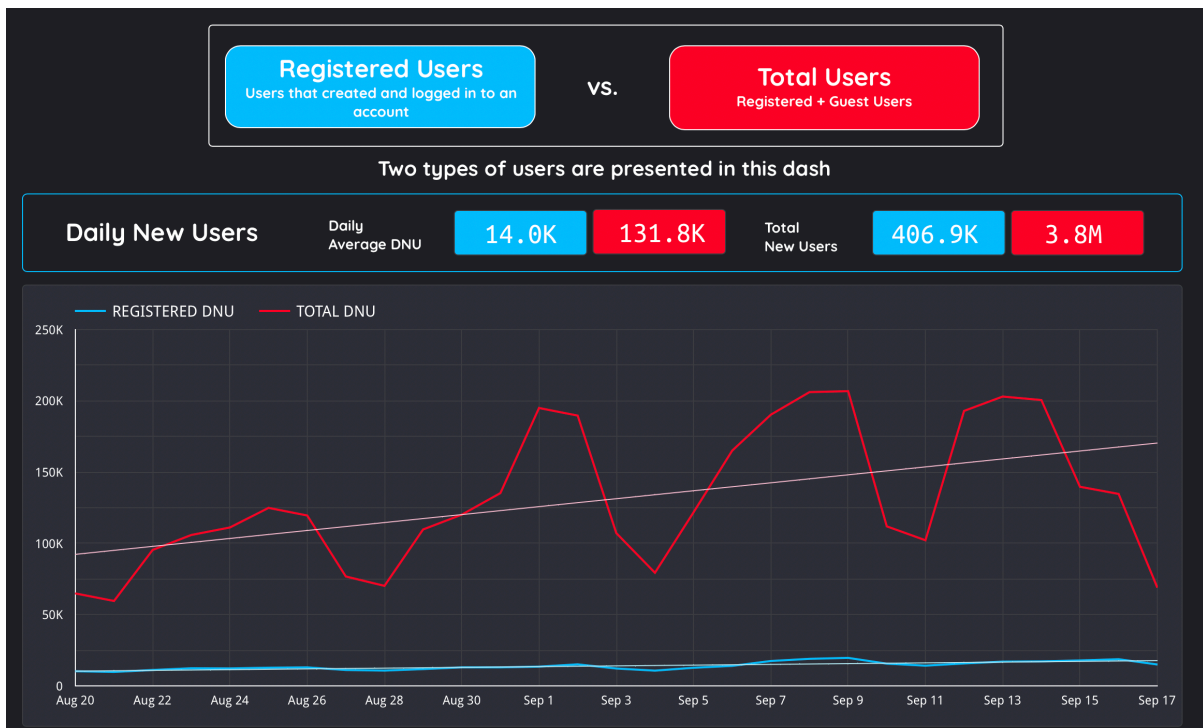

Figure 28 : Daily Users Page of the K Exclusive Dashboard

The majority of players are under the age of eighteen, which explains the overall DAU and DNU trend. A decrease happened around June due to the summer vacations. In the figure above, the DNU trend line has been increasing since the end of August and reaching levels registered in June; this is a seasonal increase that coincides with the back-to-school season.
Since the start of the tracking script, there has always been the wave trend for DAU and DNU. Players mostly play during the week, with a decrease in number of players during the weekend. However, it is a fact that in-app purchases (IAP) and corresponding revenue are larger in amount on the weekend than weekdays. Revenue will not be shown due to company policy.

This page is using the model mentioned in section 2.b section : krunker_daily_users_overview. It displays: DAU, DNU, Activity Index (DNU/DAU) the daily proportion of New Registered Users, Rewarded Impressions and Interstitial Impressions.

The User Monetisation :

User monetisation is divided into three pages: In-Game Economy, Spins and IAP Monetisation.

Spins are a way a player can spend in-game currency. While playing the game, the player will encounter Rewarded spins. There are four types: free, starter, heroic and elite spins, each corresponding to a tier or level of rewards with an upward evolution in quality.
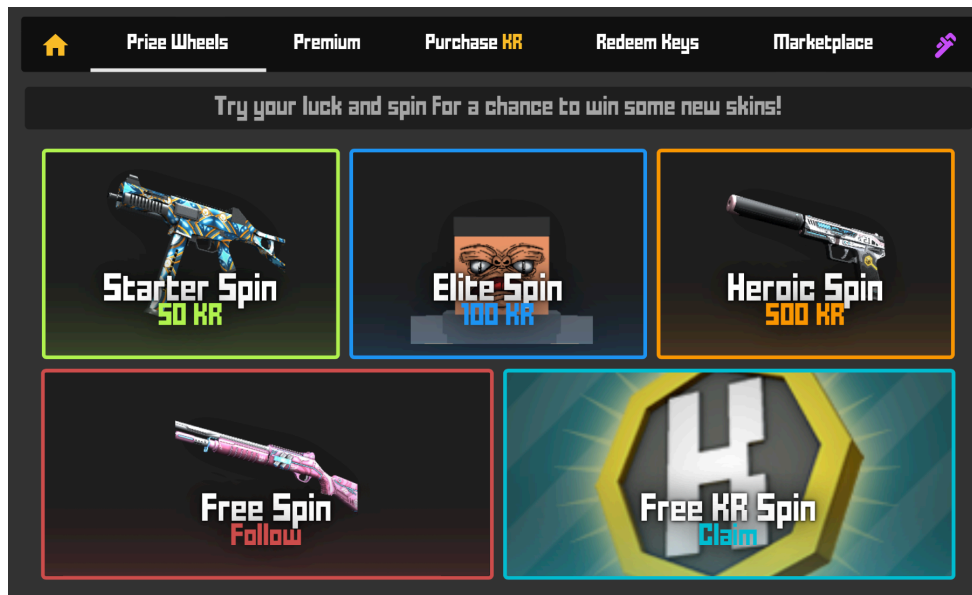
Figure 29 : Krunker Spins Tab

The first one is free and can be used after watching an advertisement (a rewarded impression), while the other three are only available with Krunkers, the games' soft currency. This page was requested from the In-Game Experience Workstream with the goal of understanding how players interact with spins. Because the spins result in a reward, only Registered Users have access to them. Surprisingly, just 24% of Registered Users are interacting with spins. The low percentage could come from a variety of different reasons.

Figure 30 : Krunker Spin Page of the K Exclusive Dashboard

Are spins expensive? Are spins user friendly? Do players have easy access to them? Are they too hard to find? Are they not prompted enough? Are they too expensive? Furthermore, data may bring more questions to the table. Data will also lead to answers and improvements over time.
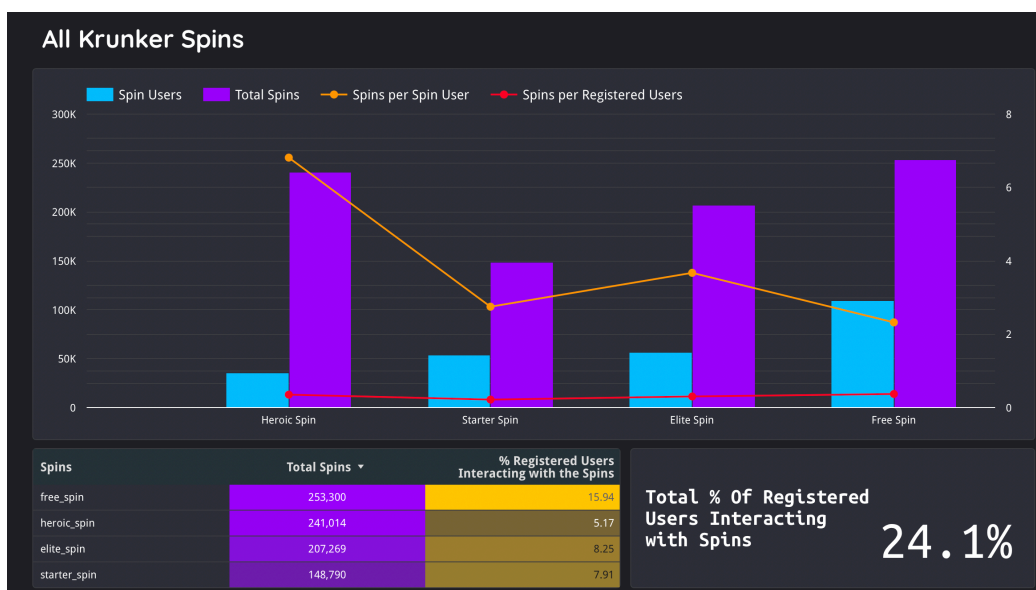
The combo chart gives an overview of all spins. In this visualisation, we can easily see which is the most used. The bars on the primary axis (left) show the number of spins, the number of users with a spin (Spin Users) while the lines based off the secondary axis (right) represent the spins per user and Registered Users. Free Spins are the most popular. Heroic Spins, despite having a lower number of total users, have a lot more spins per user (with 7 spins per user as opposed to 2 free spins per user). This shows the more a user is engaged with the game, the more they spend in-game currency.

It points out that the more engaged the user is the more they spend in-game currency. Figure 32 shows the K Price Wheels on the browser. The Heroic Spin is the most expensive one at 500 KR. This amount of KR is equal to around 1.79 USD.
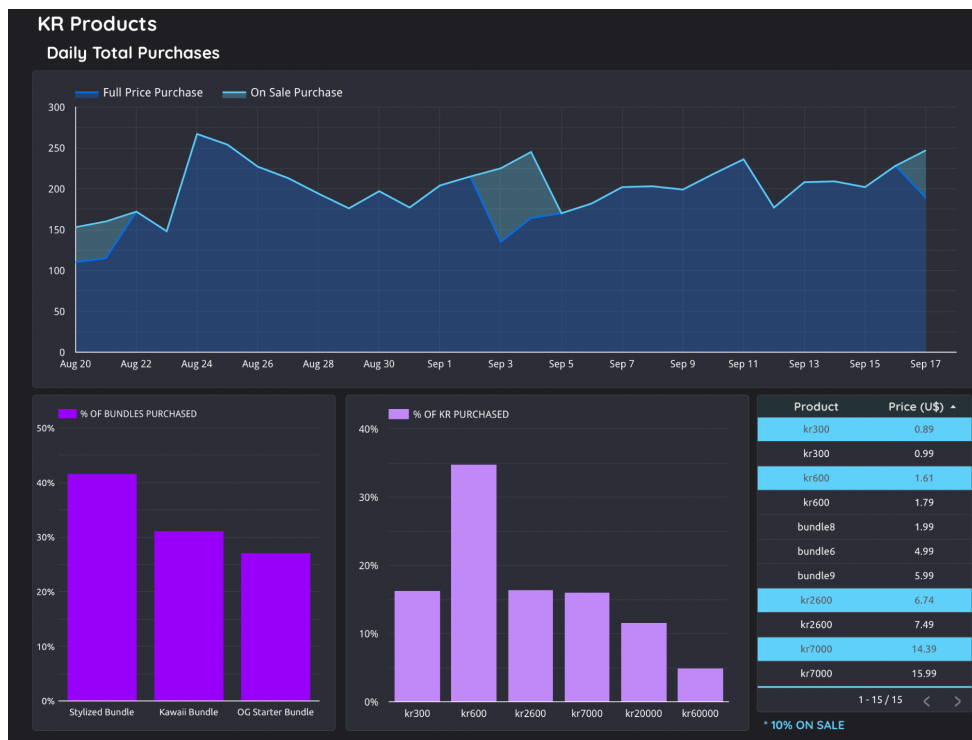
Figure 31 : In App Purchases Details - K Exclusive Dashboard

The IAP Monetisation part focuses on the In-App-Purchases made on the game. All Revenue shown is Gross, as it is not focused on the revenue but on the purchase behaviour of players. The page is divided into three parts : Revenue, Products Purchased and per Countries. Below, the figure shows which products are most bought from players and their respective prices. The purpose is to understand the players' purchase behaviour. What do they buy the most, and for what reasons? Based on the data the In-Game Experience Workstream came up with the new bundle : Stylised bundle, which is slightly more expensive than the prior ones. As you can see on the dark violet bar chart on the left, it was successful. For the last month it was the most bought bundle.
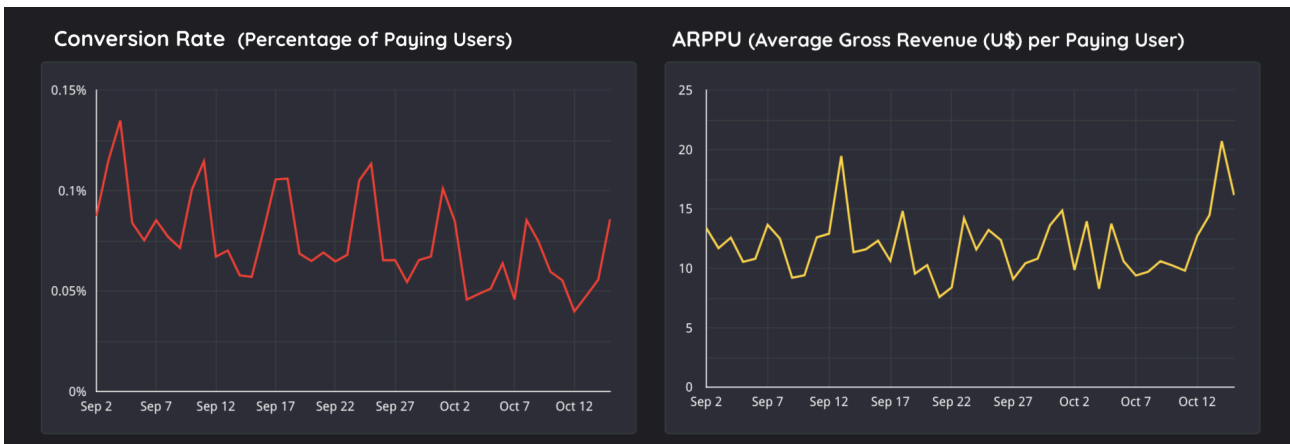
Figure 32 : IAP Conversion Rate and ARPPU - K Exclusive Dashboard

There is a very low percentage of conversation rate — users converting to paying users. However the Average Revenue Per Paying Users is around 10 to 15 dollars.

The In-Game Characteristics :
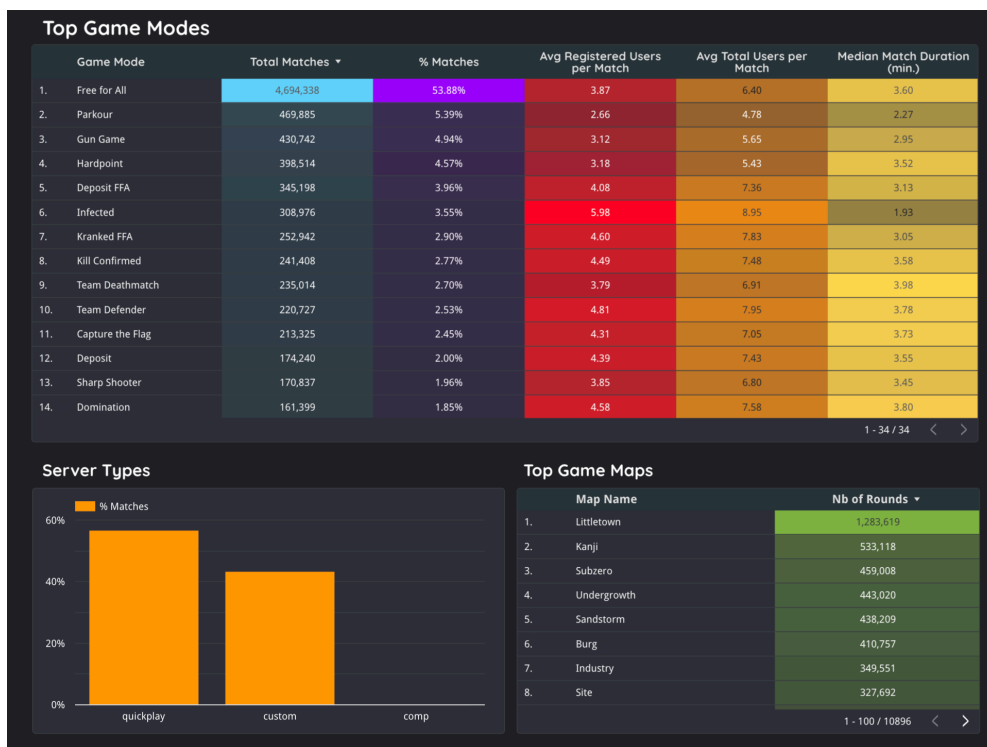
Figure 33 : Top Game Modes and Maps on K Exclusive Dashboard

Krunker has many different game modes. They have different purposes, and gameplays. For example Free for All which is the most famous is the basic battle royal game mode. Eights gamers playing against each other in a four minutes match. It accounts for more than 50% of all matches. The second one is Parkour which is the opposite, in this game mode the goal is to jump onto different platform and not fall. Based on the data, the K product manager chose Free for All, Parkour and Gun Game, with the Maps Littletown and Kanji as first game modes and maps to be available on the App and Facebook Releases.

Appendix 8 : dbt Krunker Table Match Characteristics is available to see the dbt table I created to feed the dashboard and the visualisation from the Figure 36.

3. Where to next ? Post Mortem K

For the past few months, the results have been below expectations, and even decreasing.

a. Workshop Post Mortem on K

A workshop regarding the low results of the game, was organised by the game producer managers to understand the state of the team. During this all-morning meeting, multiple activities were put in place in order to receive as much feedback as possible from everyone. The results from the workshop were very low team morale, and an important need of restructuring.

b. Re Evaluation of the Roadmap

From this initiative, and other executive meetings the roadmap shifted, and goals were modified for project K. The K team restructured and went from having four teams to only one In-Game Characteristics team of 30 people. At first we were 5 data analysts on the project, following the new structure, I became the only data analyst on K.

The new main focus is to introduce the game to Facebook, and to maintain our current players in the current platforms (web, and steam). To improve user experience, the product manager want to implement :
- Tournaments and challenges with friends.
- Tutorial for new users.
- Matches against bot for training or if there aren't enough players in a server.

The game soft launch[29] on Facebook in the Philippines and Australia. After a week, I analysed the data we received and led a data-oriented meeting with the K team, to communicate the results. The key points were :
- Players only coming from the Philippines, very few from Australia
- The lowest day 1 retention of all of our games on Facebook. K has 4% of its new users coming back the next day. A 'high casual' game (which is the opposite of K) has a day 1 retention around 9% and a 'hard-core' game has around 15% day 1 retention.
- 71% of the users are starting a match, and only 46% of them are finishing it. There is a churn of 25% of users during a 4-minute match.
- There are too few players connecting to the game at the same time. At 3pm only 4 players are playing at the same time.

From those data insights, the core K team has decided to upgrade the amount of User Acquisition Campaigns in the Philippines.

As of right now, this is all the information I have on the current situation of the project.

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[29]A soft launch refers to the common strategy of releasing a product ahead of its scheduled launch with little or no marketing push.
https://www.is.com/

V. Discussions

1. Enrichment

Working at FRVR and being a full-time member of the data team is a great opportunity to learn more about myself : my capacities, my limits and my career prospects. You never stopped being a student, throughout university, and throughout every work experience. Everywhere, there is something to learn and to bring on your next journey. The biggest difference I would say between being an actual student and a worker would be responsibility. You are not only responsible for yourself, you are also responsible and held accountable for what you deliver.

Ownership and Responsibility

The more time I spend working at FRVR, the more trust and confidence I gained. From all the different projects I worked on, the more responsibility I got. Having more responsibility can be frightening and stressful, but it also taught me to be more assertive, and to speak out my ideas. When you are put in a room full of professionals (non-data) and you are the sole representative of the data team, you need to come in prepared and ready. The first few weeks, I was not confident enough to speak out my concerns or ideas. It took a bit of time for me to learn, and to feel legitimate about my position. All the dashboards I presented are fully owned by myself. There is an evolution from my first to last projects. Having more important projects made me work and learn more. I am now the main data analyst on Project K, and I am happy that team members across FRVR are relying and trusting me to deliver quality data and insights.

Responsibility comes with skills and knowledge. As a student at NOVA, I learned how to retrieve data in SQL, how to clean and process data in Python, and finally how to turn data into stories. During my time at FRVR, I was lucky to explore and deepen those skills.

Skills and Knowledge

The biggest enrichment that comes out of this experience is the knowledge I got from my team. Countless meetings, brainstorming sessions, and discussions with the data team, have taught me so much on data visualisation, business intelligence, decision-making data driven, and the gaming-industry. New knowledge came from everyone, from juniors to seniors, I am very happy with the team I got to work with everyday. I have now reached good capabilities in SQL, and can understand and code complex queries, using common table expressions, partition by and pivot tables!

The work and collaboration with everyone taught me a lot as a Data Analyst, but also a lot on project management, and time management.

2. Difficulties and Limitations

For each of these projects or ad-hoc requests, difficulties and limitations rose along the way.

The general limitation I've faced on most of my tasks was the tool we are using. Google Data Studio is the only tool we are using for Dashboarding and Data Visualisation. It has many limitations around data integration, and data transformation. I had to figure out many 'tricks' in order to have the best final product, when I knew that Power BI or Tableau could have done it quicker and easier. A major issue is that it is very slow to load (even with s small and reduced data data set!) With the data team we encountered many times, where parts of the dashboards would disappear out of

nowhere, and have to recreate hours of work. I understand it is complicated to change BI tools, as we have many dashboards, to migrate them would take a lot of workforce and time. It is also hard to find the right tool to move on to.

Project K also had their fair share of difficulties. As it came as a huge project for the firm, an entire team was created to tackle it and to bring it to its full potential. There were many product managers and leaders in this team, too many. It got very difficult to have one clear view of what the goal was. Even after the re-organising of the team, following the port mortem workshop, I feel like there are still many leaders and too little workforce. Having to be the only data analyst on Project K is a bit overwhelming, with different requests coming in from every side.

VI. Conclusions

During my time at FRVR, I applied technical and soft skills that I learned along my studies, but I also learned a lot. It is my first work experience as a Data Analyst. Adding my year studying at NOVA IMS in Data Science to my year at FRVR, I'm getting a clearer idea of the role I want to play in a company.

Today, I really enjoy creating Business Intelligence tools, and translating data into stories. Creating a dashboard, all the way from the data integration to the final product has been one of my favourite parts of the job. Working daily with the data team, it is easy to believe that everyone is data literate. Prior to working at FRVR, I never really understood how important Data visualisation and communication are. It is useless to have tons of dashboards, tons of reports, and tons of analysis if no one understands them. I worked hard on making data more approachable, and visually understandable, and hope to have contributed to a more data-oriented FRVR.

The most surprising finding for me, would be working in the gaming industry. I am not a hard-core gamer, but I have discovered a joy in exploring and analysing player's behaviour. How it changes depending on games, and platforms. For instance, a player is not behaving the same on Facebook and on Samsung. From the core of those behaviour analysis, we can then pursue on improving the gameplay of users, and their experiences through testings. In the future, I intend on staying in the gaming industry, and would love to work for a more 'hard-core' game company.

To conclude, I had a great time at FRVR. This experience has fulfilled all of my expectations as a Data Analyst. For now I would like to keep working as a Data Analyst oriented in Business Intelligence. For the future, I am always open for new opportunities, and experiences. I would enjoy working more around machine learning, and after a few years, I would like to transition to Data Scientist. I hope to have helped FRVR in the best way possible, and to have contributed to a better user experience!

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Appendix

APPENDIX 1 : A PART OF THE DASHBOARDS INDEX
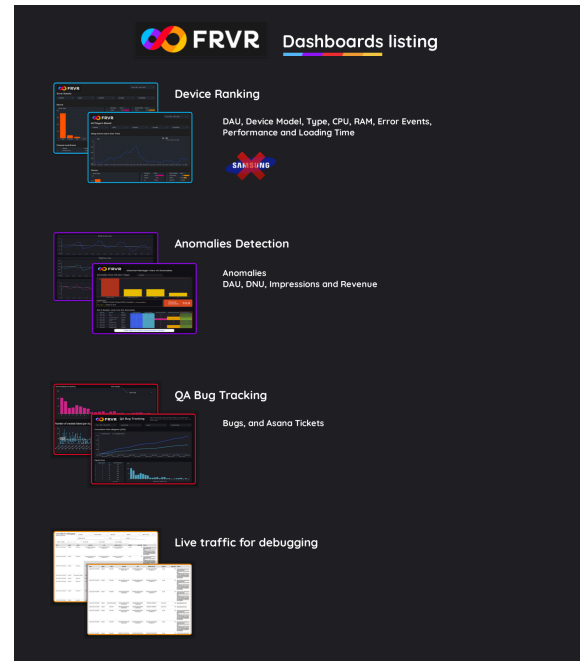
APPENDIX 2 : SCHEDULE QUERY OF MINIMAL DRAFT TABLE

```
CREATE TABLE IF NOT EXISTS `frvr-analytics-
inhouse.daily_updated_channels.aggr_all_channels_minimal_draft`
(    date DATE,
     user_id STRING,
     channel STRING,
     game STRING,
     country STRING,
     entry_point STRING,
     app_build INT64,
     app_version STRING,
     revenue FLOAT64,
     impressions INT64,
     sessions INT64,
     impressions_interstitial INT64,
     impressions_rewarded INT64 )
PARTITION BY date
CLUSTER BY user_id, country, channel, game;

DELETE FROM `frvr-analytics-
inhouse.daily_updated_channels.aggr_all_channels_minimal_draft`
WHERE date = DATE_SUB(@run_date, INTERVAL 1 DAY);

INSERT INTO `frvr-analytics-
inhouse.daily_updated_channels.aggr_all_channels_minimal_draft` (
SELECT
     users.date,
     users.user_id,
     users.channel,
     users.game,
     MAX(users.country) AS country,
     MAX(users.entry_point) AS entry_point,
     MAX(users.app_build) AS app_build,
     MAX(users.app_version) AS app_version,
     SUM(rev.revenue) AS revenue,
     SUM(rev.impressions) AS impressions,
     COUNT(DISTINCT play_session_id) AS sessions,
```

```
    SUM(IF(rev.ad_format = 'interstitial', rev.impressions, 0)) AS
impressions_interstitial,
    SUM(IF(rev.ad_format = 'rewarded video', rev.impressions, 0)) AS
impressions_rewarded
FROM ( SELECT DISTINCT
        date,
        user_id,
        play_session_id,
        time,
        country,
        game,
        channel,
        app_build,
        app_version,
        entry_point
    FROM `frvr-analytics-inhouse.daily_updated_channels.all_channels_prepped`
    WHERE
        date = DATE_SUB(@run_date, INTERVAL 1 DAY)
) users LEFT JOIN ( SELECT
        date,
        user_id,
        time,
        revenue,
        ad_format,
        1 AS impressions
    FROM `frvr-analytics
inhouse.daily_updated_channels.all_channels_ads_revenue_impression_level`
    WHERE
        date = DATE_SUB(@run_date, INTERVAL 1 DAY)) rev
USING (user_id, time)
GROUP BY
    users.date, users.user_id, users.channel, users.game)
```
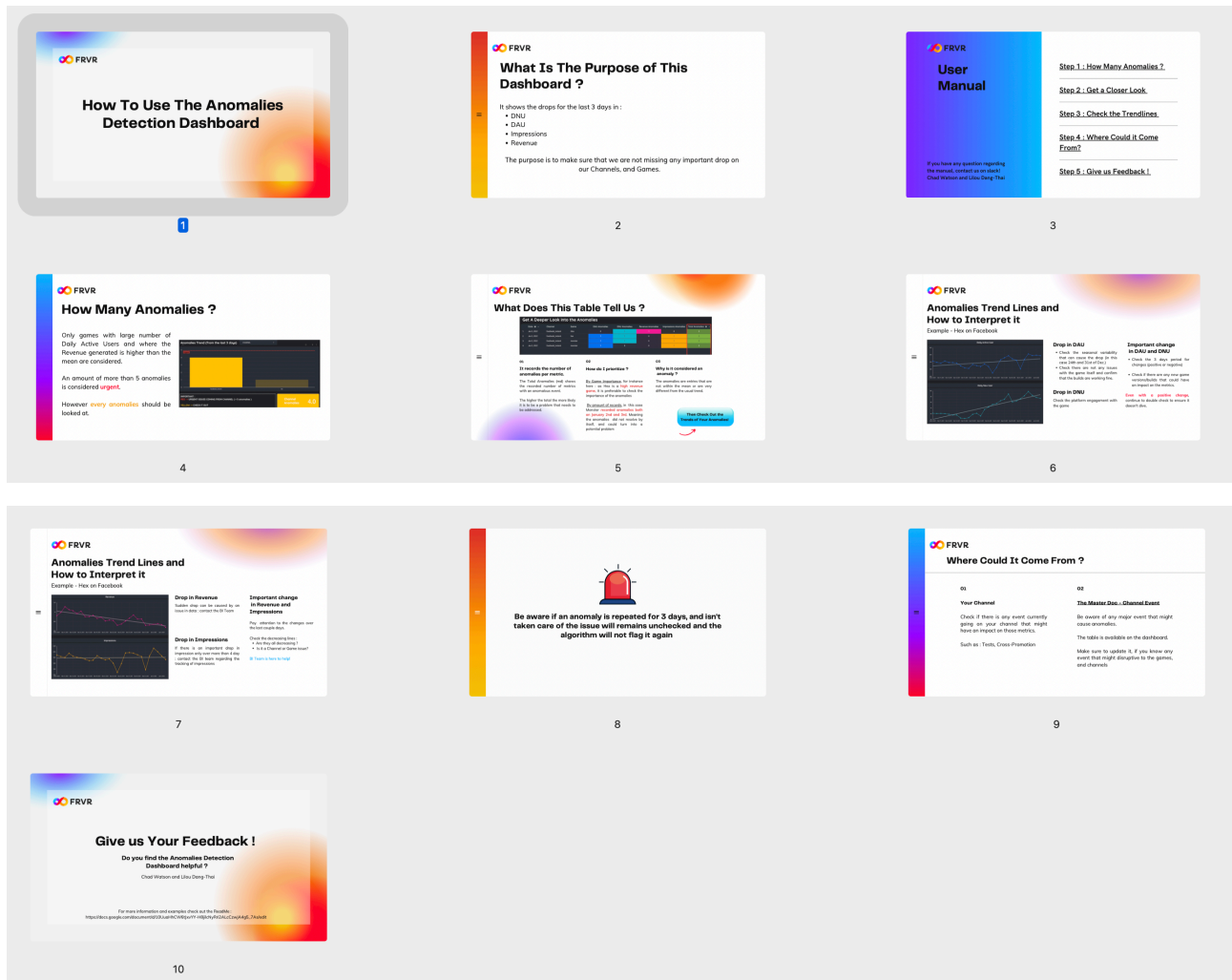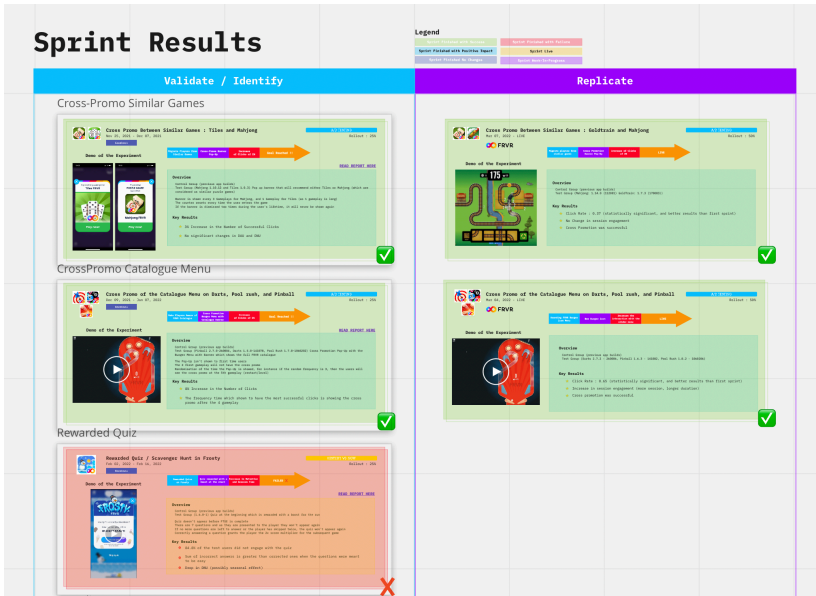
APPENDIX 3 : USER MANUAL - ANOMALIES DETECTION DASHBOARD

APPENDIX 4 : A PART OF THE SPRINTS OVERVIEW RESULTS MIROBOARD

APPENDIX 5 : A PART OF DASHBOARD OF THE A/B TESTS : NEW WAYS OF BOOKMARKING
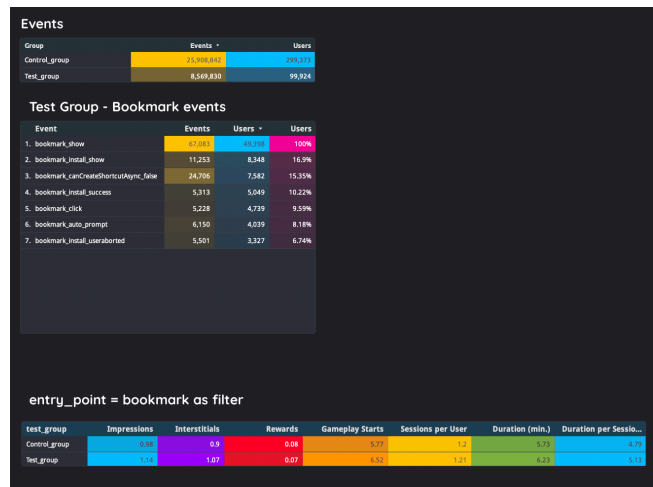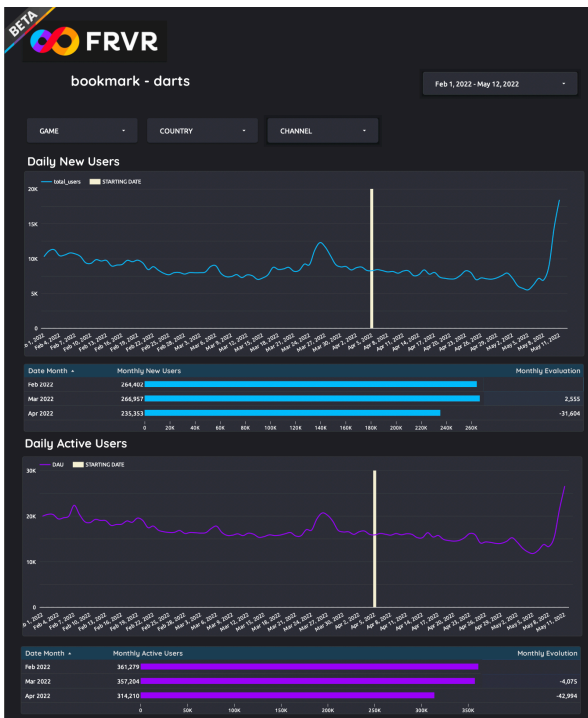
APPENDIX 6 : K FLOW EVENT - MIROBOARD

APPENDIX 7 : DBT KRUNKER TABLE - KRUNKER_DAILY_USERS_OVERVIEW

```
{% set partitions_to_replace = partition_day_intervals(
    date_type="date"
  )
%}

{{
  config(
    materialized = "incremental",
    incremental_strategy = "insert_overwrite",
    partition_by = {"field": "date", "data_type": "date"},
    partitions = partitions_to_replace,
    cluster_by = ["channel", "game", "country_code"],
    tags = ["krunker", "daily"]
  )
```

```
}}

with krunker_stream as (
    select *
    from {{ ref("krunker_stream") }}
    {% if is_incremental() %}
        where date in ({{ partitions_to_replace | join(",") }})
    {% elif target.name == "local" %}
        where date >=  {{ local_days_interval() }}
    {% else %}
        where date >= "2022-05-01"
    {% endif %}
),

ad_revenue as (
    select
        event_id,
        user_id,
        anonymous_user_id, --Do we really need these columns if we only merge using
        time,              --ad.event_id and ad.time?
        ad_format,
        ad_revenue
    from {{ ref("krunker_impression_level_revenue_ads")}}
    {% if is_incremental() %}
        where date in ({{ partitions_to_replace | join(",") }})
    {% elif target.name == "local" %}
        where date >=  {{ local_days_interval() }}
    {% endif %}
),

krunker_stream_ad_revenue AS (
    select
        stream.*,
        ad.ad_format,
        ad.ad_revenue
    from krunker_stream as stream
    left join ad_revenue as ad
        on stream.event_id = ad.event_id
        and stream.time = ad.time
),

daily_first_value as (
    select
        date,
        user_id,
        anonymous_user_id,
        game,
        channel,
        first_value(country_code) over (
            partition by anonymous_user_id, date, game, channel order by time
            rows between unbounded preceding and unbounded following
        ) as country_code,
        first_value(country_name) over (
            partition by anonymous_user_id, date, game, channel order by time
            rows between unbounded preceding and unbounded following
        ) as country_name,
        first_value(app_build) over (
            partition by anonymous_user_id, date, game, channel order by time
            rows between unbounded preceding and unbounded following
        ) as app_build,
        first_value(app_version) over (
            partition by anonymous_user_id, date, game, channel order by time
            rows between unbounded preceding and unbounded following
        ) as app_version,
        first_value(entry_point) over (
            partition by anonymous_user_id, date, game, channel order by time
            rows between unbounded preceding and unbounded following
        ) as entry_point,
        play_session_id,
        JSON_EXTRACT_SCALAR(_params, "$.round_id") as round_id,
        game_mode_name,
        map_name,
```

```
        server_type,
        cast(JSON_EXTRACT_SCALAR(_params, "$.kills") as int64) as kills,
        cast(JSON_EXTRACT_SCALAR(_params, "$.deaths") as int64) as deaths,
        cast(JSON_EXTRACT_SCALAR(_params, "$.score") as int64) as score,
        cast(JSON_EXTRACT_SCALAR(_params, "$.player_level") as int64) as player_level,
        case
            when JSON_EXTRACT_SCALAR(_params, '$.winner') = 'true'
            then 1 else 0
        end as winner,
        case
            when event = 'game_play_start'
            then 1 else 0
        end as game_play_starts,
        case
            when event = 'game_play_end'
            then 1 else 0
        end as game_play_ends,
        case
            when event = 'ad_rewarded_finish' and ad_result='success'
            then 1 else 0
        end as impressions_rewarded,
        case
            when event = 'ad_mandatory_finish' and (ad_result = 'success' OR ad_result =
'skipped')
            then 1 else 0
        end as impressions_interstitial,
        case
            when event = 'iap_request_payment_success'
            then price_amount
            else 0
        end as iap_revenue,
        ad_format,
        ad_revenue,
        _params
    from krunker_stream_ad_revenue

),

final as (
    select
        date,
        user_id,
        anonymous_user_id,
        game,
        channel,
        country_code,
        country_name,
        app_build,
        app_version,
        entry_point,
        play_session_id,
        round_id,
        game_mode_name,
        map_name,
        server_type,
        sum(winner) as winner,
        sum(game_play_starts) as game_play_starts,
        sum(game_play_ends) as game_play_ends,
        max(player_level) as player_level,
        sum(impressions_interstitial) as impressions_interstitial,
        sum(impressions_rewarded) as impressions_rewarded,
        sum(ad_revenue) as ad_revenue,
        sum(if(ad_format = 'rewarded video', ad_revenue, 0)) as ad_revenue_rewarded,
        sum(if(ad_format = 'banner', ad_revenue, 0)) as ad_revenue_banner,
        sum(iap_revenue) as iap_revenue,
        case
            when sum(iap_revenue) > 0 then 1 else 0
        end as is_payer,
        max(kills) as kills,
        max(deaths) as deaths,
        max(score) as score,
        if(max(deaths) = 0, 0, max(kills) / max(deaths)) as kills_per_death,
```

```
                if(max(deaths) = 0 and max(kills) > 0, 1, 0) as no_deaths
        from daily_first_value
        group by
            date,
            user_id,
            anonymous_user_id,
            game,
            channel,
            country_code,
            country_name,
            app_build,
            app_version,
            entry_point,
            play_session_id,
            round_id,
            game_mode_name,
            map_name,
            server_type
)

select *
from final
```

APPENDIX 8 : DBT KRUNKER TABLE - KRUNKER_MATCH_CHARACTERISTICS

```
{% set partitions_to_replace = partition_day_intervals(
    date_type="date"
  )
%}

{{
  config(
    materialized = "incremental",
    incremental_strategy = "insert_overwrite",
    partition_by = {"field": "date", "data_type": "date"},
    partitions = partitions_to_replace,
    cluster_by = ["channel", "country_code"],
    tags = ["krunker", "daily"]
  )
}}


with krunker_stream as (
    select *
    from {{ ref("krunker_stream")}}
    {% if is_incremental() %}
        where date in ({{ partitions_to_replace | join(",") }})
    {% elif target.name == "local" %}
        where date >=  {{ local_days_interval() }}
    {% else  %}
        where date > '2022-06-28'
    {% endif %}
)

select distinct
  date,
  country_code,
  country_name,
  channel,
  app_build,
  app_version,
  JSON_EXTRACT_SCALAR(_params, '$.round_id') as round_id,
  game_mode_name,
  map_name,
  server_type,
  count(distinct user_id)                    as total_krunker_users,
  count(distinct anonymous_user_id)          as total_anonymous_users,
  timestamp_diff(
      max(time), min(time), second
    ) as round_duration
from krunker_stream
```

```
where game_mode_name is not null
group by
    date,
    country_code,
    country_name,
    channel,
    app_build,
    app_version,
    round_id,
    game_mode_name,
    map_name,
    server_type
```