CHALMERS

The Fastest and the Greenest

Bachelors's thesis in Industrial Design Engineering, BSc

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A bachelor's thesis that explores an environmentally friendly future racing experience

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Abstract

This thesis presents a conceptual product development project that explores how to introduce a new way to enjoy motor racing, in the year 2030, through the use of Augmented Reality and Virtual Reality technologies. The purpose of the project is to develop and design a cockpit solution that can provide an immersive motor-racing experience.

The background to the project is that conventional racing is both expensive and has a negative impact on the environment (Kravchenko & Nosov, 2012; Pruett, 2021). As a result it is desirable to develop a new way to experience racing that addresses these concerns and connects the virtual world with the reality. The project was initiated by Lynk & Co, who presented the first design brief.

The outcome of this project is a concept for a racing simulator that is integrated into a car. This new concept allows drivers to participate in virtual races in their standard car, while it is stationary. The racing is shown on the car's windshield screens, and the experience is controlled with the cars existing controls.

These cars can be virtually customized. Through the use of Augmented Reality, modifications can be seen in real life, creating a new way of owning a digital car. To bind these areas together, a racing community was created around the concept to appeal a broad audience.

To showcase the concept a short film was produced, displaying the different aspects of the concept. It should be noted that the concept is not a fully developed product suitable for manufacturing but rather a foundation for further developments or as inspiration for future projects.

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Keywords: Motor Racing, Virtual Reality, VR, Augmented Reality, AR, Simulators.

Sammandrag

Det här kandidatarbetet presenterar ett konceptuellt produktutvecklingsprojekt som utforskar hur man kan introducera ett nytt sätt att uppleva motorsport år 2030 genom användning av AR- och VR-teknologier. Syftet med projektet är att utveckla och designa en cockpit som kan erbjuda en unik racingupplevelse.

Bakgrunden till projektet är att konventionell motorsport är både dyrt samt har en negativ påverkan på miljön (Kravchenko & Nosov, 2012; Pruett, 2021). Därmed eftersträvas ett resultat som erbjuder en lösning på dessa problem, samtidigt som det kopplar ihop det virtuella med verkligheten. Projektet initierades av Lynk & Co, som presenterade den första designbriefen.

Resulatet av detta projekt är ett koncept för en racingsimulator som är integrerad i en bil. Detta gör det möjligt för förare att delta i virtuella race i sin vanliga bil medans den står still. Racingen visas på bilens vindrute-skärmar och styrs med bilens befintliga reglage.

Konceptet tillåter användarna att modifiera sina bilar med hjälp av Augmented Reality. Dessa ändringar kan sedan ses i verkligheten, vilket skapar ett nytt sätt att äga en digital bil. För att binda samman konceptet har ett racing-community skapats för att locka en bredare publik.

För att presentera projektet producerades en kortfilm som visar de olika delarna av konceptet. Det bör noteras att konceptet inte är en fullständigt utvecklad produkt som är redo för tillverkning utan snarare en grund för ytterligare utveckling eller som inspiration för framtida projekt.

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Executive Summary

Motor racing has been around for almost as long as cars. Since its beginning motor racing has grown into a sport that is practiced all over the world and that attracts millions of viewers and fans every year. But even though racing is a popular sport, only a small portion of enthusiasts have the means to engage in racing themselves due to the high costs involved. The cost of racing consists of buying or renting a car, tires, fuel, maintenance, race gear and equipment and entry fees to a race track. This unavailability to the masses together with its negative impact on the environment has led Lynk & Co to initiate this project to develop an alternative to conventional racing for the future.

The purpose of the project was decided to be to develop and design a cockpit solution that can provide an immersive motor-racing experience. The solution should be more environmentally friendly and available to a larger part of the racing community than regular racing while also providing an experience closer to real motor racing than the simulators that exist today.

With this in mind the work began. At project start, the purpose was unclear, making it hard to proceed. After a briefing with Lynk & Co, the scope became clearer but still too broad. Phase 1 consisted of defining the project's purpose and problems to solve. Lynk & Co shared a brief about a man racing in a simulator, then switching to a real car with AR-enhanced racing.

To understand what a great racing experience is, a semi-structured interview was held with Cyan Racing. The interview discussed important factors and differences between simulators and real racing.

During phase 2 the team created scenarios to extract and develop key aspects, resulting in two concepts that were developed with Bartle's player types in mind. These concepts were presented to Lynk & Co and the feedback from them led to the concepts being reworked and split into three new concepts. After further analysis of these ideas a new concept was developed, which was then refined into the final concept *Velocity*. Before continuing with the development of the representation of *Velocity* in phase 3. The concept was analysed with the Octalysis framework to validate if the concept achieved the set goals.

Phase 3 Development. During this phase, the team further developed *Velocity* and decided on the final deliverables, which included a short film showcasing the project's results. Storyboarding was used to create a cohesive story that highlighted the key features of the concept. The team used Freytag's pyramid as a framework to structure the story, making it more engaging for viewers. Unreal Engine was chosen to create the virtual aspects of the concept, and the team used Blender for realistic car models that could be imported into Unreal Engine. The final film showcased the fusion of real cars and *Velocity*, with the Lynk & Co Club, customization, community, and AR applications playing key roles in the experience.

Velocity is a racing simulator built into Lynk & Co cars which allows the drivers to take place in virtual races. The two visible hardware differences between a *Velocity* car and a normal car is the race-mode switch located near the gear stick on the center console and the windows in *Velocity* cars are transparent screens. There will also be new additional hardware and software infrastructure in the car to make it function but this won't be anything that the driver will see or interact with and isn't a part of the concept. *Velocity* will be available as an add-on in the Lynk & Co cars, either when buying or leasing.

Contents

1
Introduction

In this chapter an introduction to the background and description of the project is given, with its purpose, limitations and goals.

1.1 Background

People have been motor racing for as long as cars have been around (Encyclopædia Britannica, n.d.). According to Encyclopædia Britannica (n.d.) the first official race was held as early as 1895 and since then racing has grown into a sport that is practiced all over the world and attracts millions of viewers and fans every year (Statista, 2023). But even though racing is a popular sport, only a small portion of enthusiasts have the means to engage in racing themselves. The reason could be the fact that racing is a very expensive sport as a season of racing for an amateur can add up to tens of thousands of dollars (Pruett, 2021). The cost of racing consists of buying or renting a car, tires, fuel, maintenance, race gear and equipment and entry fees to the race track.

Racing in its current form also has a negative impact on the environment due to pollution from the engines, tires and the whole operation around the races (Kravchenko & Nosov, 2012). An alternative to real racing that has emerged in recent years are racing simulators with physical interactive cockpit set-ups that try to recreate the racing experience. This is a step towards a more accessible and environmentally friendly alternative to traditional racing but it requires more development until it can fully compete with real racing (Beckford, 2018). This is where this project was started, aiming to create a greener way of racing available to a broader crowd.

1.2 Collaborating companies

The thesis project was initiated by the client Lynk & Co. Assistance with defining important elements of a racing experience was provided by the racing team Cyan Racing.

1.2.1 The Client Lynk & Co

The project was done in cooperation with Lynk & Co, who produced the first project brief. Lynk & Co is a Chinese-Swedish car manufacturer with a design department in Gothenburg, Sweden. Simple and easy car ownership is one of Lynk & Co´s key

ideas. For example, they only offer two options when purchasing a car, black or blue paint and with or without a towbar (Lynk & Co, n.d.). Furthermore they also offer a flexible subscription based ownership model where cars can be leased short or long term. Lynk & Co call their showrooms clubs and in addition to showing off their cars, they also contain cafes, co-working spaces and sell some assorted items. Events like organized running sessions and movie nights are also held at the clubs. The Lynk & Co 03+ model competes in the World Touring Car Cup through the Cyan Racing Team where they have become world champions several times (Cyan Racing. n.d.). Lynk & Co now want to design the next racing experience for the customers, drivers and fans that are proud of the racing and sporty heritage of the brand, without forgetting the reality we live in (see Appendix A).

1.2.2 Cyan Racing

Cyan racing (Cyan Racing, n.d.a) describe themselves as a global racing team with their roots in Sweden, Scandinavia. They were founded in 1996 and have since their founding won 19 Scandinavian titles and 8 world titles in the racing genre of Touring Car Cup. In 2019 they started a new collaboration with Lynk & Co and have since then competed with modified versions of the brands car models. One of their most experienced drivers, resides in Gothenburg. During the last 10 years he has claimed three Swedish championship titles and one world championship title (Cyan Racing, n.d.b).

1.3 Original Design Brief Summary

The design brief (see Appendix A) describes the challenge faced by Lynk & Co´s Prospective Design Team in designing a new experience for customers, drivers, passengers and fans who are proud of the racing and sporty heritage that the brand represents. The brief acknowledges that the excitement of speed and adventure comes at a cost and impact that cannot be ignored. Therefore, the design challenge is to create a cockpit solution that is swappable, reusable and makes the racer conscious of their racing in both a Virtual Racing and IRL Racing setup.

Lynk & Co focus on the form and function of the product, where interaction and journey are given equal value to form and finish. The design is expected to be part of an immersive experience that represents a future in 2030. The team were encouraged to challenge the brief, ask questions, and share ideas with prototypes that can be played with. The brief suggests using tools such as Unreal Engine 5, but should feel free to use any tool that best fits the purpose. The brief ends with a request to help define the Conscious Racer, implying a racer who is aware of the impact of their racing on the environment and society.

1.4 Target Audience "The Conscious Racer"

The Conscious racer is a term created by Lynk & Co as the target group for the project. The conscious racer is described as a fan of the motor racing sport that is aware of the negative effects that the sport has on the environment. The conscious racer is positive to explore new ways of exercising the sport considering the pollution and high prices of cars.

1.5 Purpose

The purpose of this project is to develop and design a cockpit solution that can provide an immersive racing-simulator experience. The solution should be more environmentally friendly and available to a larger part of the racing community than regular racing while also providing an experience that is more rooted in reality than the solutions that exist today.

1.6 Limitations

Only the driver's experience of racing will be considered and not that of the passenger. Racing is a driver focused activity and therefore the passengers are not prioritized. The solution is a concept for the future of 2030 and detailed descriptions of any technical infrastructure needed to make the concept work will not be developed. This is because the concept might rely on technology that is not commercially available yet.

1.7 Specification of issue under investigation

This bachelor's thesis explores how augmented reality and virtual reality technologies could impact racing in the future. These technologies have the potential to transform the racing sector by providing a safer and more environmentally friendly alternative to conventional motor racing. Simulators and virtual racing can also fill the gap between real-world racing and digital entertainment as gaming and esports gain popularity (Statista, 2022). With the help of this thesis, the goal is to examine the potential advantages and difficulties of applying these technologies to racing and offer suggestions for potential future advances in the sector. This is to be achieved by first defining what is essential in an immersive racing experience and then present a concept that achieves this and that fulfills all the demands.

1.8 Goals

The set goals for this project vary a lot in the ability to be measured. Some of the goals are easier to determine if they are accomplished, while others are more abstract hence harder to measure.

For the goals, the purpose of this project is a good reference. The main goals drawn from this are to create and develop a racing cockpit solution. This solution will provide an immersive, virtual racing experience, which has a connection to the real world.

As mentioned in the original design brief (see Appendix A), this will be a futuristic concept taking place in the year of 2030. With this in mind, the project will both explore current technologies and future ones that are still in the process of being developed. The areas that are focused on here are Virtual Reality, Augmented Reality and Open-Source elements. These will be combined with real-life products to create an experience that blends reality with the virtual counterpart.

The merge of these two worlds can bring something else to the table. A new way of ownership, where a product can be used both in the virtual and the real world.

The end result of this concept is meant to create curiosity and interest for the future. The racing experience has to be delivered to the viewer in an interesting way. Furthermore, it has to distinctly explain the concept and how the different parts of it work together to create the experience.

To conclude this, we can draw these main goals out of the above:

- Design and develop a cockpit solution
- Create an immersive racing experience
- Available to a larger part of the racing community
- Implement AR, VR and Open-Source elements
- Blend reality with the virtual counterpart
- A new way of ownership
- Create a representation of the concept that awakes interest and curiosity

2

Final Result Velocity

This chapter introduces the final result of the project, *Velocity*, which is a racing simulator concept built into Lynk & Co cars. *Velocity* allows drivers to participate in virtual races while parked. Races are based on real-life locations and can be hosted by Lynk & Co or by other users. Customization of cars is made possible through digital versions of Lynk & Co cars that can be customized via phone or in-car screens. The Lynk & Co Club serves as both a showroom and meeting place for potential customers to experience *Velocity*. (For the resulting representation of the concept, see Appendix B).

2.1 Introduction to Velocity

Velocity is a racing simulator built into Lynk & Co cars which allows the drivers to participate in virtual races, while the car are in a standstill (see Figure 2.1). The two visible hardware differences between a *Velocity* car and a normal car is the race-mode switch located near the gear stick on the center console, and the windows, which in *Velocity* cars are transparent screens. *Velocity* will be available as an option when ordering a new Lynk & Co car. *Velocity* cars can also be leased or rented through Lynk & Co's subscription based ownership model. Making it easier to try out for a shorter period of time if the user isn't sure *Velocity* is for them.

Figure 2.1: Visualization showcasing that cars are parked while racing.

2.2 Racing with Velocity

All racing with *Velocity* is done in parked cars that are standing still. *Velocity* races are driven in a virtual racing environment (see Figure 2.2). When the car is parked the driver can enter the virtual race environment by activating the race-mode. This is done by hitting the race-mode switch located on the center console near the gear stick. This switch activates the *Velocity* software which turns on all the screens in the car.

Races in *Velocity* are based on real life locations and every race has a starting location located somewhere in the world. The races are virtual versions of real streets that have been created and added into a race database. Races are either created by Lynk & Co or by other users who add their tracks to *Velocity*. The technology where new race tracks can be created is open source based, which allows users to create their own tracks, bringing a sense of community to the concept by allowing the users to contribute to the experience. Official race tracks added by Lynk & Co have been altered by adding race track elements like racing curbs and roadblocks that shape the track to make it feel more like a structured race instead of a street race. Races can vary in size from small gatherings with friends to large competitions with lots of drivers. This makes it possible to hold championships in *Velocity* racing where all the best racers get together. For example, ten Lynk & Co cars could be parked at Times square with all of the best *Velocity* racers in the world behind the wheels. The big audience is cheering, watching the drivers' points of view on the big screens while they brawl through the virtual streets of Manhattan.

There are two ways to start a race with *Velocity*. The first option is that a driver can start a race by driving up to the real life start location of that race and hit the race-mode switch. By positioning races to real life locations, *Velocity* provides a connection to reality. Giving users the possibility to experience a part of a professional race driver's life in the sense of traveling to different places to compete against other drivers. When the race-mode switch is pressed at a real life race location, that specific race will be initiated and any nearby *Velocity* racers will be able to join the race. This creates a way to meet up with fellow competitors before a race and increase the immersion in the way of creating a community around the experience.

The second option a user can start a race is by hitting the race-mode switch outside of a race start location. When the race-mode switch is activated outside of a race start location the driver will be shown a menu where they will be able to choose a race located anywhere in the world from a race database.

When driving the virtual car in a race, the driver controls the car using the steering wheel, gas pedal and gear stick like normal. Only allowing racing in still cars will both increase safety by eliminating the risk of crashing and will reduce the environmental impact by decreasing emissions and energy used by the car.

Figure 2.2: Racing in *Velocity* visualised.

2.3 Customization

To further increase the sense of community amongst *Velocity* racers the concept also introduces a new way of customizing your car. This is made possible by owning a digital version of a Lynk & Co car. This digital car can be customized either on a phone or on a screen in the car (see Figure 2.3). Customization will consist of changing the car's color, rims, adding spoilers, changing body panels and adding stickers and decals to your car. This makes for much easier customization of cars and eliminates the need for installation and manufacturing of custom car parts while also being cheaper and with less material usage. The customized cars will be visible in the race-mode and in real life. To achieve this AR technology in the car windows will overlay the customizations onto all customized cars outside of the windows. The customization aspect is enhanced by the ability for users to create their own custom skins and mods, and share them with the community.

Figure 2.3: Showcasing customization on iPad.

This way of personalizing cars allows drivers to both express their personality and prove their skills as a driver while also being a new, easier way to modify cars with

less material usage. Personalization allows the drivers to really make their cars their own and increases the sense of ownership. This will in turn make the users more motivated to improve and customize their cars even further according to Chou (2015). Chou (2015) also writes that if a user spends a lot of time customizing their belongings they will feel a greater ownership towards them which will make them more attached to their cars and the Lynk & Co brand.

Another customization feature are unique modifications unlocked by winning races. Users can display their achievements through their modifications. This will further engage the users by achieving goals and growing as a person according to Chou (2015).

2.4 The Lynk & Co Club

The already existing Lynk & Co clubs will be a place where potential customers can be introduced to the *Velocity* racing experience (see Figure 2.4). In their current state these clubs are among other things a showroom for Lynk & Co's new cars. With *Velocity* built into these cars, customers can get a feel for the driving experience before taking the car out for a ride, and at the same time experience the thrill of racing. This easy to access experience will increase the knowledge of the brand and get more people to experience the driving sensation. But the Lynk & Co club is not only a showroom, it is also a meeting place. During the day it is a co-working space and a café and in the evenings it turns into a place to hang out where people in the racing community can meet like-minded, new friends, enjoy workshops or just enjoy a drink in a vibrant environment. All this will help in building a strong community which in turn will lead to more engagement in the *Velocity* racing experience.

Figure 2.4: The Lynk & Co Club visualized.

3
Theory

This chapter describes different technologies and principles that are being discussed and implemented in the project. It also explains the different methods that have been used to create the final result and the software used to visualize the final concept.

3.1 Technologies and principles of the project

Relevant technologies and principles for this project are Augmented reality (AR), Virtual reality (VR) and Open Source principles.

3.1.1 What is Augmented reality?

Augmented reality is a way to merge the real and the virtual world (Dray, 2023). This is done through different mediums: visual effects, sounds and other sensory stimuli. There are essentially 3 main features to AR: combination of digital and physical world, real-time interactions and accurate identification of digital and real-life objects.

To further understand AR, it can be described as overlaying the reality with digital elements. This can help to blur the line between the two worlds, enhancing the real life experience without having to leave it (Petrenko, 2022). This makes AR different from VR. The latter is an alternative reality, where the experience is digital. Input from the outer world is not possible. AR lets the user experience the real world with interaction and other stimuli coming from the digital side.

AR is used in a wide variety of areas. Apps such as Snapchat use it to add objects to pictures. The game Pokemon GO merges the real world with virtual objects. In addition to social media and games, AR is used by neurosurgeons as support in surgery (Dray, 2023).

For the automotive industry, navigation systems implementing AR are used to guide the driver through the windshield. It is a growing market, with compound annual growth rate expected to more than triple until 2028 (Petrenko, 2022).

There are different types or AR implementations in automotives. Marker-based or image-based utilizes physical markers on products that the AR software recognizes and that initializes the AR (Petrenko, 2022). This can let users manipulate a car's

appearance in real time through a mobile or PC. Sensory-based AR provides the feeling of an alternate reality. It uses stimuli like visuals and audio to make the user feel like they are somewhere else. This is used to present driving experiences before a vehicle is produced. The former is already used in existing cars. This lets drivers get information about traffic and navigation on their windshield using AR. This can make the driver more aware of their surroundings and create a safer driving experience.

Digital showrooms using AR is another tool for this industry. 2D and 3D displays of different car parts and functions help the users understand the products (Petrenko, 2022). One of the newer ways of using AR for automotives is through design and customization. This lets users choose different designs on their car digitally, for example a paint job. This makes decision taking easier and provides an immersive experience in designing your car digitally.

3.1.2 What is Virtual reality?

Virtual reality (VR) is the use of computer modeling that provides the ability for an individual to interact with an artificial, computer-generated environment (Lowood, n.d.). The environment is a three-dimensional or other sensory space that simulates reality by using interactive devices which receive and send information from and to the computer. These interactive devices can take the form of goggles, headset, gloves or even full body suits. The illusion of actually being in these artificial environments is affected by motion sensors that use the individual's movement and adjust the viewport accordingly. This adjustment is usually in real time, thus a user can interact with an environment as if he or she really is there.

The creation of this immersive experience replicates how the eye and brain form visuals (Bardi, 2022). The human eyes are about 7 to 8 centimeters apart and will therefore create two slightly different views to create a sense of depth . VR applications mimic that phenomenon with two exact images but shown from two different perspectives. This is to offset the view for each eye, instead of a single image shown over the whole display. By doing this the brain gets tricked into perceiving a sense of depth and accepting the illusions of a multi-dimensional image.

There are three main categories for VR: Non-immersive-, Semi-immersive- and Fully immersive Virtual reality (Heizenrader 2019):

- Non-immersive Virtual Reality: This category includes a computer-generated environment where the user still remains conscious of their physical environment. Video games are a prime example of this type of VR and therefore it is often overlooked as a type of VR.
- Semi-Immersive Virtual Reality: This category provides the users with an experience featuring a partly virtual environment. It gives the user the perception of being in a different reality while focusing on the digital screen but still gives them the possibility to be connected to their physical surroundings.

- Fully Immersive Virtual Reality: This category gives the user a simulation that is the most realistic. Where both sound and visual elements complete the experience. In order to interact with this type of VR the user needs proper VR glasses or a head mount display. These VR headsets provide the user with high-resolution content and a wide field of view. The digital image often splits between the eyes of the user, creating a three-dimensional effect of the image. In addition to this the headsets feature input tracking to create a further immersive and believable experience.

A phenomenon that is associated with VR technology and is highly relevant in a racing context is simulator sickness or better known as virtual reality sickness. Virtual reality sickness is the physical discomfort that occurs when an end user's brain receives conflicting signals about self-movement in a digital environment (Brush, 2019). According to Brush (2019) the exact number of people who are affected by VR motion sickness is usually estimated to be 25% by software engineers that develop virtual- and augmented reality. To put it in context it is the same amount of people that experiences motion sickness when there is turbulence on an airplane.

Furthermore Brush (2019) writes that the cause of VR sickness is signals that are in discordance, sent to the brain from the eyes, inner ear and body tissue sensory receptors. Illness often occurs when a person is viewing themselves in 3rd person moving quickly in a digital environment whilst their physical body is still. There are different theories on why people experience VR sickness but the biggest cause is the sensory conflicts that sends mixed and confusing signals to the brain states Brush (2019).

Brush (2019) suggests that VR developers should focus on adjusting the frame per second (FPS) to avoid lag time and reduce sickness. VR engineers recommend that the focus should rather be on increasing the FPS to at least 90 rather than using power to create sharper pictures. Brush (2019) points out that the sensory conflict caused by VR can be worsened by delay in the frames. For instance if a VR user looks to the right whilst wearing a VR headset the screen shifts to the left to help match the digital environment with the real world. However Brush (2019) writes that the shift might seem to appear in real-time but it actually take place in near real-time. This delay creates a mismatch between what the person is seeing and what the body is experiencing. Brush (2019) concludes that the best way to avoid sickness is to test each shot individually and expose someone who is sensitive to frame rates to see how they react.

3.1.3 Exploring the "Open Source" concept

The term open source refers to something that is publicly available and that anyone can modify. Open source was first coined in 1998 and in the beginning only referred to source code in software (Open Source Initiative, 2018). From then it has evolved into a movement that believes that sharing designs and making them available to more people can benefit progress and allow for faster development.

The use of open-source concepts in product development has both advantages and disadvantages. One of the benefits of open-source concepts is cost savings. By using existing software code and design specifications that are freely available, companies can avoid paying licensing fees or royalties, resulting in significant cost savings (Crowston, Wei, Li, & Howison, 2012). Additionally, open-source concepts encourage collaboration and knowledge sharing among developers and users, which can result in faster development and improved quality (Gonzalez-Barahona, 2000).

However, there are also some drawbacks associated with the use of open-source concepts. One of main drawbacks of the use of open-source software can raise intellectual property concerns, as developers may be required to share modifications and improvements they make to the software with the community (Gonzalez-Barahona, 2000). Finally, the use of open-source software may result in compatibility issues with other software systems or hardware components (Scacchi, 2007).

3.1.4 Transparent TV-screens

A transparent TV-screen is a display screen that you are able to see through. These tv-screens are made using one of the two technologies, LCD and OLED (Awa-Abuon, 2021). Transparent displays with LCD use transparent LED backlights, to eliminate the need of other light sources and thus making transparency possible. OLED displays are manufactured with layers of transparent plastic placed between two glass panels consisting of emissive and conductible layers. Electrical impulses pass through the conductive layer which produces light in the emissive layer. What makes transparency possible in OLED-displays are the gaps in between the pixels of the screen and the clear cathodes within these gaps. OLED-displays can be made much thinner than those made with LCD. This is due to OLED-displays generating their own light and thus eliminating the need for additional lightning.

3.2 Methods

The methods of this project consist of gamification frameworks, storyboarding, system theory, design methods and software used.

3.2.1 Octalysis

Octalysis is a gamification framework developed by Yu-Kai Chou. Gamification is a way of taking the engaging elements of gaming and applying them to real world activities (Chou, 2015). It focuses on the human motivation of the system, instead of optimizing for example efficiency. Chou (2015) refers to this as “Human-Focused Design”.

The Octalysis framework is built around eight core drives which makes games appealing to the users and gives them the motivation to keep playing. These eight core drives are (Chou, 2015):

1. Epic meaning & Calling is the first drive and is the motivation that a person gets from feeling like they are doing something greater than themselves or was chosen for something. This can be motivation for a person to create or maintain things in a community without it directly benefiting them because they believe it is for the greater good.
2. Development & accomplishment is the drive that people get from improving, achieving goals and growing as a person. It is important to Implement ways for the user to improve and achieve goals to make them more engaged and motivated.
3. Empowerment of Creativity and Feedback represents the motivation that users get from engaging in creative processes. It appeals not only to the human desire to express themselves and show off their creativity but also to the need to receive feedback on their work and ideas.
4. Ownership & possession is based on the human desire to own, take care of and personalize things to our liking. People who feel like something is uniquely fitted to their preferences become more attached, leading to stronger feelings of ownership and a desire to protect it.
5. Social influence & relatedness deals with motivation driven by comparing and connecting with other people. Feelings of envy play a large role here, users will become more motivated if they see someone else that has accomplished a goal of theirs or that owns something they want.
6. Scarcity & impatience deals with the drive to have something that is difficult to obtain. We as humans have a natural tendency to want things that are rare or take time and skill to obtain. Which means adding these aspects into a game will keep the players engaged.
7. Unpredictability & curiosity is the drive that motivates users by bringing the element of chance into an experience to keep them engaged. This core drive also includes the aspects of exploration and curiosity.
8. Loss & avoidance is the final core drive which is based around the fear that users get from the possibility of losing progress if they fail a task. Making the users driven to avoid the negative outcomes by being careful or performing better.

In Chou's Octalysis model, (see Figure 3.1), these eight drives are visualized as an octagon where each side represents one of the eight drives. The octagon can also be split up into four different halves where each half divides the drives into groups that deal with the same kind of motivation. If the octagon is split up into a left and a right side, the drives on the left side of the octagon; development & accomplishment, ownership & possession, scarcity & impatience are more related to logic, calculations and ownership. The left side drives are related to extrinsic motivation. Extrinsic motivation is when doing the task itself is not what motivates the user but instead it is the reward for completing the tasks that is the motivator. For example a lot of people only do their job because they want their pay and not because they enjoy doing the work. The three drives on the right; empowerment of creativity & feedback, social influence and relatedness, unpredictability & curiosity are instead characterized by sociality, creativity and curiosity. These rely on intrinsic motivation. This means that the user is motivated to do a task because they enjoy

doing it instead of only doing it because they will receive a reward at the end (Chou, 2015).

The Octalysis octagon can also be split up into a top and a bottom half. Chou (2015) refers to the drives on the top as white hat motivators and the bottom drives as Black hat motivators. The white hat motivators are positive motivators which make the user motivated to keep playing by empowering them and letting them use their creativity and become better. Black hat motivators on the other hand drive the player to keep playing by pushing them down by for example putting them under pressure or threatening them with losing their progress if they don't play enough or if they fail in the game. Even though they are negative motivators it is not necessarily wrong to use them but if they are overused it will make the user feel bad and they will leave the experience if they get the chance.

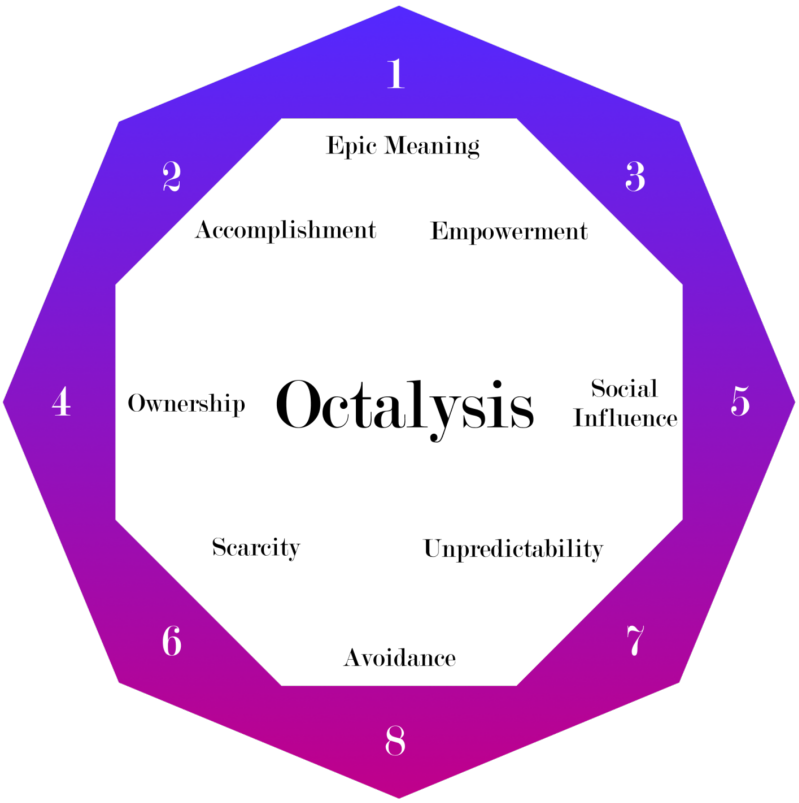

Figure 3.1: Visual guide off Octalysis Framwork.

The octalysis method can be used as a tool to evaluate games, systems and products. A score ranging from 0 to 800 can be calculated using the octalysis tool depending on how much of each drive is implemented in the system. This can be used to improve products to make them more engaging and put the experience in focus.

3.2.2 Bartle's four taxonomy types

In 1996 Richard Bartle identified four types of gamers based on their motivations and behaviors when playing games – socializers, achievers, explorers and killers (Bartle,

1996). According to the study, socializers mainly focus on socializing and building relationships with other players while gaming. This is in contrast to explorers, whose main objective is discovering the world that exists in games. Explorers gains knowledge through trial and error, Bartle further explains.

Bartle further describes achievers who get satisfaction from completing different tasks, challenges and milestones and being rewarded when they succed. This is not very different from killers, who instead of completing tasks and gaining points, get a thrill from winning and seeing other people lose – they want to become the best.

With these player types you can create a stable balance between the types when creating your game (Bartle 1996). Every game does not have the same number of players for each type, rather that over time the proportion of players of each style stays relatively constant. By considering this balance you can tailor your product to appeal to the different player types that the game is aimed towards.

3.2.3 Freytag's pyramid

The concept of Freytag's Pyramid was developed by Gustav Freytag in the 19th century as a way to describe the narrative structure that has been used by fiction writers for centuries.

Freytag's Pyramid consists of five stages that define the structure of a story (Glatch. 2022). These stages include the exposition, rising action, climax, falling action and resolution. Each of these stages is essential in providing a conceptual framework for writing a story from beginning to end.

The exposition is the stage where the story is introduced, providing information about the setting, characters, and initial conflict. The rising action stage is where the conflict and tension build up, leading to the climax, which is the point of maximum tension or excitement in the story. The falling action stage follows the climax and leads to the resolution, where the story's conflict is resolved, and the story comes to a close.

3.2.4 Storyboard

The article by van der Lelie (2006), discusses the use of storyboards in the product design process. In product design, communication between the client, the design team and future users is crucial. Throughout the design process, ideas and concepts are generated and must be conveyed to evoke comments and critique, depending on the process phase. Storyboards are a valuable aid to the designer in this task by providing a visual language for the task.

Van der Lelie (2006) argues that designers can benefit from choosing appropriate visualization styles for the needs of each phase of the design process. The visual style of the storyboards influences the reactions of the people who view them. While open and sketchy storyboards are inviting comments, detailed presentations can be overwhelming. The article notes that while storyboards are widely used in the movie

and advertising industry, little research has been done on their use in product design. Most publications on storyboards deal with the production of motion pictures and on neighboring fields such as comics. Some of the expressive techniques used in cinema and comics can be applied in product design storyboards as well.

Furthermore the article states that a product design storyboard is a powerful tool for the designer because, by telling a story about the interaction, it enables the reader access to the expressed ideas on two levels. Firstly, the reader can experience the visualized interactions by empathizing with the user or the situation, like they would while reading a book or watching a movie. This establishes a common ground, which supports communication within the design team about each member's thoughts. Secondly, the reader can reflect on the visualized interactions from their own expertise by withdrawing from the experience and looking at the unfolding event from the outside. This objective perspective supports analysis, picking out certain aspects of the interaction, and getting an idea about time development.

3.2.5 System Theory

System theory is used to explore complex systems in science, society, and nature (von Bertalanffy, 1968). It is a theoretical framework that offers a viewpoint to comprehend the behavior and interaction of various system components. The approach emphasizes the need to examine a system as a whole rather than dissecting its component elements in order to properly comprehend it. To evaluate and improve complex systems, system theory is widely employed in many disciplines, including engineering, economics, ecology, and management (Gharajedaghi, 2011).

3.2.6 Empirical data collection - interviews

Interviews are a form of data collection suited to acquire more in-depth data. The questions asked can be closed-ended or open-ended questions (Post- och telestyrelsen [PTS], n.d.). Closed-ended questions are questions that expect a short and simple answer. Open-ended questions are questions that give the interviewee more freedom to explain something and create a dialog.

An interview can be structured, semi-structured or unstructured. A structured interview means that you have a template of decided questions and that these questions are asked in the exact same order. A semi-structured interview means that you have a template of questions as a foundation of the interview. But the interview is supposed to be flexible for discussions that could occur. An unstructured interview means that you have no template of questions and is rather an open discussion around specific topics.

3.2.7 Brainstorming and Brainwriting 6-3-5

The methods used to generate concept ideas were Brainstorming and Brainwriting (Wikberg Nilsson et al., 2015). Brainstorming is a method used for generating a large

amount of ideas. The purpose of the procedure is to stimulate the creative potential of the participants by listening to each other's ideas. Therefore it is important to abide by the rules of the method in order for all participants to feel confident in creating wild and crazy ideas.

The rules of brainstorming is the following:

1. Don't criticize yours or other ideas. Do not consider the usability or possibility of realization of the ideas. Save the evaluation of the ideas for when the session is finished.
2. Aim for wild and crazy ideas. The crazier the ideas are, the better. You should feel confident to explore every kind of idea.
3. Combine and enhance the ideas. Search for combinations, improvements and changes in the ideas. This is not meant for criticizing, but to further develop all the ideas generated.
4. Aim for quantity over quality. Having more ideas is beneficial, the chances of creating great ideas is higher when you have a large amount to choose from.

Brainwriting 6-3-5, or just Brainwriting, is an alternative method of brainstorming, where each participant writes ideas under a certain amount of time (Wikberg Nilsson et al., 2015). After the set time has expired, every participant sends their paper to their neighbor for them to further develop the idea. The purpose of this method is that every participant participates for every idea, hence no idea is specific to one singular individual. The rules of Brainwriting are the same as those of Brainstorming.

3.3 Software

A wide variety of tools have been used to develop this concept. All the tools are digital softwares for filmmaking and animation, which has been explored in the process of this project.

3.3.1 Photoshop (Actions)

Adobe created Photoshop, an image-editing program that is used in the fields of graphic design, photography, and digital art (Adobe, n.d.b). Photoshop actions are a collection of scripted instructions that may be applied to one or more photos, enabling rapid batch editing. Photoshop actions can streamline the editing process by automating time-consuming processes like color correction, image scaling, and filter addition. Photoshop is a popular tool for designers and photographers trying to improve their workflow since users can build and share Photoshop actions.

3.3.2 Unreal Engine 5

Epic Games Unreal Engine 5 is a game engine for building immersive and high-quality video games, simulations, and virtual worlds (Epic Games, n.d.). Developers

may build intricate and realistic landscapes because of the engine's extensive feature set, which includes excellent rendering capabilities, physics modeling and networking capabilities. New features in Unreal Engine 5 include Lumen, which offers global illumination in real-time, and Nanite, which enables the rendering of billions of polygons in real-time. Unreal Engine 5 is one of the most versatile and cutting-edge game engines currently available to developers because of these capabilities.

3.3.3 Blender

Blender is a free and open-source 3D creation software that allows users to create a variety of 3D content, including animations and 3D models etc (Blender Foundation, n.d.). Blender provides a comprehensive set of tools and features that enable artists and designers to bring their ideas to life in a 3D space. With its user-friendly interface and powerful capabilities, Blender has become a popular choice for professionals and hobbyists alike in the fields of film, game development, architecture, and product design.

3.3.4 After Effects

Adobe created After Effects, a potent motion graphics and visual effects program (Adobe, n.d.a). It is employed in the production of animations, the compositing of video, and the addition of special effects. Users can easily choose and isolate foreground elements from a video clip with the Roto Brush tool in After Effects, making it simpler to add effects. By tracking items within a video clip, the Tracker function enables users to create features that move together with the tracked object. With the Find Edges effect, you may more easily add effects or make masks around objects in videos by highlighting their edges.

3.3.5 Premiere Pro

Premiere Pro is a video editing program made by Adobe (Adobe, n.d.c). It offers a variety of capabilities, such as tools for editing video and audio, color grading, and special effects. Additionally, Premiere Pro has strong organizational features that help editors manage big projects, like the ability to build sequences and use markers. Users of Premiere Pro may establish fluid workflows between various phases of the post-production process because of its interface with other Adobe Creative Cloud applications like After Effects.

3.3.6 Figma

User interfaces, wireframes, and interactive prototypes are all created using the design and prototyping tool Figma (Figma, n.d.). Figma, which was created in 2016, has become well-known for its collaborative features, which lets several designers collaborate on the same project in real-time while exchanging comments and suggestions. Figma is a well-liked solution for remote teams because of its cloud-based platform, which allows designers to access their drawings from any device.

4

Process

In this chapter the different phases that the project consists of are described. Figure 4.1 describes a simplified view of the project's workflow in a flowchart.

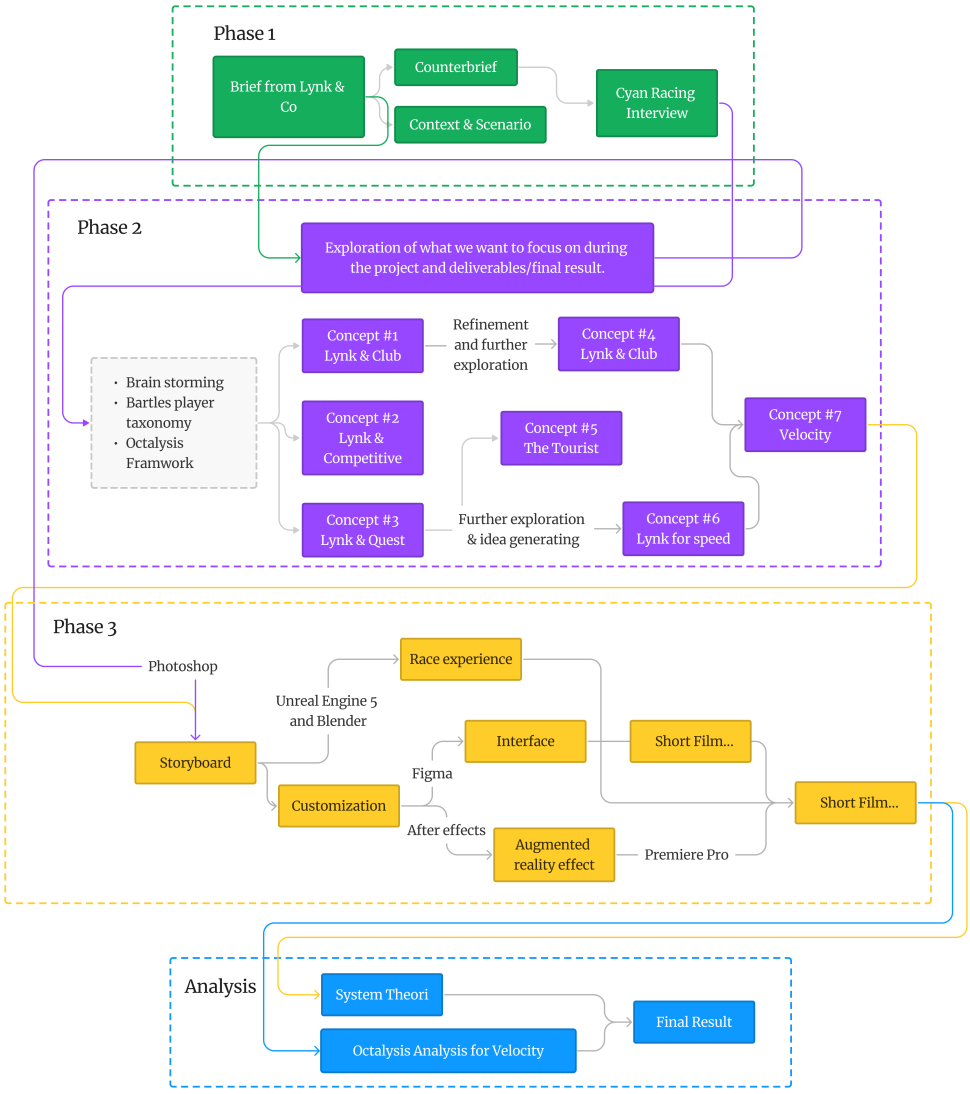

Figure 4.1: Simplified view of the project's workflow.

4.1 Phase 1 - Defining the problem

At the beginning, the purpose of the project was not clearly defined, which made it difficult to start working towards a solution. After the first brief with the client Lynk & Co the scope of the project became clearer. From here, it was the project had to be narrowed down, in order to find an area to develop a solution for. This led to the main objective of the first phase: defining the purpose of the project and what problems needed to be solved in order to fulfill this.

During the first meeting with Lynk & Co, they gave a brief where they explained what their ideas for the project was. Their brief contained a short story of a man who sat at home racing in his own racing simulator while wearing a VR-headset. He then gets a message that he won some free laps at a real race track and that he should bring his simulator steering wheel to the track. When he gets to the track he plugs his steering wheel into a car that is waiting for him. He then races around the track and the car uses AR technology to alter the experience by for example adding dinosaurs that chase the racers around (see Appendix A).

From here, the most important aspects in the brief were extracted. This was done by creating new scenarios and stories where these aspects were included to try and explain them by putting them in contexts. In these scenarios The *Lynk & Club* and *Lynk & Quest* concepts were described. The *Lynk & Club* concept was based around improving the already existing Lynk & Co clubs and turning them into racing locations where drivers can meet and race in racing simulators. *Lynk & quest* was based on AR implementation in the windows of your car that transformed the city around you. It was like a game in which you were given quests that you had to drive around the city to complete. These different concepts were developed with Bartle's player types in mind where The *Lynk & Club* focus more on the socializer and *Lynk & Quest* on the explorer.

4.1.1 Interview with Cyan Racing

In order to understand what is important in a racing experience a semi-structured interview was held with one of the drivers at Cyan Racing (see Appendix C). This was held at the headquarters of Cyan Racing in Gothenburg. During this meeting a tour was received of their facilities. This gave insight of the most important factors of a racing experience when creating a simulated version. When sitting in one of the cars, the interviewed driver could explain the importance of all the different instruments on the dashboard.

Discussions around the advantages of simulators that he uses to practice for races were also held, since the driver had wide knowledge in both. He also explained the differences between simulators and real racing and what is necessary to implement in a simulator to make it more realistic.

4.2 Phase 2 - Creating concepts

Phase 2 consisted of creating concepts from the scenarios and briefs that were introduced in Phase 1. A big part of the work in this phase was to decide what were the most important aspects that needed to be in the final concept for it to achieve the desired experience. To create these concepts methods such as brainstorming and brainwriting were used. To enhance the quality of these creative session Bartel's player types of gamification was implemented. One brainstorming and brainwriting session was performed for each of the player types. From these sessions 3 concepts were created. *Lynk & Quest* was created with regards to the Explorer, *Lynk & Club* to the Socializer and *Lynk & Competitive* to the Killer. Since appealing features to the Achiever could be implemented in the concepts above there was no need for a specific concept for the Achiever player type.

Moving forward with these concepts *Lynk & Quest* transformed into two new concepts, *The Tourist* and *Lynk 4 Speed*. *Lynk & Quest* was too broad and therefore to make it more tangible it was divided into two concepts. In contrast to *The tourist*, *Lynk 4 Speed* was more of a game and aimed toward a specific kind of users whilst *The Tourist* being more accessible.

At this point *Lynk & Competitive* was eliminated. This was due to that *Lynk & Competitive* lacked design challenges and did not fulfill the early set goals for the project. Further, the solutions already existed to some extent and it would be difficult to create a broad and interesting project towards this concept. The last of the early concepts, *Lynk & Club*, remained unchanged at this point.

Going forward, *The Tourist* was eliminated and *Lynk 4 Speed* was merged with *Lynk & Club* which resulted in the final concept *Velocity*. *The Tourist* was eliminated for several reasons; it was not related to racing, it was not as interesting as the other concepts and solutions like this already existed. *Lynk 4 Speed* and *Lynk & Club* were merged because their main ideas had a lot of potential, did not exclude each other and created a better concept together than individually.

The final concept *Velocity* was then analyzed with the Octalysis framework to validate if the concept achieved all the set goals.

4.3 Phase 3 - Development

The next phase was to further develop the concept and figure out what to design. During this phase the final deliverables for the project was also decided. A short film was determined to be the best way to explain and showcase the result. To create the story for the film storyboarding was done where what was important to feature in the film and how it should be visualized was decided. The main focus points for the film is to show how the AR works and how it is used and how the racing-mode works.

The result of phase 2 acted as the foundation for *Velocity*. This concept worked as the direction for the development of the project. *Velocity* is a concept that fuses real cars and racing simulators, where the drivers will park and race virtually in their Lynk car.

4.3.1 Storyboard

In order to create an understandable and cohesive story that communicates the project's main ideas and focus storyboarding was used (see Appendices D and E). This method was implemented to build up the story around the final concept, *Velocity*. The storyboard was split into five different chapters that all represented different parts of the concept. By doing this it was easier to extract and apply specific design challenges to each part.

The storyboard conveyed the key elements of the concept, it concise of the racing experience, the Lynk & Co Club, the customization aspects, the community aspects and the AR applications. In order to make it more understandable a color theme was applied where IRL aspects were in black and white and objects in AR were in color. This was in order to communicate a clearer vision for the viewers. The storyboard was also used to create a plan for filming the short film. It created a clear template of what shots that were needed and how and what workflow suited each shot best. The storyboard was created using Photoshop Actions, which are a collection of scripted instructions that can be applied to one or more photos, allowing for rapid batch editing. Additionally, a picture library from Lynk and Co and Cyan Racing was used to supplement the visuals in the storyboard.

The storyboard was further divided into five main parts according to Freytag's pyramid, which is a classic model for dramatic structure in storytelling. By using Freytag's pyramid as a framework for the storyboard, the team was able to structure the story in a way that captivated the viewers and made them emotionally invested in the project's key ideas and focus. The storyboard provided a visual representation of the project's narrative, making it easier for the team to understand and communicate the story to supervisors.

4.3.2 Exploration of Unreal Engine

The end result of this bachelor thesis will be presented as a short movie (see Appendix B). As this concept consists of many virtual aspects from the AR cars displayed on windshields to a racing experience inside of a car, some kind of 3D program needed to be used. After inspiration from the first meeting with Lynk & CO where a movie of their new concept car where shown, Unreal Engine (further written as UE) was chosen as the software. Since the team had zero experience in working in UE the software had to be learned and explored before knowing what would be possible to create.

The work started with using Youtube tutorials to learn the basics of UE. After the storyboarding where scenes were planned, focus was put on learning two areas: cars with realistic physics and city environments. These two areas were considered critical to be able to create the scenes planned.

For the cars, free 3D models of Lynk & Co cars were used. These were setup in Blender and imported into UE. The cars were made drivable with real-life physics added to create as realistic shots as possible.

For the environments, free 3D models of cities were imported into UE. These models were used to build city environments consisting of buildings, sidewalks, trees and more. This to create environments where the racing experience will take place. Further, skies and lights were added to light the scenes created.

These two were later merged. The realistic car was put driving in the created environments. Using cameras in UE the cars could be tracked driving in the cities. Different angles and tracking of the cars were used to create cinematic shots to capture the virtual part of the racing experience.

4.3.3 Blender

To be able to create a realistic car in UE, Blender was used. This is another 3D software, where the 3D models of the cars were prepared to be able to be imported to UE. 3D models of the Lynk & Co models were imported into blender. To create a suitable model that could be imported into Unreal Engine 5, modifications of the model had to be done. The wheels of the car had to be set in a particular way in order to create realistic animations. The different materials slots of the car models also had to be edited in order to apply desired materials in an aesthetically pleasing manner.

4.3.4 Filming

As this concept consists of many parts merging the real world with the virtual, footage from the real world is essential. The real footage helps to ground the virtual elements of customization playing a racing game inside of a real car. To actually see

how this could work in a video, instead of it just being described in text can create a far more immersive and exciting experience. Additionally, it can illustrate how the products works in a productive way. Since this concept is of the future, real-life footage can help to realize it in the present.

For the filming, places were scouted all over Gothenburg. Lynk & CO Club was utilized to make a good connection to Lynks already existing store. Since the Club is part of the *Velocity* concept, it works as a great starting point for the movie and a good connection to the real world.

4.3.5 After Effects

To merge the above mentioned methods After Effects were used. This software is used to cut the real footage and the 3D animations into an exciting short film. Furthermore, different effects were explored to create visualizations of the AR customization of cars, AR cars presented on the windscreens and video effects to explain how *Velocity* works. The different types of footage could also be merged, to create an experience mixing the reality with the virtual world. Sound design was also used to enhance the racing experience and create excitement and tension in the short film.

5
Result

This chapter describes the result of the project, from the beginning to the end result.

5.1 Understanding the project

The objective and future challenges were presented through a back brief (see Appendix F), that was created based on the presentation of the initial brief. This brief included future challenges that needed to be explored, target audience and design considerations. The back brief also contained the key requirements of the concept which were:

- Fusion of virtual and real-world racing
- Alternative form of ownership, allowing users to feel connected to the Lynk & Co racing community
- Inclusivity for all fans of the racing community

To give an initial idea how these key requirements could be satisfied, a scenario was created (see Appendix G). This scenario was similar to the one presented by Lynk & Co, but with some modifications. The scenario tells a story about a character called Neo that discovers that he and his friends can drive real cars at a Lynk & Co race track. This aspect of the scenario explains the goal to create an experience that relates to reality and real racing. In addition to this, Neo can customize a virtual version of the car that he eventually will drive at the track, thus creating an alternative ownership and implementing virtual elements to the experience. By racing together with his friends, the challenge of creating a community was presented. The scenario also describes the race track, where the environment is altered through augmented reality, thus representing the requirement of a fusion between reality and virtual elements.

5.2 Important factors for a racing experience

To further understand what is important in a motor racing experience, an interview was held with a professional driver of Cyan Racing (see Appendix C). The following information is a summary of the interview.

5.2.1 The importance of control and data

During the interview, discussions around the interior of the car were held. When questioned about the difference between an ordinary car and a race car interior wise, the driver showed us the interior of his personal racing car. As seen in figure 5.1 and 5.2, the interior of a racing car is more unadorned than an ordinary car. The instruments of the racing car show information regarding the velocity, RPM of the engine and in which gear the car is in. In figure 5.1 there are small led diodes that represent which gear the car is in. The driver explained that this instrument is of great importance in order to have full visual clarity when controlling his vehicle. He states that when racing at high speeds full control of the car is necessary in order to enhance his performance on the track. To further provide the driver with full control of the vehicle the steering wheel is optimized with gear shifting pedals and other controls. The steering wheel is also personalized for the driver to accommodate to the needs for each individual driver.

The driver is also provided with statistics of each lap of a racetrack through a display, as seen in figure 5.2. This instrument is important when practicing for a race. To look back at your performance during a lap and receive potential improvements for specific turns and other parts of the racing track. The driver states that as a professional race car driver you always need to improve your driving in order to compete.

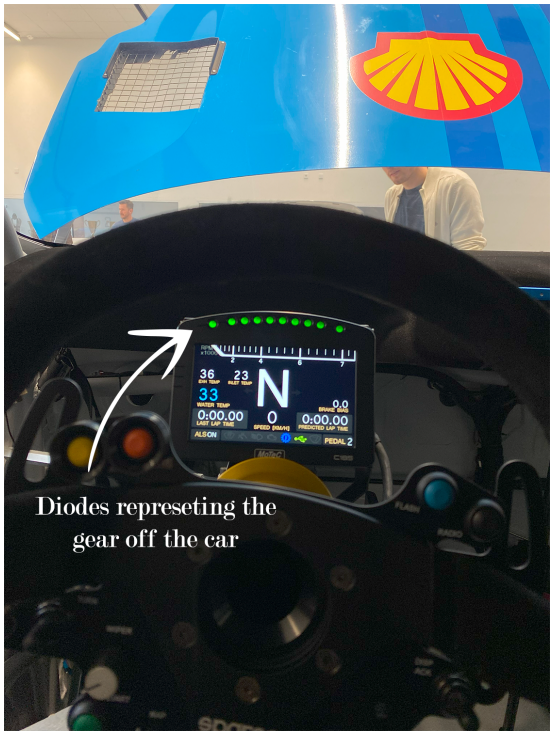

Figure 5.1: Diodes representing gears

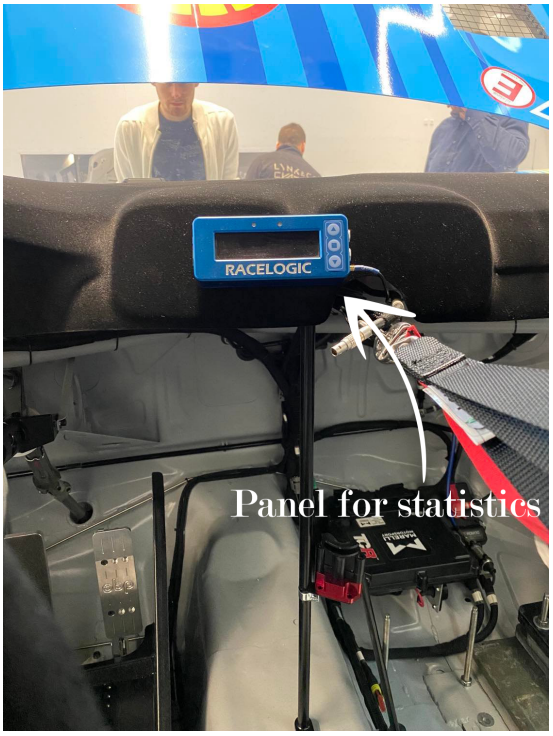

Figure 5.2: Panel for statistics

5.2.2 Racing simulators and the bridge to real racing

When asked about his experience using simulators the driver explains that he often uses simulators when preparing for a race abroad. This is to try out the race track virtually before getting to practice the track in real life. He also said that virtual competitions have been getting more popular since the Covid-19 pandemic. Professional racers have in the absence of real life events competed against each other on computer setups online, similar to other computer game competitions.

When asked about the advantages and potential of virtual racing being a complement to real life racing, the driver states that he feels like they are two different genres. He explains that he feels like the bridge between the two ways of racing are missing, and that they are very different from each other. He sees the potential of virtual racing being a good introduction to the sport for new fans.

5.2.3 The importance and implementation of haptics

When further discussing simulators compared to real life racing, the topic of haptics was brought up. When there is no possibility of including physical movement in the simulator, the driver explained that sound is the most important haptic to include. As an example he mentioned using a more simple simulator where there was no movement included. When driving in the simulator he could understand the state of the car because of the sound design. For instance, in a turn of the racing track, the driver said that he could hear the wheels locking and could then act accordingly to keep himself on the track.

5.3 Created concepts

During the concept creation phase multiple concepts were created which were very different in both how the experience would look and where it would take place.

5.3.1 Lynk & Quest

Lynk & Quest was a concept for a driving experience where AR technology transforms the world around the car. *Lynk & Quest* is an adventure game that is played inside of a car. The concept presents players with a story-driven experience set in a virtual city, where they must complete various missions to save the city from danger. To provide a more exciting experience AR technology is utilized to transform the world around the car. Players can interact with each other and complete missions which encourages teamwork and collaboration. Social interaction will also take place in friendly competitions through time trials and online races. The concept is meant to appeal to all the Bartle's player types. *Lynk & Quest* would later be split into two separate concepts, *The Tourist* and *Lynk 4 speed*.

5.3.2 Lynk & Club

Lynk & Club was a concept where the experience begins at home. It was a new way to introduce ownership, where you were able to own a digital version of a Lynk car. The car was supposed to be customizable through an app or a website. These customizations would be available in an open sourced library where you and other users could create custom mods and looks.

The racing experience and events are bookable through the same service. If you own a physical or digital Lynk Car, a membership is received. Members are granted perks, discounts and physical members car keys.

To bring a digital car to *Lynk & Club*, one brings a member's key. The key acts as a drive that contains a digital car. To be able to see the car, the key will be connected to an AR racing helmet that is received at the Club.

The racing experience takes place in a "racing room" that contains physical racing setups. Everything that the driver can interact with is physical, steering wheel, chair, pedals, driving stick and more. Everything else in the experience is in an augmented reality. This is in order to display personalized cars as well as freedom in choice of racing tracks. When the AR helmet is worn the track, the personalized interior and the exterior appear. The experience will be enhanced by real life driving haptics, racing sounds and different scents, like the smell of burned rubber or gasoline.

Lynk & Club is more than just the racing simulator. Events are hosted at the Club where new Lynk cars will be displayed. These cars can be tested in the simulators. Virtual racing leagues will be held with several divisions where you can compete.

5.3.3 Lynk & Competitive

Lynk & Competitive was a concept that mainly took place on Lynk & Co's racetracks in China. This concept had a lot of focus on the competitive part of racing and customization. Instead of being a revolutionizing experience this was more about amplifying the already existing aspects of racing and making it more exciting. Apart from *Lynk & Club* the customizations were not only made in AR but the possibility to create your own interior design through 3D printing and open-source was available as well.

5.3.4 The Tourist

As mentioned earlier, the concept *Lynk & Quest* was split into two separate concepts. One of these was *The Tourist*. This concept provides a sightseeing themed GPS system through the utilization of AR technology. When driving a Lynk & Co car, the driver gets directions through the windshield to navigate through the city in an efficient way. Additionally the system provides the driver with information regarding the places that the driver passes. An example could be history about the Eiffel tower when driving through Paris. With the AR technology, the windshields could show how the Eiffel tower looked like in the year it was built.

5.3.5 Lynk 4 Speed

Lynk 4 Speed is the other concept that originated from *Lynk & Quest*. *Lynk 4 Speed* creates a new unique way of racing virtually, by locating the virtual races to real locations. In order to start a virtual race, you have to drive your car in real life to a designated location and from there start the race. This means that the Lynk & Co car has an integrated gaming system inside of the car. Even though you start the races at a real life location, the virtual race will be driven with the real car standing still, ensuring a safer way of racing the streets of your city. When entering the racing mode, the windshields of the car turn into monitors, displaying the gameplay similar to other racing simulators.

Lynk 4 Speed provides the user with a new way of ownership, with the possibility of owning a digital version of a Lynk & Co car which you can modify. Giving the user the possibility to personalize their vehicle with less material usage. These modifications will be displayed in the virtual environment of the concept, but also through AR technology in the windshields when driving through the city in real life.

5.4 Velocity - The final concept

From the concepts *Lynk 4 Speed* and *Lynk & Club* a new concept was created. The main influence comes from *Lynk 4 Speed*, where the new concept, called *Velocity*, is based on the same experience but with a few additions and changes. The theme of *Lynk 4 Speed* was the possibility of exploring cities and competing in safe and legal street races. The idea of the concept was approved by the client. But in order to comply better with their brand the theme of street races had to be changed. In *Velocity*, the virtual races still take place in cities. But the virtual tracks are modeled to be structured city circuits. This will create a more inviting experience for all users and also keep the concept from being portrayed as an underground racing experience. From *Lynk & Club*, the idea of a gathering place for the community was brought into *Velocity*. Having the already existing clubs act as a starting ground for the experience will create an opportunity for people to meet other drivers while also providing the possibility of renting equipment for the experience.

Velocity is a racing simulator built into Lynk & Co cars which allows the drivers to participate in virtual races. The two visible hardware differences between a *Velocity* car and a normal car is the race-mode switch located near the gear stick on the center console, and the windows, which in *Velocity* cars are transparent screens. *Velocity* will be available as an option when ordering a new Lynk & Co car. *Velocity* cars can also be leased or rented through Lynk & Co's subscription based ownership model. Making it easier to try out for a shorter period of time if the user isn't sure *Velocity* is for them.

All racing with *Velocity* is done in parked cars that are standing still. *Velocity* races are driven in a virtual racing environment. When the car is parked the driver can enter the virtual race environment by activating the race-mode. This is done by

hitting the race-mode switch located on the center console near the gear stick. This switch activates the *Velocity* software which turns on all the screens in the car.

Races in *Velocity* are however based on real life locations and every race has a starting location located somewhere in the world. The races are virtual versions of real streets that have been created and added into a race database. Races are either created by Lynk & Co or by other users who add their tracks to the database. The technology with which new race tracks can be created is open source based which allows users to create their own tracks, bringing a sense of community to the concept by allowing the users to contribute to the experience. Official race tracks added by Lynk & Co have been altered by adding race track elements like racing curbs and roadblocks that line the track to make it feel more like a structured race instead of a street race. Races can vary in size from small gatherings with friends to large competitions with lots of drivers. This makes it possible to hold championships in *Velocity* racing where all the best racers get together. For example, ten Lynk & Co cars could be parked at Times square with all of the best *Velocity* racers in the world behind the wheels. The big audience is cheering, watching the drivers' points of view on the big screens while they brawl through the virtual streets of Manhattan.

There are two ways to start a race with *Velocity*. The first option is that a driver can start a race by driving up to the real life start location of that race and hit the race-mode switch. By positioning races to real life locations, *Velocity* provides a connection to reality. Giving users the possibility to experience a part of a professional race driver's life in the sense of traveling to different places to compete against other drivers. When the race-mode switch is pressed at a real life race location, that specific race will be initiated and any nearby *Velocity* racers will be able to join the race. This creates a way to meet up with fellow competitors before a race and increase the immersion in the way of creating a community around the experience.

The second option a user can start a race is by hitting the race-mode switch outside of a race start location. When the race-mode switch is activated outside of a race start location the driver will be shown a menu where they will be able to choose a race located anywhere in the world from a race database.

When driving the virtual car in a race, the driver controls the car using the steering wheel, gas pedal and gear stick like normal. Only allowing racing in still cars will both increase safety by eliminating the risk of crashing and will reduce the environmental impact by decreasing emissions and energy used by the car.

Velocity was presented to Lynk & Co and the concept received positive feedback. Thus it was chosen as the final concept to be further developed. In order to validate the concept, an analysis was executed through the use of the Octalysis framework (see Chapter 6). This confirmed that the concept achieved all set goals. Further, a system description was created to understand how all elements of the concept interacted with each other to create the experience.

5.4.1 System Boundaries

In order to enhance the experience, it is important to understand how the different products, i.e. the sub systems, interact when creating the experience. To further analyze this, a system description was made to gain insight for further design development. For the subsystems themselves but also the interaction between them in the whole system.

Sub Systems	Description	User Interaction
VR Simulator Software	The software that enables the virtual racing environment and controls the car's screens and hardware.	Activated by the racing-mode switch located on the center console near the gear stick. Turns on all the screens in the car and allows the driver to enter the virtual racing environment.
Lynk Co Car Hardware	The hardware in the car allows for the racing-mode switch and transparent screens, as well as the hardware that the driver interacts with while driving in the simulator.	The race-mode switch is located near the gear stick on the center console and the transparent screens allow for the virtual racing environment to be displayed to the driver. The steering wheel, pedals, and dashboards are used for interactions in *Velocity*.
Velocity Racing Database	The database of virtual race tracks that can be accessed by the driver.	Accessed through the racing-mode switch located on the center console near the gear stick. When pressed outside of a race start location, the driver is shown a menu where they can choose a race located anywhere in the world from the race database.
AR Software	The AR software allows for showcasing virtual customizations.	Users can see their own and others' customized cars through the Customization Software on a phone or tablet, as well as through the windshield of Lynk Co Cars.
Lynk Co Digital Car Customization Software	The software that allows for the customization of digital Lynk cars.	Can be customized either on a phone/tablet or on a screen in the car. Changes to the car's color, rims, spoilers, and body can be made. Customized cars will be visible in the race-mode and in real life through the AR software.
Lynk Co Club	The physical meeting place for Lynk Co customers to experience the *Velocity* racing experience and meet other racing enthusiasts.	Potential customers can experience the *Velocity* racing experience and get a feel for the driving experience before taking the car out for a ride. During the day it is a co-working space and a café and in the evenings it turns into a place to hang out where people in the racing community can meet like-minded new friends, enjoy workshops, or just enjoy a drink.

5.4.2 System Interactions

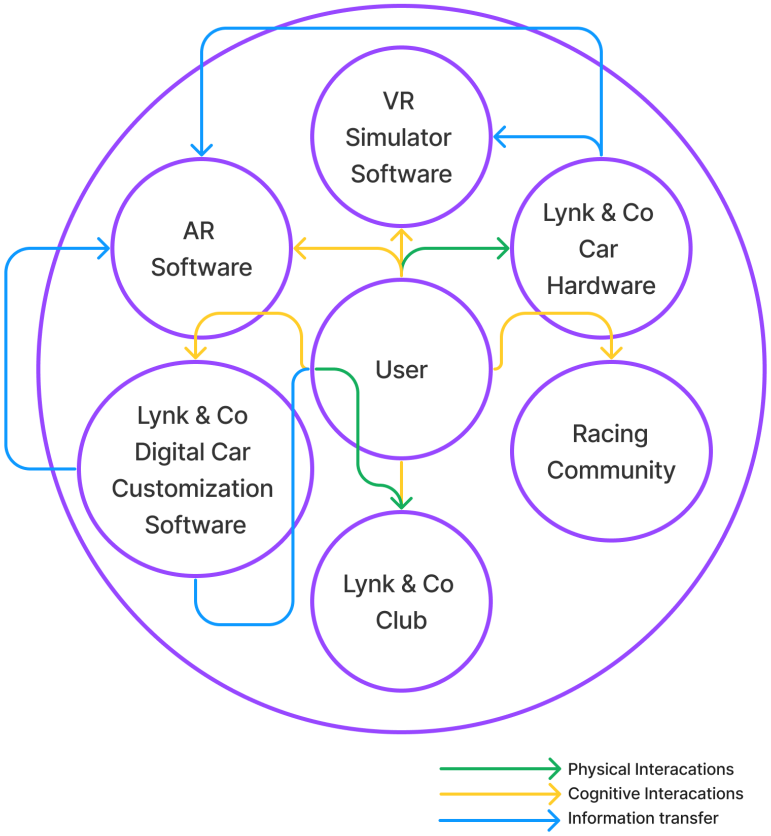

Figure 5.3: Visualization of System.

The user-centric system model was created to provide a clear and comprehensive view of *Velocity* that integrates VR and AR technology, car hardware, a racing community, Lynk & Co Club and customisation software (see Figure 5.3). This system model's six main components are as follows:

1. Virtual Reality (VR) Simulator Software: A realistic racing experience is simulated by the VR simulator program. Users have cognitive interactions and can race cars in a simulated environment created by the software. Users obtain real-time data on the performance of the car and modify their driving as necessary thanks to the car hardware's information transfer capabilities with VR software.
2. Augmented Reality (AR) Software: The AR software provides users with an interactive experience by overlaying digital information onto the real world.

This technology enhances the user's experience by providing information about their surroundings and custom modifications to other Lynk & Co cars. The car hardware also has information transfer with the AR software by showcasing the customization of other cars through the windshield.

3. Car Hardware: The car hardware includes the actual car that the user will be racing. The hardware also consists of a number of sensors and pieces of gear that collect information on the surrounding environment in order for the AR software to work. In order to give the user real-time data, the automobile hardware has information transfer capabilities with VR and AR software.
4. Racing Community: The racing community is a group of people who share a passion for racing. This community can be online or in-person and provides users with the opportunity to connect with other racers, share tips and advice, and participate in organized events. The user has cognitive interactions with the racing community by participating in online forums or attending in-person events.
5. Lynk & Co Club: The Club is a physical space where users can meet to interact with other racers. Through information access, conversation participation, and event attendance, the user engages in cognitive and physical interactions with the Club.
6. Customization Software: Users can personalize their cars using the customisation software. This alters the vehicle's exterior, adding new virtual components, and improving its looks. By using this software, users can construct a special automobile that embodies their sense of style and tailor their racing experience. Users can view their personalized car in the actual world thanks to information exchanges between the customization and augmented reality software.

5.5 Storyboard for chosen concept *Velocity*

As a result of the research conducted in this thesis, a storyboard was created for the chosen concept *Velocity*. The purpose of the storyboard was to provide a clear and comprehensive visual representation of the concept in its early stages, which was used as a template for the "short film" presented in Chapter 5.9 (for full Storyboard see Appendices D & E). The storyboard played a crucial role in structuring the plan for the filmmaking process, and was integral in ensuring that the final product effectively communicated the intended message. In Chapter 5.6, parts of the storyboard will be presented to illustrate the developed concept with explanations on the key points of each scene.

Additionally, the storyboard created for the *Velocity* concept aims to showcase the various components and features of this new racing experience. It starts by introducing the Lynk & Co clubs, which serve as the hub for the *Velocity* racing experience. This provides a showroom for Lynk & Co cars and a meeting place for the racing community. The storyboard then illustrates how *Velocity* works, starting from the real-life location. Here all race participants meet up, activating race-mode in the Lynk & Co car which turns the windows into monitors and launches the virtual race world. The virtual car is controlled using all the instruments in the real car and races can range from smaller local events to larger world events with big audiences. The storyboard also highlights the importance of customization and personalization, which is an integral part of the *Velocity* experience. With AR technology, the customized cars are visible both in the virtual race world and in real life, allowing drivers to express their personality and increase their sense of ownership towards their cars and the Lynk & Co brand. Overall, the *Velocity* storyboard aims to communicate the innovative and engaging aspects of this new racing experience, which provides a safer and more sustainable alternative to traditional racing.

5.6 Short film for chosen concept *Velocity*

The film's main objective in the thesis was to clearly present the concept. As *Velocity* is a broad concept containing many parts of a racing experience, a short film was chosen as the medium to best present this (see Appendix B). To present the whole experience starting at the Lynk & Co Club, car customization and the racing game inside of a car the short film was chosen. 3 focus areas were chosen to present here, while the storyboard was developed around these main areas of the concept. The main areas of the concept where:

- Lynk & Co Club
- Customization
- Racing game inside of car

As presented, *Velocity* consists of many different parts which together form this concept. As it is a concept for the future, it can be hard to describe different

parts of the concept since many technical aspects are not specified or chosen. But the concept still has to be described. This can be done in an efficient way with a movie. Movies and animations have the ability to express a feeling that text or still renderings can miss out on. This is exactly what the team wanted to present, a racing experience that catches your interest and excites you.

Creating feeling and excitement is important as mentioned. As it essentially is a commercial movie, creating feelings is important for creating interest in the product (Grand Canyon University [GCU], 2020). These sensations can encourage people in the decision of buying a product.

5.7 Presentation of Storyboard and Short film

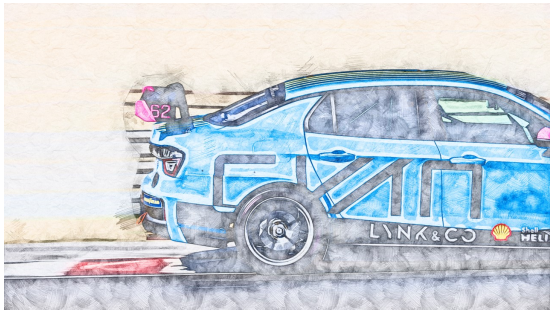

Figure 5.4: Scene Description
Showcasing this scene through fast paced and somewhat ambiguous racing scenes. Short sequences with no deeper context shown. The goal is to make the viewer curious and want to see more.

Figure 5.5: What is emphasized?
Excitement and a sense of fast paced racing.

Figure 5.6: Scene Description
The shot shows the Club from the outside. The shot starts with a close zoom on the Lynk sign and zooms out to show the whole exterior and two cars that are parked outside on the street. The main character is seen sitting at the bar inside the club.

Figure 5.7: What is emphasized?
An establishing shot to show that we start at the Lynk & Co club to give context to the viewer. It gives the user context and makes it easier to understand where we are.

Figure 5.8: Scene Description
Person customizing their Lynk & Co 01 virtually with an iPad, through the Lynk & Co app. Changing color. The camera perspective is standing behind a person, view on both iPad and car.

Figure 5.9: What is emphasized?
That you can virtually customize your car. Emotional attachment to a car Prolongs the life span of the car for the user.

Figure 5.10: Scene Description
Person two exits the club and gets in his car. While entering his car he nods to Person person one, nods back.

Figure 5.11: What is emphasized?
Community, customized functions, fellowship and emotional attachment.

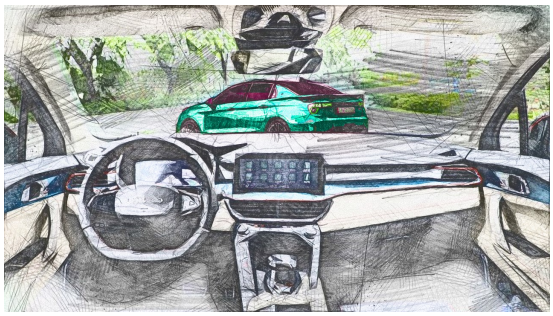

Figure 5.12: Scene Description
Person one gets in his car and turns on the car. AR appears on the windshield and he looks impressed as he sees Person two car change color in front of him.

Figure 5.13: What is emphasized?
Connection between racers that make up the community. The scene also shows the customization aspect and how it can affect others.

Figure 5.14: Scene Description
It cuts back to the man at the bar who is still working on his computer (previously filmed from a slightly behind angle). His phone is lying screen-up beside the computer. Suddenly, the screen lights up and he receives a notification. The man picks up his phone and there is a new camera angle, zoomed in on the phone. The notification says that there will be a race at location at 7 pm.

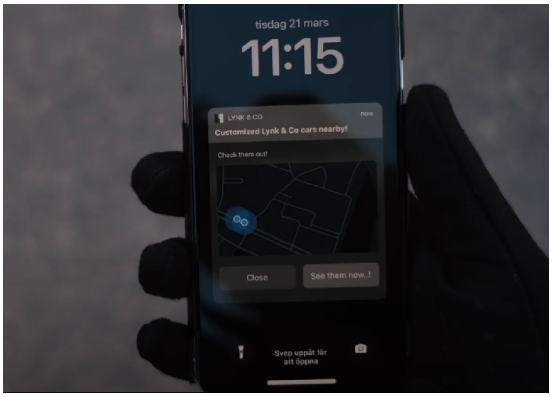

Figure 5.15: What is emphasized?
Users in *Velocity* are able to conveniently stay up-to-date about current races.

Figure 5.16: Scene Description
Two more people looking over the shoulder of the person seeing the car on the phone, trying to get a look.

Figure 5.17: What is emphasized?
That the AR customization is visible through a phone.

Figure 5.18: Scene Description
Both cars roll into a parking lot next to each other

Figure 5.19: What is emphasized?
This is is meant to show that the racing takes place in a car that is parked.

Figure 5.20: Scene Description
A wide angle shot from behind (the backseat, so that the whole interior is visible) where the racing lever button is pressed. It is located in the mid console. An animation starts on the windshield that slowly (almost growing) and in a cool way, that brings the driver into the VR racing world.

Figure 5.21: What is emphasized?
That the need of a physical button is necessary to enter racing mode, also the transition into VR racing. It's important to show the viewer how you enter the racing mode.

Figure 5.22: Scene Description
A new shot where the camera pans pretty close and follows the growing animation on the windshields. When the animation "grows together" and fills the entire windshield the shot ends. Maybe it zooms in through a "vine" either it goes to black or it goes to the next scene.

Figure 5.23: What is emphasized?
The animation. The scene's purpose is to describe the transition from real life into *Velocity*.

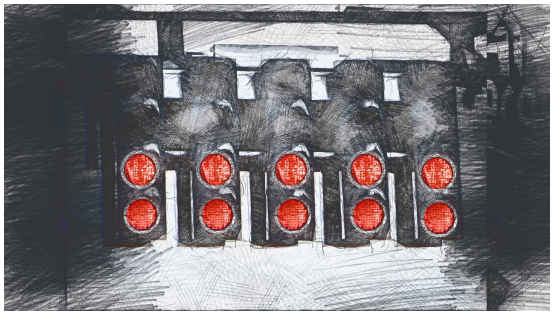

Figure 5.24: Scene Description
Start of the race, The shot consists of a close up, slight zoom, off racing start lights. The lights turn on one by one (5 in total) and then turn off. This is when the racing starts.

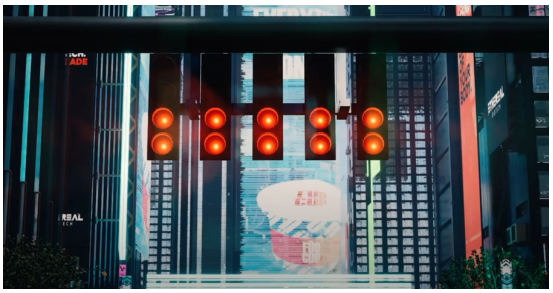

Figure 5.25: What is emphasized?
Shows that the racing starts, building suspense for the race, the calm before the storm.

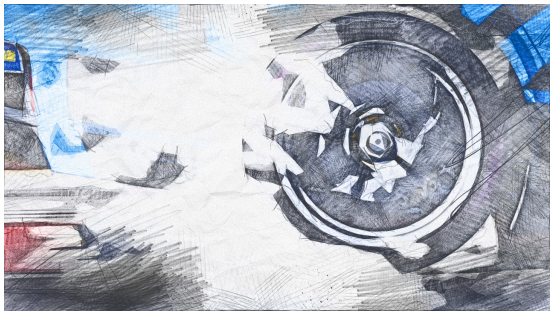

Figure 5.26: Scene Description
Wheel spins on the start grid.

Figure 5.27

Figure 5.28: Scene Description
The next couple of scenes will be similar. Racing scenes overall , close-ups, overtakes, panning shots, etc. But with the AR mod skin showing in the VR world.

Figure 5.29: What is emphasized?
These scenes' purpose is to showcase the Racing Experience, the sub-purpose is to show that the cars AR skins translate into VR.

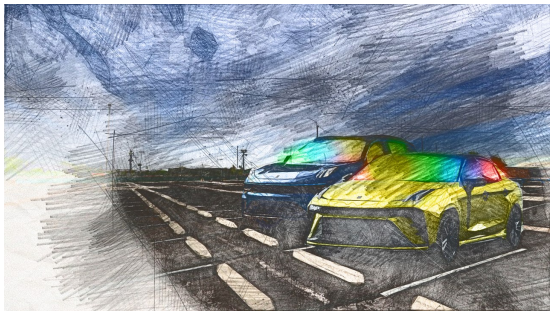

Figure 5.30: Scene Description
Back to reality. The camera jumps out from the racing and pans over the parked cars standing still in a parking lot. The cars windshields are flashing with colors, but the sound of the shot is calm because the racing sounds are "turned down/muted", but not all the way.

Figure 5.31: What is emphasized?
Bringing the viewers back to reality, showcasing that the car is actually standing still while it's racing.

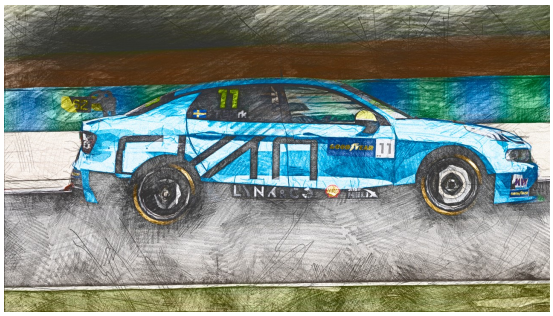

Figure 5.32: Scene Description
Camera spins to the right and the motion blur that it creates will act as a transition back to the racing scenes.

Figure 5.33: Scene Description
Camera keeps turning and catches one car (the motion blur of the environment stops when the camera catches the car that is driving) driving down the straight at the same angle but with a lot of camera shake. An overtake shown from the same side angle. Another car appears in front of the car that we followed and drives past it.

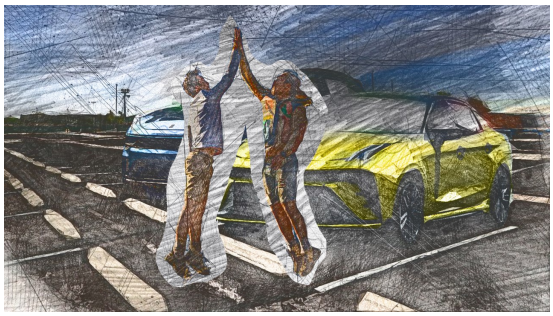

Figure 5.34: Scene Description
A high five and some laughs are caught on camera, maybe in slow motion.

Figure 5.35: What is emphasized?
This shot is important to showcase the community that *Velocity* brings after a finished race. While just a few moments ago being in a adrenaline filled race, to now being friends and having a laugh about it.

Figure 5.36: Scene Description
Camera angle switches to more of a wide angle shot of the parking lot, the two Drivers are still in view as the camera pans back up to the sky. When the camera has panned up so that the cars are still a bit visible, the sky is most of the screen. Text appears one by one "Race greener", "Race Faster", "Lynk & Co *Velocity*". The text in white in a blue sky with some clouds, "*Velocity*" is in a cool typeface.

Figure 5.37: What is emphasized?
The last scene that presents the concept and its punchlines.

6

Octalysis Analysis for *Velocity*

This chapter provides an analysis of *Velocity* utilizing the Octalysis framework. A summary of the analysis is presented in Figure 6.1. Later in the chapter, a detailed analysis of each core drive is presented.

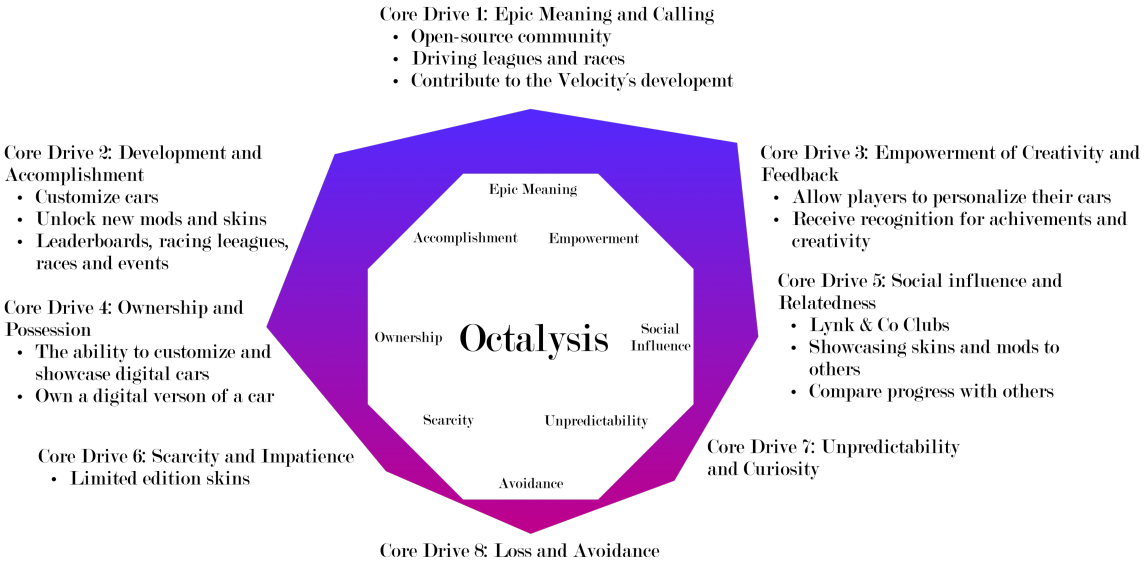

Figure 6.1: Visual guide off Octalysis Analysis.

6.1 Core Drive 1: Epic Meaning and Calling

The concept of epic meaning and calling is one of the eight core drives of human motivation in gamification theory. It refers to the human desire to be part of something bigger than themselves and to feel a sense of purpose or calling. This core drive is present in the *Velocity* racing experience, which brings together the racing community with Lynk & Co at the center.

The experience begins at the Lynk & Co Club, which serves as both a showroom for Lynk & Co's new cars and a meeting place for the racing community. The club offers a place for like-minded individuals to meet, make new friends, and enjoy workshops or drinks in a vibrant environment. By creating this community, *Velocity* aims to increase brand knowledge and encourage more people to experience *Velocity*.

Furthermore, *Velocity* is built on open-source design principles, which allows players to contribute to the game's development and personalize their customization. Players can participate in open-source workshops at the Lynk & Co Club to learn how to customize their cars. This aspect of the game allows players to express themselves in their unique way, further enhancing their sense of epic meaning and calling.

Finally, the customization aspect of the game is also a part of the epic meaning and calling core drive. Players can create their own custom skins and mods, and share them with the community. This sense of personalization and ownership contributes to the player's sense of purpose and calling within the game.

6.2 Core Drive 2: Development and Accomplishment

The development and accomplishment drive are evident in several features of *Velocity*. First, the game provides players with various challenges that they need to overcome to progress in the game. As players complete races and tournaments, they unlock new achievements, which provide a sense of accomplishment and recognition of their progress. In addition, players can customize their cars and unlock new mods, skins, and upgrades, but also serve as a tangible representation of their development and accomplishments in the game.

Another way *Velocity* contributes to the development and accomplishment drive is through its ranking system. Players are ranked based on their performance in races, tournaments, and leagues, providing a sense of competition and motivation to improve their skills and performance. The ranking system also provides players with an opportunity to compare their performance against other players and gauge their progress and development.

Velocity's open-source design principles also foster the development and accomplishment drive. The game allows players to create and share their custom skins, mods, and designs, providing a platform for creative expression and recognition. Players who contribute to the game's development and customization are rewarded with credits, recognition, and opportunities to participate in game development workshops and events. This not only fuels the player's drive for development and accomplishment but also creates a sense of community and collaboration that enhances the overall gaming experience.

6.3 Core Drive 3: Empowerment of Creativity and Feedback

Velocity not only provides an exciting virtual racing experience but also empowers players to exercise their creativity and receive feedback from the community. Core Drive 3, empowerment of creativity and feedback, is central to the game's design, as

it allows players to take ownership of their racing experience and express themselves in unique ways.

Velocity is built on open-source design principles, which means that players can contribute to the game's development and personalize their customizations. Open-source workshops are held at the Lynk & Co Club, where community members can learn to customize their cars and contribute to the game's development. This feature allows players to take ownership of the game's development and express their creativity in ways that they would not otherwise be able to.

Feedback is another critical aspect of Core Drive 3, as it allows players to receive recognition for their achievements and motivates them to continue playing the game. *Velocity* provides players with a platform to receive feedback from the community, which helps them improve their skills and performance. Players can display their achievements in their profile, serving as an indicator of their skill level to other racers.

6.4 Core Drive 4: Ownership and Possession

The fourth core drive, Ownership and Possession, is all about the desire to own and control things. In *Velocity*, players have the ability to own their digital Lynk car, customize it, and showcase it. This core drive is closely linked to the concept of scarcity; the more rare or valuable an item is, the more desirable it becomes. This is true in *Velocity* as well, where players can earn credits through winning races or progressing in the game. These credits can then be used to purchase customizations, skins, and other digital mods. The more rare or unique these items are, the more desirable they become to players.

Additionally, the ability to customize and own a digital version of a Lynk car creates a sense of pride and ownership in the brand, potentially leading to future purchases or leases of Lynk & Co cars. Another aspect of *Velocity* is that it offers players the ability to create their own custom skins and mods and share them with the community. This allows players to showcase their creativity and add value to the game for others. However, players may also feel a sense of completion or satisfaction in collecting custom skins or mods, leading to increased engagement and motivation to play.

6.5 Core Drive 5: Social influence and Relatedness

Velocity also provides a platform for social interaction and relatedness. The game's social features and community building components tap into the core human need for social connection and belongingness, making the game more engaging and satisfying.

Through *Velocity*, players can connect with other racing enthusiasts who share their passion for cars and competition. The Lynk & Co Club serves as a hub for this community, where players can meet, share their experiences, and participate in various activities and events. The club's co-working space and café during the day transform into a hangout spot in the evenings, where people can enjoy drinks, workshops, and meet like-minded individuals. The community-building component of *Velocity* creates a sense of belonging and shared identity among players, which enhances their engagement and motivation to play the game.

The game's social features, such as leaderboards, allow players to compare their progress with others and compete for recognition and status within the community. By displaying the achievements and rankings of top players. The social feedback and recognition that players receive from their peers serve as a powerful incentive for continued play and mastery of the game.

6.6 Core Drive 6: Scarcity and Impatience

Scarcity and Impatience is an important driver of human motivation that focuses on the fear of missing out or the desire for immediate gratification. This core drive can be seen in *Velocity*, particularly in the limited availability of exclusive customizations, skins that can only be purchased with credits earned through in-game achievements. The sense of urgency created by this scarcity drives players to engage with the game more frequently and for longer periods of time, in order to accumulate credits and access exclusive items. These exclusives can both be time-limited or exclusive for the winner or participants of certain races.

In *Velocity*, players have access to a variety of customizations, skins, and mods that can be purchased with credits earned through in-game achievement. However, some of the most desirable items are only available for a limited time or in limited quantities, creating a sense of scarcity and urgency among players. For example, players may only have a limited time to purchase a special edition skin or car part. Different skins and customizations can also be achieved through participating or winning different races. This will motivate the drivers to play the game since they don't want to miss out.

6.7 Core Drive 7: Unpredictability and Curiosity

Users are often driven by the desire for new and exciting experiences, which can be satisfied by incorporating elements of surprise, mystery, and intrigue into the design of a product or service. This core drive is not a big part of *Velocity*.

6.8 Core Drive 8: Loss and Avoidance

Loss and Avoidance is the motivation to avoid negative consequences and maintain one's current status quo. Users may be motivated to avoid negative consequences, such as losing a challenge or receiving a low score, by putting in more effort and time into the task.

This core drive can also be seen in the fear of missing out phenomenon, where users feel compelled to stay engaged in the experience to avoid missing out on rewards, events, or opportunities. In *Velocity*, this can be achieved through the use of limited-time offers, exclusive rewards, or special events that create a sense of urgency and motivate users to avoid missing out.

7
Discussion

The purpose of this discussion chapter is to interpret and analyze the project, evaluate the significance of the concept *Velocity*, and relate them to the broader context. This context consists of limitations and specific issues under investigation, ethical aspects and further development.

7.1 Specific issue under investigation and limitations

The idea behind *Velocity*, is highly relevant to the particular problem being examined in this thesis. The thesis examines the potential effects of augmented and virtual reality technology on racing in the future and makes recommendations for potential developments in the field. In *Velocity*, the use of these technologies is demonstrated in a way that makes racing safer and more ecologically responsible.

In addition to the above, *Velocity* makes it possible to race virtually in various locations without a physical racetrack. This idea fits with the thesis's investigation of the potential effects of augmented and virtual reality technologies on racing. The sport is given a new dimension with virtual racing, allowing for more freedom and innovation.

The *Velocity* idea also gives Lynk & Co a chance to create a racing fan community, which is another advantage. Individuals can learn about *Velocity* racing at Lynk & Co clubs, which serve as both a gathering place and a showroom for the company's latest vehicles. This feature fits with the thesis's emphasis on investigating probable future developments in the racing industry. Creating a strong racing community might promote participation and interest in the activity, which might encourage the creation of cutting-edge racing technologies.

The *Velocity* concept does have some limits, which have to be developed to apply in practice. For instance, the thesis claimed that skill shortages would exclude consideration of any software innovations necessary for the application of augmented and virtual reality technologies. In order to deploy *Velocity*, software that enables the projection of virtual and augmented reality onto the car windows would need to be created.

Furthermore, in the thesis the *Velocity* idea only considers the driver's perspective on the racing experience. The experience of the passenger is another interesting

point of view. Even though racing is a driver-focused sport, it is important to take the passengers' experience into account, especially if the concept is meant to offer a safer and more ecologically friendly racing experience. The employment of virtual and augmented reality technologies in *Velocity* could also be advantageous to the passenger, who might be able to experience a virtual racing scene.

7.2 Process

This chapter discusses the process of the project and the different phases.

7.2.1 Phase 1

Prior to further development, the strategy of defining the project's goal and identifying the important components of the client's brief offers both advantages and disadvantages.

Positively, this method enables a brief but comprehensive grasp of the project's aims and objectives. The team can concentrate on particular elements that are pertinent to the project's goal by reducing the project's scope, which can help them save time and resources. A greater comprehension of how the project will function in practice can also be achieved by developing fresh scenarios and tales that highlight its main components.

On the downside, this method may ignore crucial project components that are not immediately apparent. By narrowing its focus, the team runs the risk of missing out on chances to work on parts of the project that could be crucial to attaining its goals. The strategy may also hinder creativity because the team may become overly preoccupied with the particular scenarios and storylines that have been developed.

In general, defining the project's goal and identifying the major components of the client's brief are essential steps in creating a successful project. But, it's crucial to find a balance between limiting the project's scope and keeping an open mind to fresh concepts and growth prospects.

7.2.2 Phase 2

The project's second phase entailed developing concepts based on the situations and briefs presented in the first phase. The advantage of employing brainstorming and brainwriting sessions to develop these notions was that they made it possible to generate a wide variety of ideas, boosting the likelihood of discovering original and creative solutions. The concepts could be adjusted to particular sorts of users thanks to the usage of Bartle's player types of gamification during the brainstorming sessions, increasing the likelihood that a wider audience would find them appealing.

The decision to split *Lynk & Quest* into two distinct concepts, *The Tourist* and *Lynk 4 Speed*, was wise since it made the concepts more approachable and real. This made

it simpler to further develop each concept and allowed for a greater comprehension of each one. *Lynk & Competitive*'s elimination was likewise a good choice because it lacked design challenges and was not as intriguing as the other concepts. To assure the best potential end result, it was a good idea to concentrate on the most promising proposals.

It's possible that the variety of experiences that users could have had was constrained by leaving out *The Tourist* from the final design. Also, it's possible that some of the distinctive features of each separate concept were lost when *Lynk 4 Speed* and *Lynk & Club* were combined into the final concept, *Velocity*.

7.2.3 Phase 3

In this phase of the project, the final concept *Velocity* was developed to its final state. The beginning consisted of clearly defining how the concept works. Until this point, a clear storyline of the *Velocity* was created. Now it had to be further defined how the different parts worked. Focus was put on:

- Customization of cars
- AR windshields
- Game inside of the cars

These parts of *Velocity* were decided to be critical to have a clear description of. With these done, the video could be evolved around these. The different areas of *Velocity* had different ways of best being presented. Customization and AR windshields were decided to be shown as real footage with virtual effects on them. The gaming part of *Velocity* had better potential of being presented through 3D animations. Here the work was split up, where different parts of the team focused on one area. Later the work would be merged, to create an experience that mixes the real world with the virtual.

Since it is a wide stretching concept consisting of many parts, it was essential to focus on some main areas in this phase. However, this could lead to other parts being less focused on. An example of this is Lynk & Co Club. This part of the concept has not been thoroughly developed, since focus was put on other parts of the products. This could lead to potential of the concept being missed out on. It is the part of the concept which most effectively attracts new people to the racing world. However, the main focus of the product is on other parts, and some areas have to be less prioritized.

7.3 Velocity Concept Discussion

During the development process the ideas and inputs have come from the design team, the supervisors at Lynk & Co, the supervisor at Chalmers and the professional driver at Cyan Racing. Another interesting input would be the target audience for the product. This would have given a result that even higher validity in terms of

user experience input. Conducting further studies on the final concept could lead to knowledge that would help to develop *Velocity* further.

The technologies in the concept all exist today but in a more primitive form than the one described in the concept. To achieve the racing experience the windshield and windows of the cars in the concept have AR and VR capabilities, but how this is implemented is not yet defined. The windows in the concept are supposed to be monitors. These monitors will have to fit the criteria put on them. Transparent screens exist today in televisions and computer monitors. To be used in *Velocity* they will have to be completely transparent when driving to not be distracting and almost completely opaque when used as monitors to give as much immersion as possible. They will also have to have specific properties that regular car windows have, like the complex shape and staying in one piece when broken to not harm the passengers.

Windshields with minor AR functions is implemented amongst several car manufacturers today. These however show only smaller functions fixed on the screen. There is a way to go in this area before the entire surfaces of the windows in the car can have AR technology which also can track objects outside the car.

Another issue that will have to be considered is that because the windows are screens, when the driver moves their head the content on the screens won't follow. The AR technology will have to adjust depending on where to drivers head is located. For further development, the passengers point of view has to be taken in account as well.

A potential issue with the *Velocity* monitor windows is if they get damaged and have to be repaired. A quite common occurrence when driving is to get a stone chip on the windshield. If it is fixed early it is rather inexpensive and consists of injecting resin into the chip and then heating it up to harden it. If the chip has started to crack too much, the whole windshield has to be replaced. Fixing a stone chip on a *Velocity* windshield would probably be more difficult and is an area that has to be looked into.

7.3.1 Octalysis discussion

To leverage Core Drive 7: Unpredictability and Curiosity, *Velocity* can introduce unpredictability and novelty in various ways. For instance, it can offer new challenges or quests that are different from what users have encountered before, or it can create a sense of mystery or hidden surprises in the product. Introducing elements of randomness, such as random rewards or bonuses, can also keep users curious and engaged.

However, it is important to note that too much unpredictability can be overwhelming and frustrating for users. The right balance of predictability and unpredictability is key to keeping users curious and engaged without causing them to lose interest or feel overwhelmed. By leveraging Core Drive 7, *Velocity* can create a sense of excitement and anticipation for users, encouraging them to continue using the product or service.

At the same time, providing too much unpredictability in the way of different quests might cause the experience to resemble a video game more than a representation of a racing experience. This also connects to a previous discussion point, that the target group has not been consulted. For further development, it is of great importance to investigate what the target audience wants. Whether they require an experience that simulates real life motor racing or if they want a more creative and unexpected experience that is in the theme of motor racing.

Furthermore, Core Drive 8: Loss and Avoidance is not a big part of the *Velocity* concept. It wasn't apparent how this would be implemented in the concept without negatively affecting the other Core Drives. For example, if Core Drive 8 becomes too emphatic Core Drive 2: Development and Accomplishment suffers as a result. There needs to be a balance between all the Core Drives. To further enhance the experience and create a greater balance between the cores further analysis will be a part of the next step in realizing *Velocity*.

7.3.2 Deliverable of Result

The end result of this project is a short movie. This is not the traditional result of an industrial engineering project. These often consist of prototypes of products, physical or digital. The result of *Velocity* is not focused on presenting one specific product in detail. In this case, it is meant to describe a racing experience of the future.

Does the video describe this experience in an efficient way? It can be argued that it does. To argue for this, a comparison can be done with the traditional prototypes of a product that we are used to. The video can give an in depth look into how this racing experience is planned to look in the future. The actors can be seen interacting with an interface when customizing cars. The AR cars are seen on the windshield of the car. The real car is used for the whole experience, even in the game. This describes the different products in this experience. However, this could have been done with more traditional prototypes. The prototypes could probably have been better described and further developed by going in depth on different parts like the interface of customizing or the interface of playing the game in the car. But there is one thing these prototypes would miss out on, where the short movie of *Velocity* excels. The movie can bring feelings of excitement to the viewer. With mediums of animations, real-footage and sound design excitement for the future can be forwarded. This is exactly what the end result does. Furthermore, the result of *Velocity* can give an insight of how technology like AR windscreens in a car can look. This can be hard to describe through normal prototypes.

It has been argued that the movie can be a great medium to present an experience. However, for the sake of the products of this experience, it would have been preferable to have more developed prototypes. For example, the viewer of the movie can see an interface on a phone, where AR cars can be seen and customized. This part could have been further developed for the viewer to actually test.

7.4 Ethical aspects

It is crucial for this project to take into account societal and ethical issues, such as the effect on the environment and safety worries, especially while working in the automotive industry. Even though it's impossible to completely mitigate the environmental effects of entertainment and automotive products, it's critical to consider why these products were designed and produced in the first place given that they inevitably have a negative impact on the environment. Automotive brands may try to promote alternate racing strategies and position themselves as environmentally responsible businesses in order to address this issue. However, it's critical to avoid "green washing" and acknowledge the pollution caused by vehicles made by the automotive industry. The employment of virtual reality technology in racing raises ethical questions in addition to environmental ones. While virtual reality can provide fans with a distinctive and immersive experience, it's crucial to make sure that it is used responsibly and safely to reduce the risk of accidents or injuries. This research offers the chance to investigate how VR might be applied ethically and sustainably to improve the racing experience while simultaneously fostering safety and minimizing environmental damage.

7.4.1 Simulator sickness

One significant risk associated with the use of virtual reality (VR) and augmented reality (AR) technologies in driving is simulator sickness, also known as motion sickness. Simulator sickness can have serious consequences, both for the individual experiencing the symptoms and for other road users. For example, a driver who is experiencing nausea or dizziness due to simulator sickness may be less able to react quickly to unexpected events on the road, increasing the risk of accidents. Moreover, if a driver vomits or loses control of the vehicle due to simulator sickness, it can pose a significant danger to other road users.

To avoid the risk of simulator sickness, it is essential to use VR and AR technologies in a controlled environment, such as a racing simulator where there is no risk of collision with other vehicles or pedestrians. Therefore, it is recommended that these technologies are used more when actually playing *Velocity*, rather than when driving to races and in regular traffic. By using these technologies responsibly and in a controlled manner, it is possible to minimize the risk of simulator sickness and ensure the safety of all road users.

7.4.2 Safety

While the use of VR and AR can provide benefits for the driver there are also a few risks to be cautious of, especially if it is used while driving in traffic. One risk strongly associated with the integration of AR in cars is that it can distract the driver. Since AR is a powerful tool it can display a lot of information which for instance could be; directions, traffic updates and phone notifications which could stress or be overwhelming for the driver. This could cause the driver to lose the

attention from driving. The goal with *Velocity* needs to be the display of realistic AR cars on the windshield, to not be distracting.

Furthermore, implementing AR in the windshield could drastically impact the driver's view. The display of the AR could potentially take up a lot of the driver's field of vision which could put them in danger. For instance the information provided by the AR could block their view of animals, road signs or other obstacles on the road. Also, depending on the level of implementation of AR it could create a false sense of security. If the driver is too dependent on the technology whilst driving it could become less aware of its surroundings and endanger themselves and others.

7.4.3 Environment

The first thing that has to be said is that traditional racing contributes significantly to air pollution and environmental harm. Traditional racing generates large emissions, such as carbon dioxide, nitrogen oxides, and particulates, due to its high speeds and extensive usage of gasoline engines. This not only exacerbates climate change, but it also has a severe impact on air quality, which can be harmful to both human and animal health. Without the use of actual vehicles and engines, *Velocity*'s virtual racing experience may assist to dramatically lower these emissions.

Compared to traditional racing, this concept contributes to much less emissions during the racing. The virtual races lets the driver experience the thrill, while the car is standing still. Hence, *Velocity* allows for a greener way of racing, since no fuel is required to drive the car.

The implementation of digital ownership and customization of your digital car is beneficial in the sense that it minimizes material use for both manufacturing new cars and modifications. Instead of buying new paint jobs and rims, *Velocity* allows for digital customization which can be seen in real life. This is very beneficial in the comparison of real physical modifications. The aspect of open-source further enhances this by providing the possibility for users to develop their own modifications and sharing them with others, thus creating a large library of customizations that can satisfy a larger group of the audience.

Velocity as a physical product takes advantage of the Lynk cars as a medium. The concept is played inside of a car and takes advantage of a lot of existing parts. The parts of the car are utilized, from steering wheel to pedals and wheels. However, parts to create this experience will have to be implemented in the car. Things such as AR screens and gaming simulators are additions to the cars which will have to be integrated. These parts that not yet exist will have a negative environmental impact, which has to be minimized.

The *Velocity* product's possible effects on the environment must also be taken into account. While the emissions from traditional racing are eliminated, there may still be more driving than necessary and more carbon emissions as a result. As an illustration, people might be persuaded to travel to racing sites in order to take part in virtual races, which might raise carbon emissions. And if you compare the

experience of just playing a racing video game at home, *Velocity* will have a larger negative impact on the environment in the aspect of carbon emissions from driving cars. Additionally, the product's ability to be customized may encourage more driving as people change and flaunt their modified cars in public. When assessing the overall environmental advantages of the *Velocity* product, it is crucial to take these potential drawbacks into account.

In conclusion, by lowering the emissions linked to conventional racing, the *Velocity* product has the potential to offer considerable environmental advantages. It's crucial to take into account any potential drawbacks, such as more personalization and pointless driving, which can cancel out these advantages. The *Velocity* product's environmental impact will ultimately rely on how consumers use and accept it, thus it will be critical to continue to track and assess this impact over time.

7.4.4 Reckless driving due to racing games

Racing games, including concepts like *Velocity*, have been a subject of concern for many in terms of their potential impact on real-life driving behavior. According to Hull et. al (2012), playing racing video games and driving recklessly on public highways are related.

It's possible that games like *Velocity*, which emphasize safety and are played in a controlled atmosphere, could have a beneficial or negative effect on driving habits. *Velocity* may allow racing aficionados to satisfy their urge for speed and competition without engaging in unsafe behavior on actual roads by offering a safe and regulated setting for racing. However, according to Hull et. al (2012), playing racing video games and driving recklessly on public highways are related. Racing games, including concepts like *Velocity*, have been a subject of concern for many in terms of their potential impact on real-life driving behavior.

7.5 Further development

The concept that has been developed throughout this project is set to be available in about ten years time. This means that a lot of the technology involved in the product are such that are not available today and a lot of the detailed technical development has thus been overlooked. If the concept is to be developed into a product that can be manufactured and sold, a lot more research and development into this area has to be done.

One area that could be explored further is the implementation of AR (Augmented Reality) in the windshields. This could be achieved through either projection or screen technology. With projection technology, a device could be placed inside the car that would project images onto the windows, creating an augmented reality experience. Alternatively, screen technology could be used where the windows themselves are replaced with transparent screens that display augmented reality.

Another potential development is the tracking of cars outside to project skins. This could involve using sensors on the outside of the car to track other cars on the road, and then projecting skins onto the windows that correspond to those cars. The sensors themselves need to work together with the AR technology. This could be seen as a real world benefit, as well as providing a more immersive driving experience. VR (Virtual Reality) also needs further development in order to be implemented in the windows, allowing passengers to have a completely immersive experience while racing. This could be achieved through see-through screens that display the virtual environment.

Overall, while the concept *Velocity* has been developed, there is still a lot of work that needs to be done in order to bring this product to market. Further research and development is necessary to explore the potential of AR and VR technologies in the context of car windows, and to identify the most effective ways of implementing these technologies.

7.5.1 Additional instruments in the car

From the result of the interview with the driver at Cyan Racing, 5.2.1, it was shown that having full control and knowledge of the car when driving on the track is important for the experience. In order to shape the experience into a more authentic racing experience, it would be desirable to implement these instruments. Such as the panel with diodes representing in which gear the car is in and the panel for statistics from each lap on the track.

These implementations would also ensure that *Velocity* becomes a product that is closer to a real motor racing experience, rather than only resembling a video game.

7.5.2 Haptics for authenticity

The interview, as seen in 5.2.3, also showed that the audio design of a motor racing simulator is of great importance. Designing the audio to realistically represent the physical events of the car can enhance the experience by providing a more realistic audio. As the driver at Cyan Racing mentioned in 5.2.3, hearing the wheels locking in a turn gives input that the user can act upon in order to keep themselves on the racing track. Similar audio haptics that would be of interest to additionally implement are audio representing the wheels losing traction with the surface of the track and feedback from the engine when the car is in the wrong gear.

Even further improvements of the concept would be including physical haptics. Adding movement in the car through hydraulic systems would further provide elements regarding realism. With this implementation it would also be of interest to explore the possibilities of utilizing the already existing suspension systems in the car. Adding forces to the suspension system that corresponds to events of the virtual racing. Thus simulating movement without implementing a whole new system in the car. The first step in this direction would be to simulate physics in smaller components in the car. For instance adding resistance in the steering wheel and the pedals during the virtual racing sequence.

8

Conclusion

From the beginning of this project, the end goal has been set to develop and design a cockpit solution which can provide an immersive racing-simulator experience. Throughout the process, how this was going to be visualized has changed a lot. The end concept of *Velocity* is a game played in a car, with virtual, customizable AR cars merged into reality. Hence, this goal is certainly achieved. The concept provides a new way of experiencing racing, inside of a real car.

By implementing the simulator in the car, an experience rooted in reality is created. The drivers can drive to existing locations in their city and start their virtual race from there. This way, the racing experience encourages racing enthusiasts to meet in the real world. The Lynk & Co Club serves as another meeting place, making *Velocity* available to a larger part of the racing community.

Velocity introduces a new way of ownership. The AR cars can be customized the way you want and be seen both in real life and in the game. By racing you can achieve new ways of making your car stand out. This creates a cohesive racing experience with elements of reality mixed with the virtual counterpart. By making this feature open-source, this can promote creativity and create a widely engaged community around *Velocity*.

The short film, being the representation of the concept, is an action filled explanation of the concept. This thrilling representation generates interest and curiosity for what the future will hold.

The project has introduced the team to a variety of new knowledge. With a short film as the way to present this concept, previous knowledge has been combined with new knowledge for the design process. Frameworks for gaming, storyboarding for movie-making and digital softwares are a selection of the new tools and methods learned. The team has certainly acquired a lot of new skills, which will be made use of in our future work.

Seeing the end result of *Velocity*, the project team is proud of the outcome. By the decade of 2030, if the technology allows, it would be interesting to see the concept brought to life.

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A

Brief

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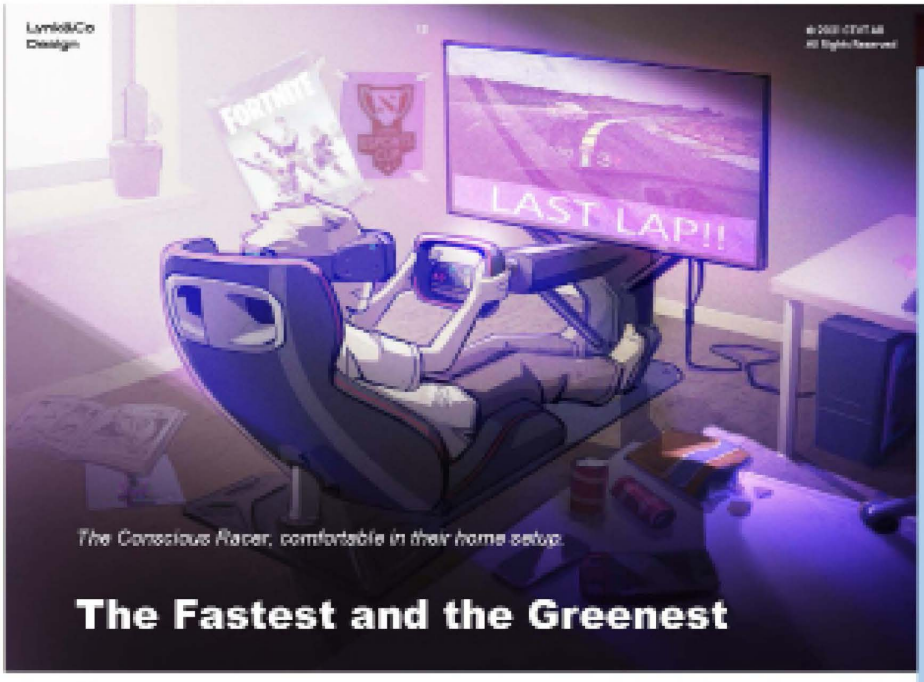
Examenskod IMSX16-23-02

CHALMERS

Institutionen för
INDUSTRI- OCH
MATERIALVETENSKAP



The Conscious Racer, comfortable in their home setup.

The Fastest and the Greenest

The adrenaline of speed, the challenge with yourself and the others, the excitement of crazy adventures.
This has a cost and an impact that we can't ignore.

At Lynk&Co Prospective Design, we are on the path to designing a new experience for the customers, drivers, passengers and fans that are proud of the racing and sporty heritage that our brand sports, without forgetting the reality we live in. We have defined bits of the context, the actors, and the interactions that will define the future of sport car experiences.

We would like you to design a cockpit solution that fits both a Virtual Racing and IRL Racing setup, is swappable, reusable, and makes the racer conscious of their racing.

We would love you to focus on the Product as a blend of form and function, where interaction and journey have equal value as form and finish.

We would love your design to be part of an immersive experience representative of a 2030(ish) future to be presented to the Lynk&Co team.

Challenge us, ask us questions, and share your ideas with prototypes we can play with. We love Unreal and Unity, but you should feel free to use the tool that best fits your purpose. We love physical models even more.

Please help us define the Conscious Racer.

Målgrupp
TD

Gruppstorlek
Mellan 5 och 6

Speciella förkunskaper

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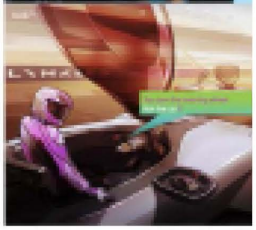
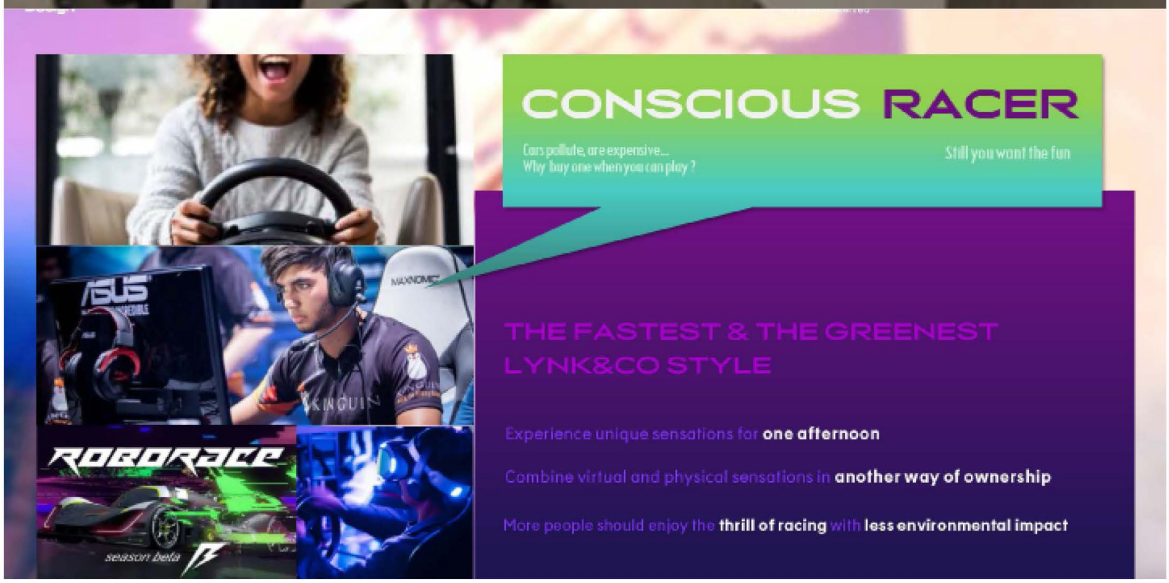
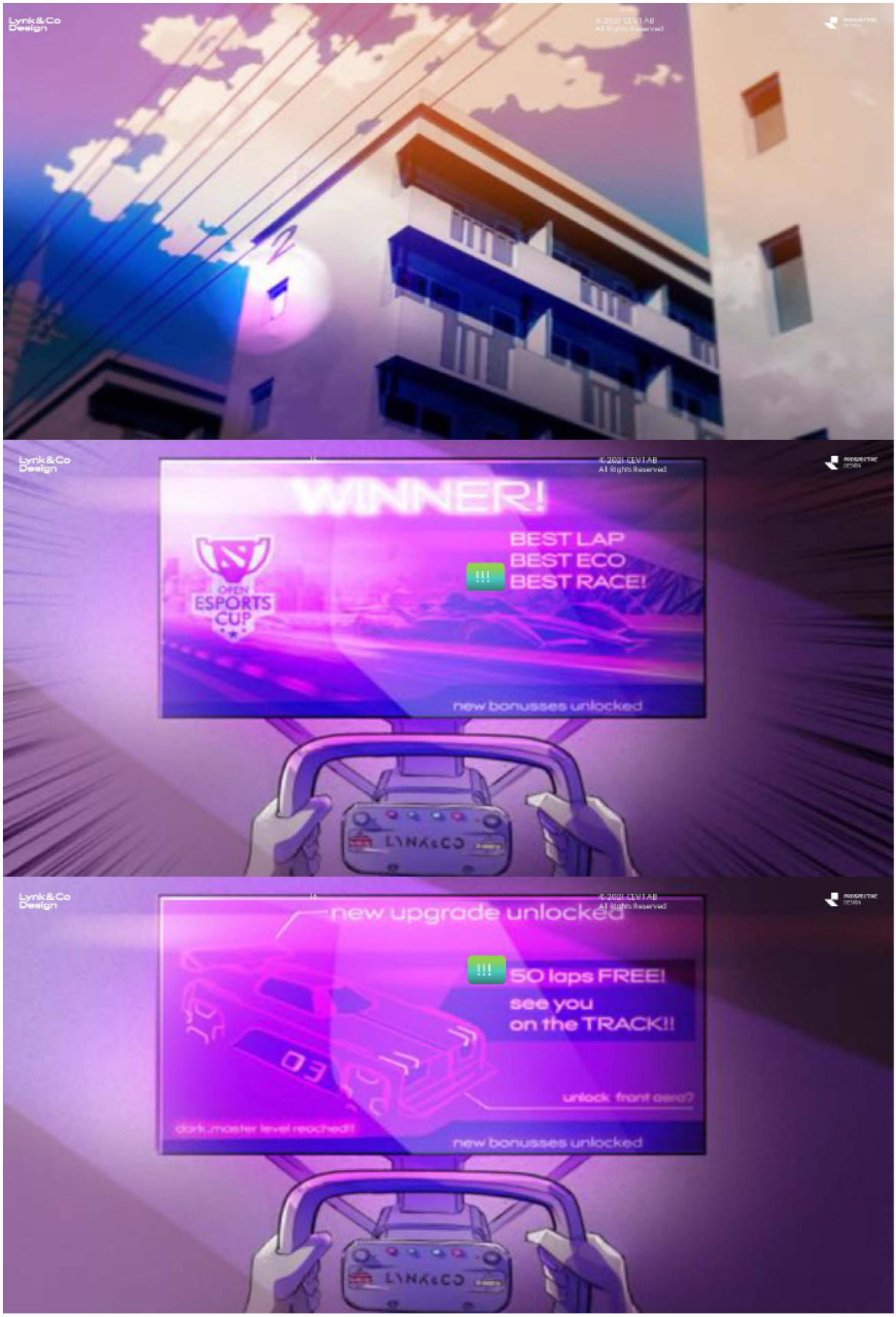
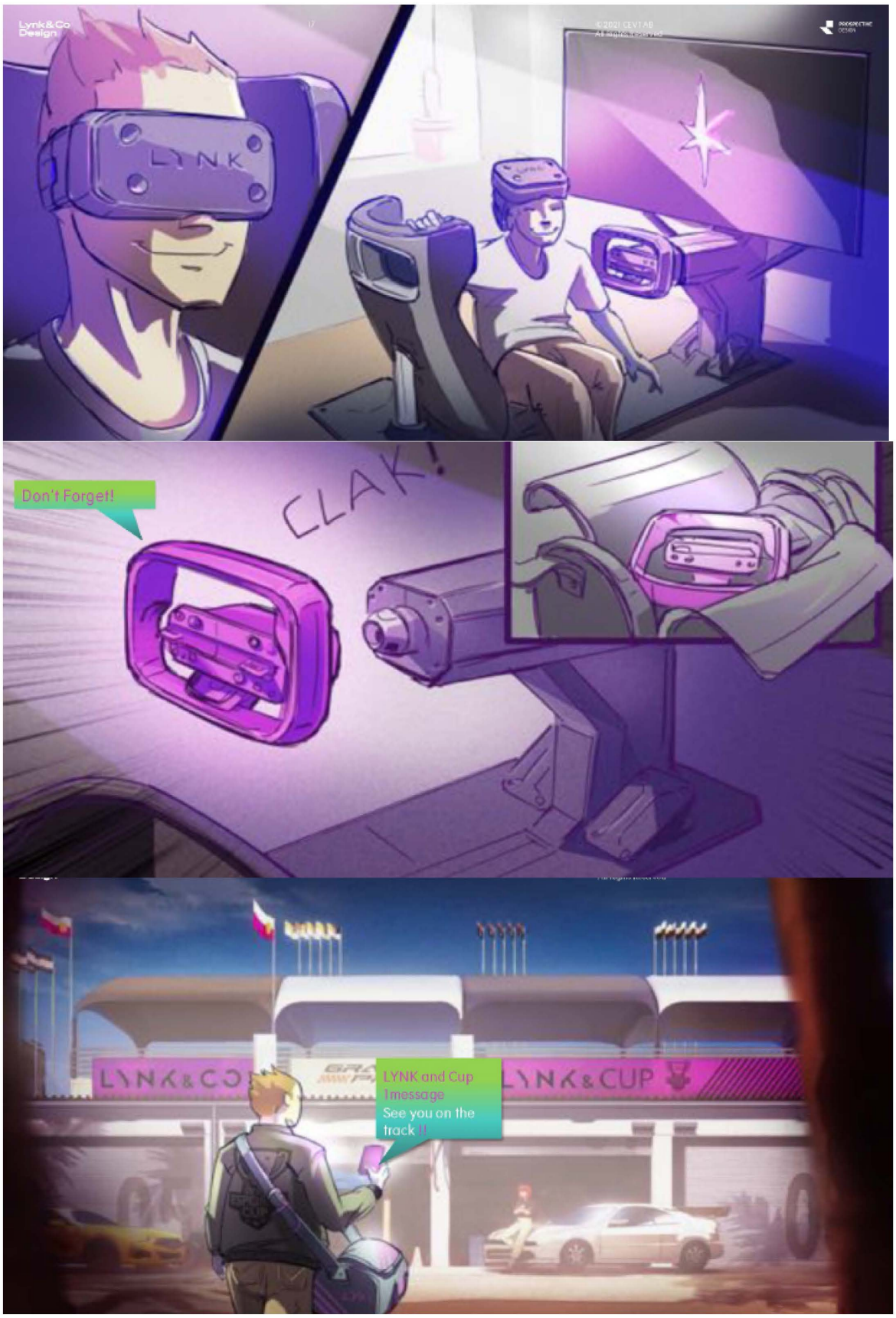



PROSPECTIVE
DESIGN
WE ARE PART OF GEELY DESIGN
We are a small excellence team focusing on the next concept cars. We work within the Lynk&Co brand for the Chinese and European market, delivering the design and core experience for our customers.
PAVE THE WAY GLOBALLY
Prospective helps collaborations with China, investigates and discovers new opportunities to diversify and strengthen our portfolio. Scouts new technologies and innovations that supports our design intentions and pushes to get them available.
WE NEED TO BE CHALLENGED
We need your thinking, background, experience, energy and criticism to push ourselves and our ideas. We want to dream big and explore every possible opportunity.


CHALLENGE 2023
EXPLORE NEW IMMERSIVE TECHNOLOGIES
ENGAGE WITH NEW AUDIENCES
PRESENT NEW -ER WAYS OF OWNING
FIND NEW FORMS & FUNCTIONALITY
DESIGN FOR A NEW CONTEXT
FOCUS ON CHINA IF POSSIBLE


CONSCIOUS RACER
Cars pollute, are expensive...
Why buy one when you can play ?
Still you want the fun
ROBORACE
season beta
THE FASTEST & THE GREENEST
LYNK&CO STYLE
Experience unique sensations for one afternoon
Combine virtual and physical sensations in another way of ownership
More people should enjoy the thrill of racing with less environmental impact


Lynk&Co Design
WINNER!
BEST LAP
BEST ECO
BEST RACE!
OPEN ESPORTS CUP
new bonusses unlocked
new upgrade unlocked
50 laps FREE!
see you on the TRACK!!
unlock: front aero?
new bonusses unlocked


Lynk&Co Design
LYNK
CLAK!
Don't Forget!
LYNK&CO
LYNK and Cup
1 message
See you on the track !!
LYNK&CUP


Lynk&Co Design
20
PROSPECTIVE DESIGN
Lynk&Co Design
21
© 2021 CEVTAB
All Rights Reserved
PROSPECTIVE DESIGN
START
You own the steering wheel
Not the car!!
Of course each car is lightweight and green and trollolo
Lynk&Co Design
22
PROSPECTIVE DESIGN
click!
welcome


The graphics and settings are the same than in the game
DONT GET CAUGHT!!
Augmented reality
Real competitors
bonus +1000

BRIEF IN JUST WORDS

THE FASTEST & THE GREENEST

How might we design the next Lynk&Co experience for the customers, drivers, passengers and fans that are proud of the racing and sporty heritage that the brand sports, without forgetting the reality we live in.

Develop and **practically demonstrate** an immersive experience representative of a 2030(ish) future to be presented to the Lynk&Co team.

Please welcome the Conscious Racer.

B

Short film deliverable YouTube-link

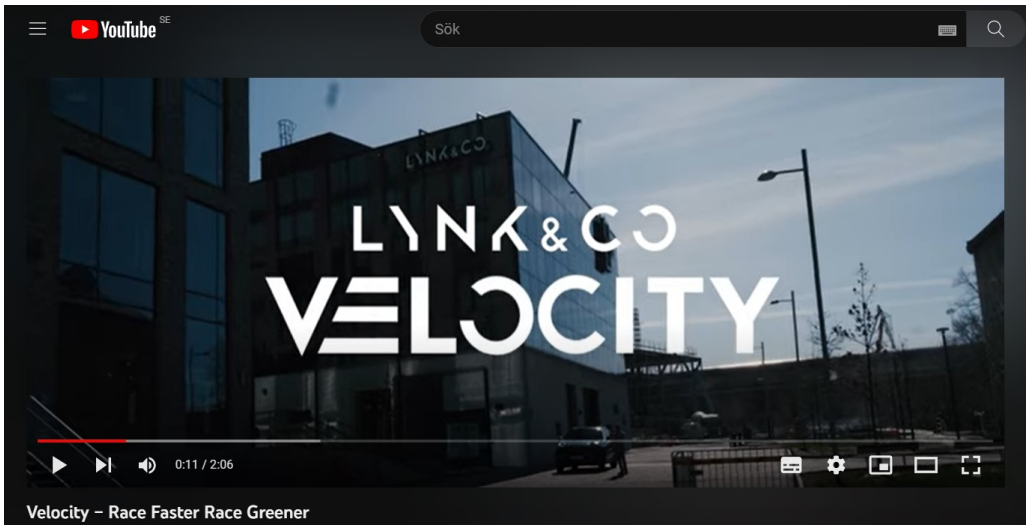


Figure B.1: `https://youtu.be/o4H63Dd6qEI`

C

Interview questions

C.1 Experience

- What would you say is a great racing experience?
- What is the most thrilling part of racing?

C.2 Experiences in racing games

- Do you have experience in playing racing games or racing simulators?
  Are there any aspects that video games capture well?
  Are there any aspects that video games do not capture well?
- Do you think training in racing simulators improves your real life racing skills?
  And do real life racing skills transfer to simulators?
- What are the biggest differences in how you race in a simulator vs. a real car? (For example, you can't use side mirrors in the same way.)

C.3 The race car

- Does the engine of a racing car have an impact on the haptics of the driver compared to a regular car?
- What are the main differences between a regular steering wheel and a steering wheel in a race car?
- What are the most important differences interior wise between a regular car and a racing car, and how important are they to the racing experience and performance.
- Would having a regular interior in a racing car have a large impact on the performance.

C.4 Competing

- What is the most exciting thing about competing?
  Is there something appealing about gathering the best drivers in the world and seeing who is the best?
  What does the community look like?
- Is the traveling aspect of racing something that appeals to you?

C.5 Future

- How do you see the future of racing evolving, and what do you think will be the biggest changes or innovations in the years to come?

C.6 E-sports racing

- Is your team also competing in Esports WTCR?
  Is that an online event or is it a LAN-event?
  Are you driving in simulators or just regular PC-setups?
  What are the most appealing aspects of the E-sport branch?
  Considering it is a more environmentally and economically friendly alternative. Would you say it is a great way to engage more people in the sport?

C.7 The physical aspects

- What makes a person a great driver, what is the difference between how a regular driver and a professional drives.

D

Storyboard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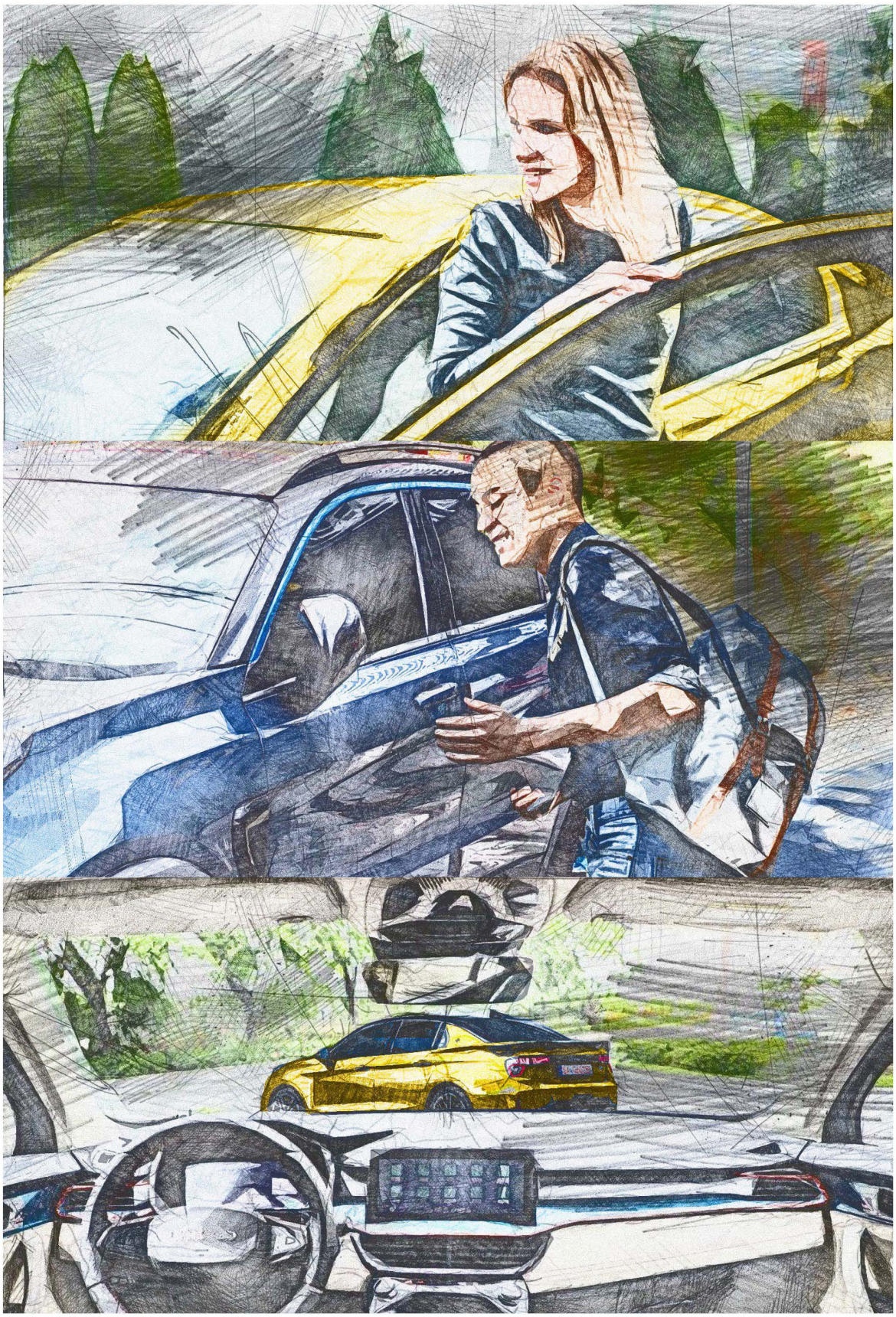
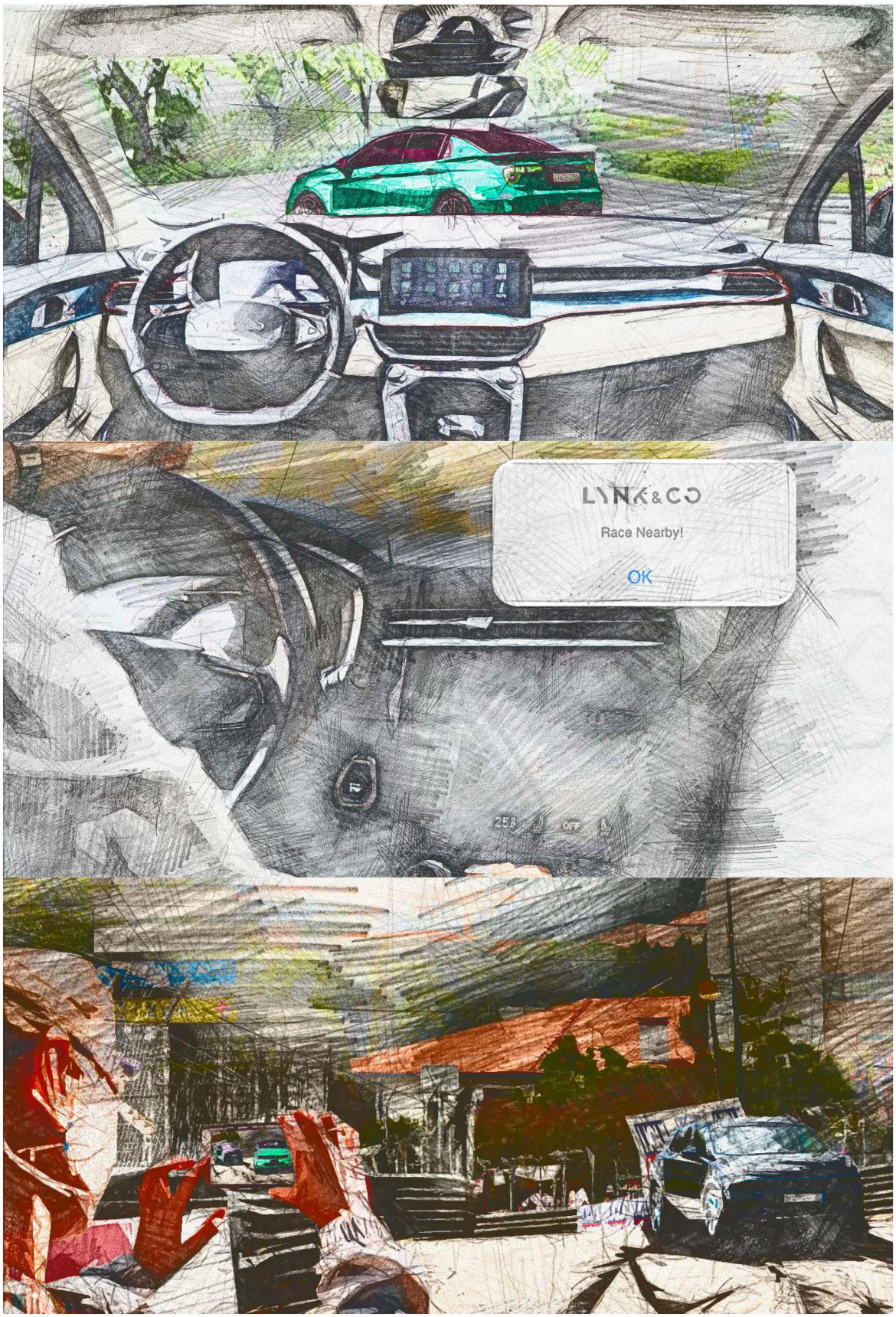
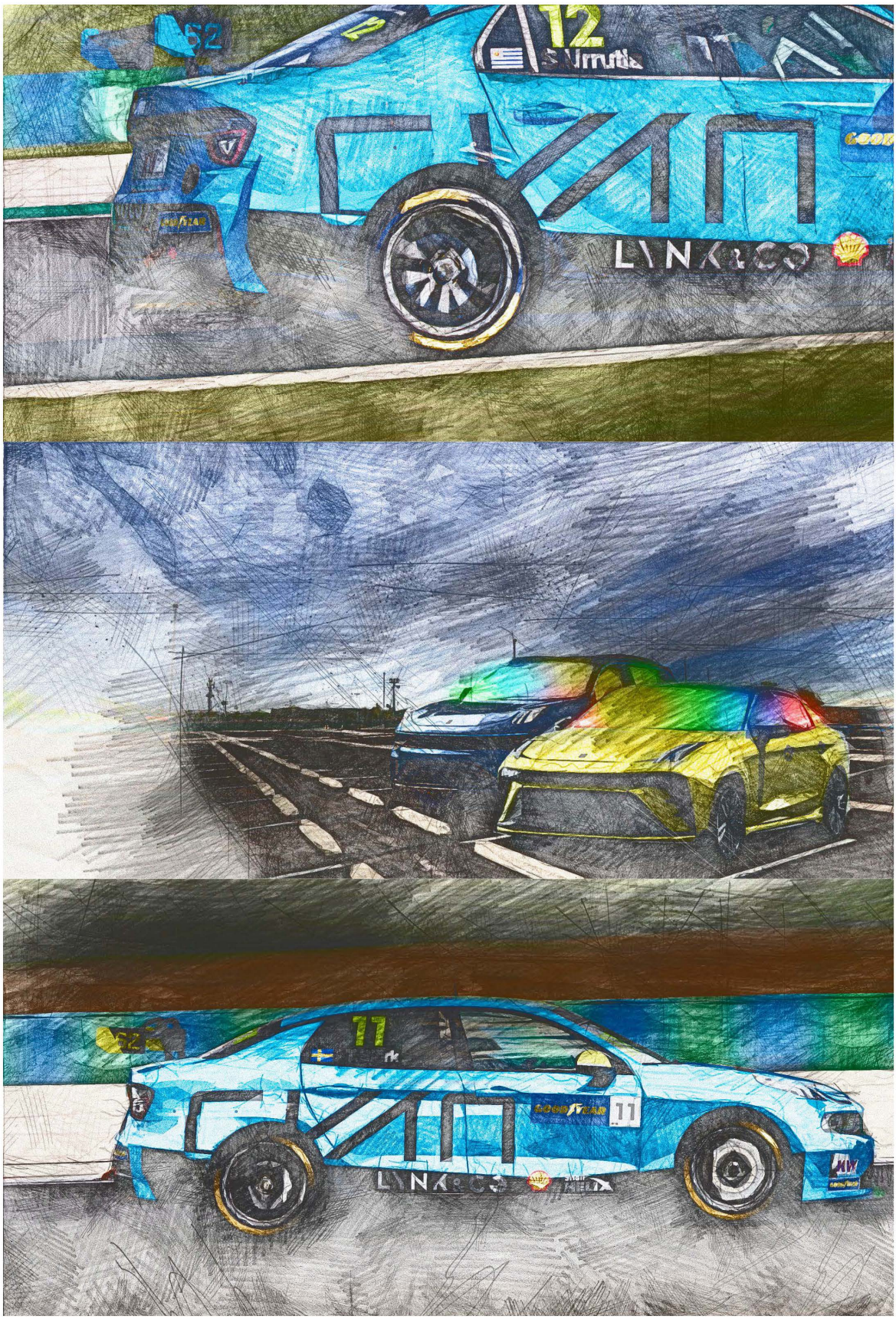
LYNK&CO
CYAN
LYNK&CO
LYNK&CO




LYNK&CO
Race Nearby!
OK


ROLEX
ROLEX


12
HYUNDAI
MOTORSPORT
BRC GAS EQUIPMENT


62
12
LYNK&CO
62
17
11
LYNK&CO

LYNK&CO
VELOCITY

E

Explanation of Storyboard

It is important to understand that all of these scenes didn't make the final cut, but this appendix is to get a general understanding of the thought process that went into the making of the Storyboard and Short film. The explanation of the Storyboard was meant to gain a deeper understanding of what each scene should represent and how to make it possible.

E.1 Chapter 1 - Racing shots

Catches the viewer's attention and leaves them wanting more.

E.1.1 Scenes in Chapter 1

What do we want to emphasize?

- We want to create excitement and a sense of racing, it should be fast-paced and really cool.

Why do we want to show this (what does the user get out of this, what is the want/need)?

- We want to capture the viewer's interest in the product that will be shown in the film.

How do we show it so that the viewer understands (both the product and the point of the product)?

- We will showcase this through fast-paced and somewhat ambiguous racing scenes. Short sequences with no deeper context shown. The goal is to make the viewer curious and want to see more.

Scene Descriptions, Examples of shots:

- Shots of multiple cars
- Fast shots up close to the car
- Shots close to the ground as cars speed past
- Close-up shots of spinning wheels
- If we have a Lynk & Co car with their logo on the back
- Camera behind the car that zooms in on the logo and then transitions to the sign at the Lynk & Co Club

E.2 Chapter 2 - Lynk & Co Club

This chapter introduces the Lynk & Co club to the viewer and acts as a starting point for the story and the film.

E.2.1 Scene 2.1

Scene Description - The shot shows the Club from the outside. The shot starts with a close zoom on the Lynk Logo and zooms out to show the whole exterior and two cars that are parked outside on the street. The main character is seen sitting at the bar inside the club (if it is possible to show that (the windows are quite dark)).

What do we want to emphasize?

- An establishing shot to show that we start at the Lynk & Co club to give context to the viewer

Why do we want to show this (what does the user get out of this, what is the want/need)?

- It gives the user context and makes it easier to understand where we are.

How do we show it so that the viewer understands (both the product and the point of the product)?"

- Show the building and the Lynk sign clearly to show that the building has a connection to Lynk & Co.

E.2.2 Scene 2.2

Scene Description - Shot showing the interior of the club. Panning over to the main character sitting at the bar.

What do we want to emphasize?

- Shows of the interior of the club to show off the vibes inside the club.

Why do we want to show this (what does the user get out of this, what is the want/need)?

- Gives the viewer a better understanding of the Lynk & Co aesthetic and makes them more interested in the club.

How do we show it so that the viewer understands (both the product and the point of the product)?

- Show off the interior and possibly have some cool background music.

E.2.3 Scene 2.3

Description: The scene starts with a shot from behind the main character as they sit at their computer. Something catches their attention and they look away in a new direction (towards the windows of the club). The next shot shows a person standing in front of a car, fiddling with their iPad (through the windows of the club if possible).

- Shot 1: Same angle from the left behind the main character. They look to the right.
- Shot 2: The camera looks out towards the windows of the club.

What do we want to emphasize?
- Mostly a scene that serves as a transition to showcasing the car customization.

Why do we want to show this (what does the user get out of this, what is the want/need)?
- The user gets to see the process of customizing cars, which could pique their interest and potentially lead to them wanting to customize their own car.

E.3 Chapter 3.1 - Customization

E.3.1 Scene 3.1.1

Description: Person customizing their 01 car virtually with an iPad, through the Lynk and Co app. Changing color. Camera perspective: Standing behind a person, view on both iPad and car.

What do we want to emphasize?
- That you can virtually customize your car
- That it is eco friendly

Why do we want to show this (what does the user get out of this, what is the want/need)?
- Emotional attachment to car
- Prolongs the life span of the car for the user

How do we show it so that the viewer understands (both the product and the point of the product)?"
- Showing Co2 saved with text outside

E.3.2 Scene 3.1.2

Description: Showing #1 looking contemplating.
Camera perspective: Headshot

What do we want to emphasize?
- There's an option for everyone.

Why do we want to show this (what does the user get out of this, what is the want/need)?
- Emotional attachment to car
- Feeling content

How do we show it so that the viewer understands (both the product and the point of the product)?"
- Showing emotion

E.3.3 Scene 3.1.3

Description: #1 Choosing the right color
Camera perspective: Continue panning

What do we want to emphasize?
- There's an option for everyone.
- Virtually customizing car

Why do we want to show this (what does the user get out of this, what is the want/need)?
- Emotional attachment to car
- Feeling content

How do we show it so that the viewer understands (both the product and the point of the product)?"
- Showing emotion

E.3.4 Scene 3.1.4

Description: Showing #1 looking content.
Camera perspective: Headshot

What do we want to emphasize?
- There's an option for everyone.

Why do we want to show this (what does the user get out of this, what is the want/need)?
- Emotional attachment to car
- Feeling content

How do we show it so that the viewer understands (both the product and the point of the product)?"
- Showing emotion

E.3.5 Scene 3.1.5

Description: It cuts back to the man at the bar who is still working on his computer (previously filmed from a slightly behind angle). His phone is lying screen-up beside the computer. Suddenly, the screen lights up and he receives a notification. The man picks up his phone and there is a new camera angle, zoomed in on the phone. The notification says that there will be a race at Röda Sten at 7 pm. He closes his laptop and begins to stand up.

Shot 1: Same angle as before on the man, with the phone on the left side of the computer.
Shot 2: The camera follows the phone as the man picks it up, quite zoomed in so you can see what it says.
Shot 3: Back to the angle on the man, he puts away the phone, closes the laptop, and stands up.

What do we want to emphasize?

- We want to emphasize that a person who is part of this community receives notifications about current races.

Why do we want to show this (what does the user get out of this, what is the want/need)?

- We want to show this because a user who is involved in Velocity is able to conveniently stay up-to-date about current races.

How do we show it so that the viewer understands (both the product and the point of the product)?"

- The text on the phone makes it clearer what is going on.

E.3.6 Scene 3.1.6

Description: The person has now put on his jacket and is standing at the bar. A new shot shows them ordering a juice, but also requesting a key to a Velocity car. Cut to a new shot that shows the protagonist looking out the window of the club while waiting for their order, and they see the person still fiddling with their iPad. The staff member gives them the juice and key, saying the car is parked right outside. The person takes their juice and key and walks towards the door.

Shot 1: The person has now dressed and is standing at the bar. The shot shows them ordering a juice and renting a Velocity car. The camera is looking from his right
Shot 2: A shot from the man's left as the person looks out through the club and once again sees the person with the iPad. The person receives their juice and key and walks towards the door.

What do we want to emphasize?

- That you can rent a Velocity car at the club.

Why do we want to show this (what does the user get out of this, what is the want/need)?

- We want to show this so that the viewer understands that you don't need to own a car to experience Velocity and that it is very easy to rent a car.

E.3.7 Chapter 3.2

What do we want to emphasize?

- Community
- Customizable function

Why do we want to show this (what does the user get out of this, what is the want/need)?

- Fellowship
- Emotional attachment

How do we show it so that the viewer understands (both the product and the point of the product)?"

- Nodding to each other
- Customization shown through windscreen
- Text "AR windscreen"

E.3.8 Scene 3.2.1

Description: #1 Opening/Exiting the door
Camera perspective: Shot from behind (Going out from the Lynk & Co Club)

E.3.9 Scene 3.2.2

Description: #2 getting in his car
Camera perspective: Half body shot (Character entering car)

E.3.10 Scene 3.2.3

Description: #2 nodding, #1 nodding back
Camera perspective: Shot from behind of #2, 50mm lens (axel nickar) (otto nickar tillbaka)

E.3.11 Scene 3.2.4

Description: #1 taking a few steps, getting in his car
Camera perspective: Full body shot. (otto går in bilen)

E.3.12 Scene 3.2.5

Description: getting in his car, turning his key, AR appears
Camera perspective: shot from behind in the backseat

E.3.13 Scene 3.2.6

Description: Looking impressed
Camera perspective: Headshot

E.3.14 Scene 3.2.7

Description: Driving away
Camera perspective: Shot from #1 car

E.3.15 Scene 3.2.8 - 3.2.14

What do we want to emphasize?

- Community
- Social influence
- Friendly competitiveness

Why do we want to show this (what does the user get out of this, what is the want/need)?

- Fellowship
- Inspiration

How do we show it so that the viewer understands (both the product and the point of the product)?"

- Emotions
- Interface if possible
- Customization shown through windscreen
- Text “Be inspired”

E.3.16 Scene 3.2.8

Description: #3 gets notification *notification sound”
Camera perspective: Shooting pocket

E.3.17 Scene 3.2.9

Description: Showing notification, notification has gps dot included so that they know what the car is.
Camera perspective: Above hand/phone

E.3.18 Scene 3.2.10

Description: #3 + two more people looking over the shoulder of the person seeing the car on the phone, trying to get a look.
Camera perspective: Behind, panning shot

E.3.19 Scene 3.2.11

Description: #3 + one more people being amazed
Camera perspective: Head shot

E.3.20 Scene 3.2.12

Description: Back inside car with #1, #2 car overtaking, AR is shown
Camera perspective: Shot from passenger seat, 50mm? f2.8?

E.3.21 Scene 3.2.13

Description: Cars rolling into parking lot
Camera perspective: Shot outside car

E.4 Chapter 4 - Velocity Racing

What are the most important points in this Chapter?

- That the car is standing still while racing
- Awesome racing experience
- The driver is actually turning the wheel in the real car
- The Community

- How the Driver enters Race mode

E.4.1 Scene 4.1

Scene Description - Camera switches to inside the car of the Driver. It's a close up of the driving looking out in the real environment getting ready mentally for a race.

What is important in the scene?
- The emotion before the driver is entering an thrilling experience.

Why do we want to show it?
- Good transition shot into the racing starts.

E.4.2 Scene 4.2 (Suggestion)

Scene Description - Before Race-mode is entered an AR Globe zoom in on the screen. The Driver can interact with the globe through hand gestures and zooms in further and chooses a race location. When the location is selected an instruction pops up and says "Initiate Race Mode".

What is important in the scene?
- The function is that it is possible to race at many different locations around the world.

Why do we want to show it?
- We want to show different race location possibilities and how the driver can integrate with the Globe.

How do we show it in an understandable way (both the product and the point of the product)?
- It's important to show through the use of "Location tags" on the Globe that many different locations are possible to choose.

E.4.3 Scene 4.2

Scene Description - A wide angle shot from behind (the backseat, so that the whole interior is visible) where the racing lever is pulled. The lever hangs down from the inside roof over the mid console behind the roof light switches (maybe just do the Lambo start...). The lever has the aesthetic of a Rally Car Stick Shift, very stripped down and functional.The Lever is now pulled down and forward. When the lever is pulled a notification on the windshield pops up (taking a pretty big space), saying that "Racing Mode is Active".

An animation starts on the windshield that slowly (almost growing fast) and in a cool way, that brings the driver into the VR racing world.

What is important in the scene?
- That the need of a physical button is necessary to enter racing mode, also the transition into VR Racing.

Why do we want to show it?

- It's important to show the viewer how you enter the racing mode and that you enter it in order to minimize confusion.The animation's purpose is to describe that you are leaving IRL and entering VR.

How do we show it in an understandable way (both the product and the point of the product)?

- Showing that everything that has something to do with VR racing is kind of "out there".

E.4.4 Scene 4.3

Scene Description - A new shot where the camera pans pretty close and follows the growing animation on the windshields. When the animation "grows together" and fills the entire windshield the shot ends. Maybe it zooms in through a "vine" either it goes to black or it goes to the next scene.

What is important in the scene?

- The animation. The scene's purpose is to describe the transition from real life into Velocity.

Why do we want to show it?

- We want to show a driver entering the experience in order to describe to the viewer that this is cool.

How do we show it in an understandable way (both the product and the point of the product)?

- By making it "out of this world" cool and futuristic.

E.4.5 Scene 4.4

Scene Description - Black Screen, short. (Maybe not necessary)

What is important in the scene?

- The transition

E.4.6 Scene 4.5

Scene Description - A drone shot over the start line where other Lynk & Co Cars are lined up ready. This shot takes place in the environment that we manage to create in UE5.

What is important in the scene?

- This scene showcases that you are not playing this by yourself, this describes the community and the multiplayer experience.

Why do we want to show it?

- We want to describe a sense of community that builds relationships and memories. This is a good way to start.

E.4.7 Scene 4.6

Scene Description -Start of the race, The shot consists of a close up, slight zoom, off racing start lights. The lights turn on one by one (5 in total) and then turn off. This is when the racing starts.

What is important in the scene?

- Shows that the racing starts, building suspense for the race, the calm before the storm.

Why do we want to show it?

- Beginning of the racing experience. To engage the viewer.

How do we show it in an understandable way (both the product and the point of the product)?

- The race lights make it clearer for the viewer that the race is about to start.

E.4.8 Scene 4.7

Scene Description -The next couple of scenes will be similar. Racing scenes overall , close-ups, overtakes, panning shots, etc. But with the AR mod skin showing in the VR world.

What is important in the scene?

- These scenes' purpose is to showcase the Racing Experience, the sub-purpose is to show that the cars' AR skins translate into VR.

Why do we want to show it?

- We want to showcase the thrill of racing.

E.4.9 Scene 4.8

Scene Description - Wheel spins on the start grid.

E.4.10 Scene 4.9

Scene Description - Panning shot in front of the cars racing (maybe 4)

E.4.11 Scene 4.10

Scene Description - Close up on the front right wheel angled from behind

E.4.12 Scene 4.11

Scene Description - An over take aerial shot into the first corner

E.4.13 Scene 4.12

Scene Description - Panning shot of the car, showcasing the side of the car

E.4.14 Scene 4.13

Scene Description - The spinning wheel scene, maybe the break wheel starts glowing/burning. The camera zooms in and a cool transition takes place here.

E.4.15 Scene 4.14

Scene Description - Back to reality. The camera jumps out from the racing and pans over the parked cars standing still in a parking lot. The cars windshields are flashing with colors, but the sound of the shot is calm because the racing sounds are "turned down/muted", but not all the way.

What is important in the scene?

- Bringing the viewers back to reality, showcasing that the car is actually standing still while it's racing

Why do we want to show it?

- This shot showcases the viewers "Racing without forgetting the reality we live in". How do we show it in an understandable way (both the product and the point of the product)? The flashing windshields will show that the racing experience is still going on inside the car, and the muted sounds will also describe that.

E.4.16 Scene 4.15

Scene Description - Camera spins to the right and the motion blur that it creates will act as a transition back to the racing scenes.

E.4.17 Scene 4.16

Scene Description - Camera keeps turning and catches one car (the motion blur of the environment stops when the camera catches the car that is driving) driving down the straight at the same angle but with a lot of camera shake. An overtake shown from the same side angle. Another car appears in front of the car that we followed and drives past it.

E.4.18 Scene 4.17

Scene Description - Point of view shot from outside the car where the viewers can see the front hood and the racing track.

E.4.19 Scene 4.18

Scene Description - Racing shots

E.4.20 Scene 4.19

Scene Description - Racing shots

E.4.21 Scene 4.20

Scene Description - Racing shots

E.4.22 Scene 4.21

Scene Description - End of the race. Cars cross the finish line at roughly the same time. The shot takes place from behind the checkered flag waving.

E.4.23 Scene 4.22

Scene Description - The camera pans up into the sky when the race is finished.

E.5 Chapter 5 - Ending

What are the most important points in this Chapter?

- Showcasing back to reality
- The community aspect
- A capturing ending sequence

E.5.1 Scene 5.1 (Suggestion)

Scene Description - From the sky the camera pans back into the cockpit of the car. The windshield shows in AR a “Race summary”, where stuff like “Emissions Saved”, “Average Pace”, “Fastest Lap” and “Total Race Time” is shown.

What is important in the scene?

- Showcasing the green aspect of our concept

Why do we want to show it?

- Because Greenwashing

How do we show it in an understandable way (both the product and the point of the product)?

- An AR overlay on the windshield with digital information about the race, quick shot, not that important

E.5.2 Scene 5.2 (Alternative)

Scene Description - Showing a close up shot off the winning Driver with a smile.

What is important in the scene?

- Communicating emotion.

Why do we want to show it?

- Convey a certain feeling after the race.

E.5.3 Scene 5.1

Scene Description - The camera pans back down from the sky. Now you can see the cars parked at the real parking lot. A “landscape shot”.

What is important in the scene?

- Back to reality. The race is finished; this is the shot that brings the viewer back to reality.

Why do we want to show it?

- It is the natural transition from the racing in order to show the community later.

E.5.4 *Scene 5.2

Scene Description - View of the Driver exiting the car, Maybe just showing the step-out and then the exit.

What is important in the scene?

- This shot is important to showcase the community that Velocity brings after a finished race. While just a few moments ago being in a adrenaline filled race, to now being friends and having a laugh about it

Why do we want to show it?

- The community aspects are a big part of the concept and adds to the experience.

How do we show it in an understandable way (both the product and the point of the product)?

- Here we need to show emotions, we need to end the story in a happy way that people can relate to some degree.

E.5.5 *Scene 5.3

Scene Description - The camera shows the Driver walking to his racing partner from behind.

E.5.6 *Scene 5.4

Scene Description - A high five and some laughs are caught on camera, maybe in slow motion.

E.5.7 Scene 5.5

Scene Description - Camera angle switches to more of a wide angle shot of the parking lot, the two Drivers are still in view as the camera pans back up to the sky. When the camera has paned up so that the cars are still a bit visible, the sky is most of the screen. Text appears one by one “Race greener”, “Race Faster”, “Lynk

& Co Velocity". The text in white in a blue sky with some clouds, "Velocity" is in a cool typeface.

What is important in the scene?

- The last scene that presents the concept and its punchlines.

How do we show it in an understandable way (both the product and the point of the product)?

- Clear text in the sky, with the words from the name of the project.

F

Back brief

F.1 Objective

To design an immersive racing experience that seamlessly blends virtual and real-world racing, offering a new and exciting experience for all members of the racing community, from common drivers to professional racers.

F.2 Problem

The main problem that this project aims to address is how to create a high-performance driving experience that is also sustainable and customizable. This problem can be broken down into several sub-problems:

- What does a high-performance driving experience look like and what are the most appealing features?
- How will the integration between the real world and the digital experience take place?
- Where does this experience take place?
- How can VR and AR technology be integrated into a system to create an immersive and customizable driving experience?
- How can open-sourced designs and software be used to create a more joint community and an eco-friendly experience?
- How can modular setups be used to allow for personalization and customization of the system?
- What does the racing community look like today, and how can we contribute to it with a new type of driving experience?
- How can different types of ownership enrich the experience?
- How can a sustainable racing concept be implemented into a company that produces cars without green washing?
- How can a thrilling, adrenaline filled, engaging racing experience look like and how do you design it?

F.3 Target Audience

The "conscious racer," an enthusiast of the racing community who seeks an adrenaline rush while also being conscious of the environmental impact of traditional gas-

powered race cars.

F.4 Key Requirements

- Fusion of virtual and real-world racing
- Alternative form of ownership, allowing users to feel connected to the Lynk & Co racing community
- Inclusivity for all fans of the racing community

F.5 Design Considerations

- Transfer of virtual customizability to an IRL-experience (VR, AR possibly)
- Real-life elements connected to racing during the experience
- Customizable for personalization and attachment/feeling of ownership
- A concept which enriches the building of a Lynk & Co community for enthusiasts

F.6 Deliverables

- Concept sketches and renderings of the proposed idea
- Not a powerpoint, provide an experience, physical model
- Scenario/story with the concept included
- Something tangible, something cool that
- The final result will be more of a concept than a specific product, but it will provide a framework for future developments in the automotive industry.

The design aims to achieve rich and insanely good looks, while exploring new opportunities in technology and challenging the market. The design will focus on an experience-first approach where the design should find a fitting place in the context of the experience. The final concept should aim to be a tool to enrich the experience for the conscious race.

G

Full initial scenario

Neo is a software engineer at a UX company in Shanghai. After a long day of code that keeps on crashing and managers complaining he is ready to go home and relax. As he packs down his things his phone pings. He glances towards his phone that is laying on the desk and notices Lynk & Co has sent him an email. Curious of what they might want to tell him he opens the email. “Hi Neo, as one of our dear customers we would like to invite you to our new racing track /Lynk & Co Club for a free hour of racing with your friends. Make sure to bring your own personalized set-up for the best experience possible . . . . . ”.

Neo doesn’t even finish reading the whole email. He is eager to contact his friends, Blade and Pixel, to share the exciting news with them. In excitement he sends a poorly composed message proposing that they should head down to the Lynk & Co club and see who’s the better driver. Blade and Pixel are down to race and Blade proposes that the loser has to pay for the beers afterwards.

He rushes home through the neon lit city and can’t wait to start customizing his rig. He rushes up the stairs of the apartment building and throws himself into his home. He starts his computer and goes online to polish the looks of his custom Lynk & Co Car. If he is going to crush his friends on the track he has to do it in style.

He opens the profile of his car. But something is different. On the interface there is a new tab: “Download car-mods from our open source community”. “No way”, Neo says for himself. He quickly clicks on the tab and is greeted with an unlimited amount of user-designed mods. From steering wheels, paint jobs to spoilers. He enters “The matrix” in the search tab and finds the perfect matrix paint job. He applies it to his car and gazes upon his beautiful creation, nothing can beat this. Before it’s time to sleep he 3D-prints new parts for his personal steering wheel, this open source community really has everything. . . The next day Pixel and Blade come

by Neo’s apartment to pick him up in Pixel’s new Lynk & Co car, “The next night”. Since Pixel is the only one bringing a race car to the track both Blade and Neo have to bring their own Lynk & Co devices to be able to bring their own settings to the track. As they arrive at the track, Pixel rolls onto the starting grid in his own car. Neo and Blade jump into separate white Lynk & Co cars (already located there), but as Neo plugs in his Lynk & Co device the car magically changes color and looks to the matrix themed car that Neo customized yesterday.

3. . . .2. . . .1. . . .GO!

The racing starts and Neo takes off at an incredible speed making him feel like he is breaking the laws of physics. When Neo gets used to the speed he notices how the names appear over his fellow race cars and their placement. He is also impressed how the environment has changed. When they arrived at the race track it looked like an ordinary dull circuit of asphalt but now Neo and his friends are driving in an rainbow road-like environment.

It's the last lap and 500 meters to the finish line. Neo´s in the lead and can feel victory around the corner. But suddenly Blade passes him on the right, and soon after pixel passes him on the left. The finish line is close and Neo tries to push the cars limits but can't get in first place. He loses the race and the defeat irritates him, now he has to pay for the beers. But as they leave their cars Blade compliments Neo on his paintjob. "Where did you get that?", Blade says. And with a smile Neo responds "I´ll tell you later. . . "

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