

**Faculté des sciences économiques,  
sociales, politiques et de communication**

# **INTEGRATING DRIVING SIMULATORS INTO DRIVER EDUCATION:**

## **ASSESSING IMPACT ON EYE-HAND-FOOT CO- ORDINATION IN NOVICE DRIVERS**

Auteur : Gabriel PUERTAS MORAL  
Promoteur(s) : Thibault PHILIPPETTE

Année académique 2024-2025  
Master 120 en Sciences et Technologies de l'Information et de la  
Communication (STIC)

## ACKNOWLEDGMENTS

Thank you to the teams at BeamNG.GmbH for their invaluable assistance in developing the missions, with special thanks to Eva, Florian, Logane, and Timo. Thank you to Mr. T. Philippette for his support. Thank you to Mr. G. Joppart for his help as an expert. Thank you to Stéfanie for her guidance and encouragement through most of this thesis. Lastly, thank you to myself for pushing through and making it this far – I doubted I would ever finish university someday yet here I am.

## ABSTRACT

This master thesis examines the integration of automotive simulation in driving education, with a specific focus on developing eye-hand-foot coordination. Through a mainly qualitative study, we assess how driving simulators can enhance the foundational skills of new drivers, potentially replacing the initial hours of the traditional driving curriculum.

A literature review revealed that driving simulators have been widely used in fields such as aviation and healthcare (Corneloup, 2019). However, their application in automotive driver training remains emerging. Previous studies have demonstrated that simulators can improve risk perception and rapid decision-making (Deniaud, 2017), but their effectiveness in fostering eye-hand-foot coordination requires further exploration.

To address these questions, a mixed-methods approach was employed, combining experimental sessions with participants using a driving simulator and post-session self-assessment questionnaires. Thus, data were analyzed qualitatively and quantitatively. Four participants – two men and two women – with no prior driving experience were selected. They completed three training sessions using a driving simulator equipped with current mid-tier technologies for a realistic experience.

The results indicate that all participants made significant progress in eye-hand-foot coordination and basic driving situation management. For example, participants showed notable improvement in hill starts and lane maintenance. However, challenges persist, particularly in low-speed maneuvers and the use of the camera for environmental perception.

The findings suggest that driving simulators can be a valuable tool for initial driving education, providing a safe environment to develop basic skills. Nevertheless, they cannot fully replace traditional on-road training. A hybrid approach, combining simulator use with real-world driving, appears to be the optimal solution for effective training. This study highlights the potential of simulators while emphasizing the need for complementary real-world practice to ensure comprehensive skill acquisition. Future research could explore advanced technologies, such as virtual reality and motion rigs, to further enhance immersion and training outcomes.

## FORWARD

One day, while hosting a friend with no driving experience, we were both surprised by the progress he made in just two hours of gameplay: eye-foot and eye-hand coordination (on an older manual transmission vehicle), steering, trajectory management, traffic anticipation, and recognition of signs and priorities were among the skills he learned and improved in this short time. At the same time, a friend was struggling to progress with her driving lessons. She was terrified of driving. Indeed, an accident during one of her first driving experiences had traumatized her.

In this context, I had the idea of allowing new learners to adapt to the necessary commands and reflexes in a reassuring and learning-appropriate context, without the initial danger that such practice entails. I also hope that through this learning method, future drivers will be curious about testing the limits in the simulation rather than the road: "What happens if I drive above the speed limit?" or "What happens if I have a head-on collision with another car?" are legitimate questions whose answers are less risky in a simulator.

Although immersive and precise driving simulators are not super affordable for the average consumer, the one used in this study costs 4.000 € including VAT, excluding assembly (simulator with three pedals, handbrake, manual gearbox, adjustable seat, computer, game, screen, keyboard, and mouse included), which is significantly less than the cost of a new car prepared for driving schools, not even accounting for insurance, gas, maintenance and taxes.

If such a system works, it would also impact the budget allocated to driving education, a cost that is still a significant barrier for many young people and their families. Some friends of mine are struggling to find jobs because car related costs are so high. This could be an interesting option for companies and most importantly for the ones who need it to pay their bills.

# TABLE OF CONTENTS

<b>ACKNOWLEDGMENTS</b> .....	<b>2</b>
<b>ABSTRACT</b> .....	<b>3</b>
<b>FORWORD</b> .....	<b>4</b>
<b>INTRODUCTION</b> .....	<b>9</b>
<b>STATE OF THE ART</b> .....	<b>10</b>
CONTEXT AND IMPORTANCE .....	10
SIMULATION EVOLUTION AND TECHNOLOGIES .....	11
OTHER SOURCES REVIEW .....	12
<i>Evaluation Methodologies</i> .....	12
<i>Studies Focused on Simulation and Driving</i> .....	13
<i>Video Games and Transferable Skills</i> .....	14
CONCLUSION .....	15
<b>METHODOLOGICAL FRAMEWORK</b> .....	<b>16</b>
SAMPLE .....	16
PHYSICAL MEDIUM.....	17
VIRTUAL MEDIUM .....	18
<i>Grading and Evaluation</i> .....	19
EXTERNAL RESOURCE(S).....	20
SESSIONS ORGANIZATION.....	20
<i>FIRST SESSION   45 MIN</i> .....	22
<i>SECOND SESSION   1H30</i> .....	27

<i>THIRD SESSION   IH45</i> .....	33
<b>HYPOTHESES</b> .....	<b>38</b>
<i>Risk Perception and Anticipation</i> .....	38
<i>Eye-Hand and Eye-Foot Coordination</i> .....	38
<i>Improvement in Self-Confidence</i> .....	38
<i>Improvement in Movement Precision</i> .....	38
<i>Improvement in Reactivity to Emergency Situations</i> .....	38
<i>Improvement in Distraction Management</i> .....	38
<i>Comparison with Traditional Methods</i> .....	38
<b>RESULTS</b> .....	<b>39</b>
FABRICE .....	39
<i>Session 1</i> .....	39
<i>Session 2</i> .....	40
<i>Session 3</i> .....	41
<i>Conclusion</i> .....	42
KARIMA.....	42
<i>Session 1</i> .....	42
<i>Session 2</i> .....	42
<i>Session 3</i> .....	43
<i>Conclusion</i> .....	44
SEBASTIEN.....	44
<i>Session 1</i> .....	44
<i>Session 2</i> .....	45

<i>Session 3</i> .....	45
<i>Conclusion</i> .....	46
VÉRONIQUE .....	46
<i>Session 1</i> .....	46
<i>Session 2</i> .....	47
<i>Session 3</i> .....	48
<i>Conclusion</i> .....	48
<b>DISCUSSION</b> .....	<b>49</b>
NOTABLE IMPROVEMENTS.....	49
<i>Risk Perception And Anticipation</i> .....	49
<i>Eye-Hand and Eye-FoOt Coordination</i> .....	49
<i>Improvement in Self-Confidence</i> .....	49
<i>Improvement in Movement Precision</i> .....	50
<i>Improvement in Reactivity to Emergency Situations</i> .....	50
<i>Improvement in Distraction Management</i> .....	51
<i>Comparison with Traditional Methods</i> .....	51
LIMITATIONS .....	51
<b>CONCLUSION</b> .....	<b>52</b>
<b>BIBLIOGRAPHY</b> .....	<b>54</b>
AI – LARGE LANGUAGE MODELS.....	54
GENERAL BIBLIOGRAPHY .....	54
<b>APPENDICES</b> .....	<b>58</b>
DRIVING TEACHER MEETING NOTES.....	58

<i>Meeting #1</i> .....	58
<i>Meeting #2</i> .....	59
GAME MISSIONS FOLDERS.....	60
SELF-ASSESSMENT FORMULAIRE .....	61
<i>Raw Questionnaire</i> .....	61
<i>Simple Table Resume</i> .....	62
INTRODUCTION PRESENTATION TO THE SESSIONS.....	65
SESSIONS ANALYSIS .....	70
<i>Session Recordings</i> .....	70
<i>Written Analysis</i> .....	70

# INTRODUCTION

Over the past twenty years, publicly available driving simulators have gradually progressed in graphics quality, feedback quality and overall experience quality and realism. Racing teams in Formula 1 or World Rallye Championship use simulators to train their pilots. In fact, technology in this segment is at a point where even four times Formula 1 world champion, and driver in the eSport Team Redline Max Verstappen said “I also want to find an opportunity for sim drivers to get into the real world. We all know go-karting and the early steps into racing, they all cost a lot of money.” (Velasco, 2025)

Simulators have been increasingly mobilized in a plethora of fields, from aeronautics to healthcare, due to their ability to provide realistic and immersive training experiences. Driving simulators offer a unique opportunity to expose learners to diverse scenarios and developing specific skills.

This study aims to investigate the role of driving simulators in enhancing eye-hand-foot coordination among new driving and the potential for such systems to replace the first hours of driving in the traditional learning process.

To achieve the answers we want, a mixed-methods approach will be employed. The study will involve experimental sessions where participants will undergo training sessions using driving simulators. Data will be collected through post-session self-report questionnaires, and sessions will be entirely recorded with multiple cameras and screen recording. The collected data will be analyzed using both quantitative and qualitative methods.

Since we are very sensible to motorsport technologies and personally know people who cannot afford driving lessons but need a car to get work, and considering our experience with our own simulator, we thought about translating this perspective to road-driving, and more precisely to driving lessons. By testing the effectiveness of driving simulators in developing eye-hand-foot coordination, this research aims to provide valuable insights for driving schools, policymakers, and technology developers. We hope this idea, if well optimized and integrated, could lower the entry price of the Belgian driving license without sacrificing its quality.

## STATE OF THE ART

Through this state of the art, we intend to analyze the context in which simulation is introduced into learning an activity targeting eye-hand-foot coordination, and especially its effectiveness through various existing mediums. We will also analyze existing studies focusing on automotive simulation specifically.

## CONTEXT AND IMPORTANCE

Automotive driving simulation was developed to lower the high costs associated with field studies, but also to provide a safe and controlled environment where learners can be exposed to various driving situations without risk. This technology has been successfully used in several fields, including aeronautics, rail, and even health, before spreading to the automotive sector. The simulators are used to study the behavior of the operator, vehicle characteristics, and the driving environment (Deniaud, 2017).

The use of simulation in automotive driver training is interesting for several reasons. One we mentioned already is that users can practice in a safe environment, managing complex and potentially dangerous driving situations without the risks associated with real-world driving (Corneloup, 2019).

Driving simulators also help develop high-level skills, such as risk perception and quick decision-making. These skills are a core element of safe and effective driving. Drivers can test their abilities against a virtually infinite quantity of driving scenarios (Corneloup, 2019).

Simulators can provide immediate and personalized feedback to learners through a gamified medium, which is valuable for effective learning. Instructors can use the data collected during simulation sessions to identify where the drivers need improvement and how to adapt their teaching accordingly (Corneloup, 2019).

"The efficiency of skill transfer from simulation to reality in driver training remains too poorly understood. Moreover, this type of learning is relatively expensive." (Deniaud, 2017). Others also doubt the deployment of simulators on a larger scale given their price, exceptionally reaching up to nine figures (Corneloup, 2019).

In summary, simulation can play a crucial role in automotive driver training by providing a safe and controlled environment for the development of essential skills. It not only improves the safety of novice drivers but also enhances the efficiency of driver training. Concerning price, the cost of research-level simulators (up to tens of millions) is very far from publicly available options that could provide most of the feedback needed for our goal.

## SIMULATION EVOLUTION AND TECHNOLOGIES

The evolution of automotive simulation technologies has been driven by the need for safer and more efficient driver training methods. Christophe Deniaud's thesis from 2017 provides very valuable insights into this evolution, specifically focusing on the interactions between immersion, presence, and behavior.

The first development of driving simulators in the 1960s was primarily in research context, focusing on studying driver behavior in a controlled environment. These early simulators were rudimentary, generally lacking the sophisticated feedback mechanisms and realistic scenarios that we have today.

Over the next decades, technology's progression has significantly meliorated the capabilities of driving simulators. The combination of computer graphics, advanced motion systems, and real-time data processing brought more immersive and realistic simulation experiences. These improvements were meaningful in making simulators more effective tools for driver training and research.

One of the focus points in the evolution of automotive simulation technologies has been the enhancement of immersion (immersion refers to the degree to which a simulator can replicate the complex sensory experiences of real-world driving) and presence (presence refers to the psychological sense of "being there", in the simulated environment). Progression in virtual reality (VR) and augmented reality (AR) development has played a significant role in improving these aspects, making the simulation experience more engaging and effective for training purposes.

One last important aspect of the evolution of driving simulators is the improvement of behavioral validity (the extent to which behaviors observed in the simulator reflect real-world driving behaviors). Deniaud's thesis highlights the importance of optimizing experimental

protocols to enhance the ecological validity of driving simulators, ensuring that the skills and behaviors learned in the simulator are transferable to real-world driving situations.

Various types of simulators exist, each having its own set of advantages and disadvantages:

	ADVANTAGES	DISADVANTAGES
Basic Simulators (Single Screen)	<ul style="list-style-type: none"> <li>- Cost-effective</li> <li>- Relatively easy to set up and use</li> <li>- Suitable for basic driver training and educational purposes</li> </ul>	<ul style="list-style-type: none"> <li>- Limited immersion</li> <li>- Lack of physical feedback other than wheel and vibrations</li> <li>- Limited field of view</li> </ul>
Virtual Reality (VR) Simulators	<ul style="list-style-type: none"> <li>- High level of immersion and realism</li> <li>- 360° view of the environment, enhancing the sense of presence and engagement</li> <li>- Stereoscopic vision for better depth perception</li> </ul>	<ul style="list-style-type: none"> <li>- Motion sickness</li> <li>- High-performance computing systems to ensure smooth and realistic graphics</li> <li>- Complex setup</li> </ul>
Simulators With Motion Systems (Triple Screen)	<ul style="list-style-type: none"> <li>- High level of immersion and realism</li> <li>- Can replicate a wide range of driving conditions and scenarios</li> </ul>	<ul style="list-style-type: none"> <li>- High cost</li> <li>- Complex setup &amp; maintenance</li> <li>- Need for sufficient space</li> </ul>
Full-Cab Simulators	<ul style="list-style-type: none"> <li>- Replica of the entire interior of a vehicle, including controls and instruments</li> <li>- High level of immersion and realism</li> <li>- Can replicate a wide range of driving conditions and scenarios</li> <li>- 360° view of the environment, enhancing the sense of presence and engagement</li> </ul>	<ul style="list-style-type: none"> <li>- Very high cost</li> <li>- Significant space requirements</li> <li>- Complex setup &amp; maintenance</li> </ul>

## OTHER SOURCES REVIEW

### EVALUATION METHODOLOGIES

In Deery's article, we noted that novices tend to overestimate their driving skills. This behavior can lead to increased risk-taking. Thus, new drivers are overrepresented in accident statistics (Deery, 1999).

Hatakka, Keskinen, Gregersen, Glad, and Hernetkoski propose in their article a form to gather the feelings of learners. This form focuses on several aspects, including confidence in handling

the steering wheel and their awareness of surrounding traffic. We based our work on these studies to create our own [post-session self-assessment form](#). (Hatakka et al., 2002)

We will also highlight the use of self-assessment forms in this study, although solely focused on its methodology, reinforcing our desire to use a similar tool in our research (Hay et al., 2015). The follow-up to their original document complements their research with encouraging results, albeit centered on individuals over 70 years old: notably, the two cognitive training programs improved the useful field of view of the participants (Hay et al., 2016).

---

## STUDIES FOCUSED ON SIMULATION AND DRIVING

In the article by Ruscio and Daniele, they mention that some games emphasize on visual realism while others focus on realistic driving physics – the same applies to accidents. This is an observation we have been able to make over the years through our own video gaming experimentation. This point will be addressed shortly in the methodology (Ruscio, 2018).

In 2023, the article by Quan, Mansor, Jian, Rahman, Karim, and Weng informs us that their experiment with 26 young learners was conclusive: half prepared by reading printed documents and the other half trained on a driving simulator with custom made scenarios. The learners who used the simulator performed better than the control group. Although similar to our research, we targeted practical learning in driving school rather than theoretical preparation. However, it is interesting to note that the simulator could perhaps allow linking both theoretical and practical learning (Quan et al., 2023).

The authors of a study on elderly individuals aimed at improving their driving ability by playing with the Kinect device connected to an Xbox 360. They observed notable improvements in multiple skills: physical, visual, and cognitive engagement, as well as memory, reactivity, and coordination (Sue et al., 2014).

In the article by Li Li, Rongrong Chen, and Jing Chen, the authors conducted several experiments. Each was carried out with half of the participants being gamers and the other half non-gamers. The results of these experiments are straightforward: those who played even five hours on an action game saw their response amplitude, visuomotor control accuracy, and their ability to stay within a lane – in an automotive simulation – improve significantly (Li et al., 2016).

Additionally, in the research by Howard, Bowden, and Visser from 2023, it was suggested that action game players indeed have better skills when it comes to simulated driving, such as reacting to unexpected events. The results do not stop there as they also observed that action game players are better at lane-keeping and speed management. The authors, however, highlight that distractions remain effective on all participants with the same amplitude. They also point out the gender inequality among the selected subjects, with a greater number of male gamers than female gamers (Howard et al., 2023).

Through Bornard's thesis, we found the division and focus on different aspects of driver training interesting: planning, managing driving situations, mental representations, etc. (Bornard, 2012). While we have chosen a more traditional route for learning – in the sense that we inspired from real driving school methodology –, it seems interesting to try to compare our exercise models one day: one centered on the classical driving school model like ours, and the other focused on more specific exercises.

---

## VIDEO GAMES AND TRANSFERABLE SKILLS

To address potential conservative viewpoints on the usefulness of training with what is essentially a video game – based on reaction from relatives concerning this project –, we considered relevant to include research findings on the effects of video games on players.

Reading Chen and Tsai, we learn that hand-eye coordination differs between children and adults, with children having longer latencies and shorter fixation durations than adults. These observations lead us to reflect on the potential for training young people to better prepare for driving when they reach adulthood, although this is somewhat outside the scope of our study (Chen & Tsai, 2015).

Another document by Gupta, Lawendy, Goldenberg, Grober, Lee, and Perlis teaches us that improvements were observed in robotic surgery and laparoscopy for the people with a history of video gaming. Moreover, this is a relatively substantial study, as it involved no less than 575 participants across 16 studies. Again, an interesting result in the study of the spillover of video game-related skills – particularly hand-eye coordination – into third-party domains (Gupta et al., 2021).

Still in the research related to hand-eye coordination, the study by Gugura, Fischer, Tanțău, and Tefas suggests that video games offer their users better skills in endoscopy – a machine that must be manipulated via a physical interface with video feedback on a screen. The authors emphasize that only twenty hours of gameplay were needed to observe a notable difference in abilities (Gugura et al., 2023).

## CONCLUSION

Through this state of the art, we have explored the role of simulation in the context of automotive driver training, focusing primarily on its effectiveness in enhancing eye-hand coordination and other essential driving skills. The integration of simulation technology in driver education offers a safe, controlled, and immersive environment that bridges the gap between theoretical knowledge and practical application. This approach not only mitigates the risks associated with real-world driving but also provides a safe context for developing important skills such as risk perception, decision-making, and situational awareness.

The evolution of automotive simulation technologies, from rudimentary setups to highly sophisticated systems with virtual and augmented reality, has significantly enhanced the realism and effectiveness of driver training. These advancements have made it possible to replicate a wide range of driving conditions and scenarios, thus improving the behavioral validity and, most importantly in our opinion, transferability of skills learned in simulation to real-world driving situations. Despite the high costs associated with very high-fidelity simulators, the development of more accessible and cost-effective simulators opens the door to more suitable options to democratize the benefits of simulation-based training at a larger scale.

Our review of our sources has highlighted the importance of self-assessment and feedback in the learning process. Studies have shown that novices often overestimate their driving skills, which can lead to increased risk-taking behaviors. The use of self-assessment forms and personalized feedback mechanisms can help learners recognize their strengths but also areas for improvement, thereby building a more effective and reflective learning experience.

Moreover, the exploration of video games and their potential to improve transferable skills such as hand-eye coordination has opened new avenues for enhancing driver training programs. Research has demonstrated that action video game players exhibit better visuomotor control

and lane-keeping abilities, suggesting that gamified learning environments can be beneficial in developing the cognitive and motor skills necessary for safe driving.

## METHODOLOGICAL FRAMEWORK

### SAMPLE

First of all, we decided to work with a sample of four participants. We made it a point to maintain gender parity for this project: we have two men and two women. None of them possess a driver's license or have only obtained a provisional license. They have no prior driving experience through a driving school or self-taught methods.

We did not penalize individuals with video game experience or those who have previously used a car simulator, as long as they do not regularly practice on this medium (i.e., less than 6 hours per year on a simulator). We know that gamers will have better reflexes and general coordination skills (Li et al., 2016) but figured this is representative of the general population.

We selected the participants from our acquaintances since the simulator is located at our residence. However, we aimed to include as diverse a range of profiles as possible. The selected individuals are **Fabrice**, **Karima**, **Sébastien**, and **Véronique** (these are pseudonyms).

- **Fabrice** is a 24-year-old student in his final year of a Master's program in the ESPO faculty at UCLouvain. He has lived in the city for several years and primarily uses public transportation and bicycles to get around. He drove on a simulator once a year ago.
- **Karima** is an 18-year-old young woman in her final year of secondary school. She lives in a peri-urban area with limited access to public transportation. She drove once with her father in a parking lot after obtaining her provisional license.
- **Sébastien** is a 28-year-old man who has been in Belgium for two years. Originally from Sub-Saharan Africa, he studied for three years in Russia before coming to Belgium. Here, he is completing a Master's degree in ESPO at UCLouvain. He drove a little with a relative in his home country but does not have particularly good memories of it.
- **Véronique** is a 51-year-old woman and a mother. She holds a degree in social psychology. She has lived in the city for several years and has generally relied on public

transportation networks to get around. She briefly drove with her father more than twenty years ago.

Ideally, it would have been beneficial to have a control group to test the performance of each group when handling a car. Due to time and resource constraints, we acknowledge this limitation and will discuss it in the conclusion of this thesis. However, we decided to contact a professional in the field to get feedback on the participants' progress, but we will discuss this later.

4 participants, gender parity and variety of profiles <del>Full driver's license</del> <del>Driving school or self taught</del> Experience with video games or occasional use of simulators is acceptable
--

## PHYSICAL MEDIUM

*All gear presented here have been purchased by us, with our own money.*

*These brands have no participation or association with this project.*

The study will focus on a simulator that we have set up. It is a driving simulator equipped with a Fanatec CSL DD steering wheel featuring a Boost Kit, providing powerful (8 Nm) and precise force feedback (Direct Drive). The Direct Drive technology offers much more responsiveness and precision than the older, more generally used, belt-driven systems. Regarding the pedal set, it is an inverted (mounted upside down like in most cars) CSL pedals kit with clutch and loadcell brake pedal from Fanatec, with a 3DRap polymer bushing mod for a lighter brake feeling and a clutch & throttle upgrade kit (Rev3) from Race Sim Engineering for a more immersive clutch and accelerator experience. The use of haptic feedback in the pedals, thanks to the Simagic HPR system (more powerful P-HPR on the brake and lighter HPR Neo on the gas), also allows for experiencing effects like ABS in the brake pedal, among other features. Here are the haptic feedback settings for the pedals (clutch vibration motor wasn't used during the sessions):

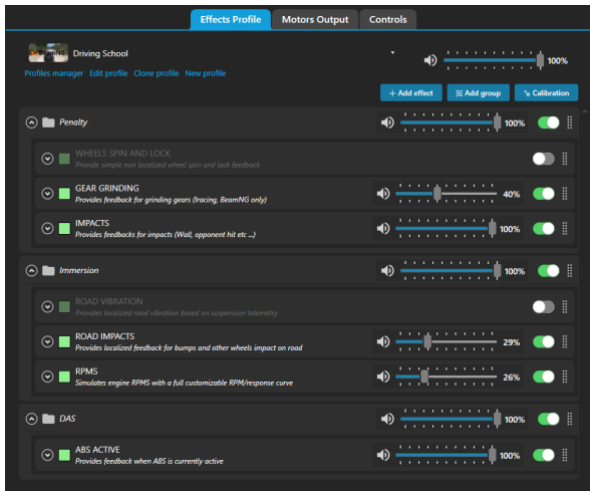


Figure 1

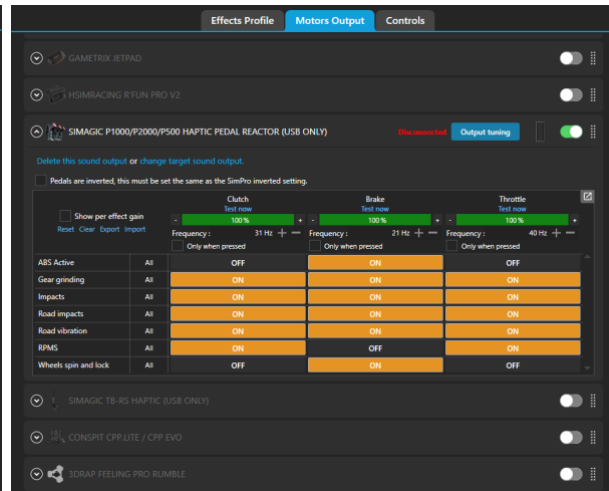


Figure 2

Also used are the Simagic DS-8X shifter and a Moza HBP handbrake (which does not have a locking mechanism). The entire setup is mounted on an extremely rigid chassis made of aluminum profiles from Trak Racer: TR120. The computer running the simulation is equipped with recent mid-range high-performance components, including an AMD RX 6700XT graphics card, a lightly overclocked tenth-generation Intel i5 processor, and 32 gigabytes of RAM. The game is running on a gen4 NVME SSD. The game is displayed on a 55-inch, 60Hz television placed approximately 1.40 meters from the player resulting in a FOV (Field Of View) of around 72° in game, which is narrow but will be discussed later in the limits of this study. The sound comes from a 60 Watts Logitech stereo (2.1) speakers set.

### Driving Simulator

Fanatec CSL DD Boost Kit (8Nm) – CSL Pedals + Clutch and mods – Haptic Motors – Simagic DS-8X – Moza Handbrake – Trak Racer TR120 Chassis

### Computer

RX 6700XT – 10th Gen i5 – 32GB 3000Hz – NVME SSD – 55-inch 60Hz TV (± 1.40 meters from the player) – 2.1 Speaker System

## VIRTUAL MEDIUM

Many driving simulation games exist. However, only a few provide the resources and documentation necessary to create custom missions. Assetto Corsa allows for driving around

freely but is limited in terms of scripting and scenario creation, with modifications and modding conversations happening through Discord servers or enthusiast forums. While there is information, it is hard to separate the good from the bad, and Discord servers are especially hard to navigate. Games like rFactor, iRacing, Need for Speed, and many others offer little to no modding capabilities. On the other hand, [BeamNG.drive](#) is a game that not only offers realistic driving mechanics but also boasts [extensive documentation](#) provided by the company directly and on [forums](#) by the community. Appreciating this approach to making creation and modding accessible, we decided to proceed with BeamNG.drive as our primary platform. Additionally, this game provides unparalleled realism in terms of physics: every accident impacts the vehicle's components in an extremely faithful manner. The game has been in constant development since its first public demo in 2013, with substantial updates approximately every three months. The traffic in the game is relatively realistic, as it serves as a learning base for companies developing autopilot systems for cars. On another note, BeamNG is also well suited for business-to-business implementation through their branch BeamNG.Tech if companies want to explore this idea at larger scales.

During our preliminary informal observations, players tend to take more risks in games where accidents do not damage the vehicle. Here, all the players we observed reduced their speed and risk-taking as their game sessions progressed. We believe this change in behavior is potentially due to the risk involved in the event of a crash.

Furthermore, we had the opportunity to work with the BeamNG.drive and BeamNG.tech teams as interns for four months to create the educational support used for this thesis. Indeed, we personally built the missions used within the framework of this research. However, on a transparency note, we had free rein regarding the project's approach: the BeamNG teams were only interested in the academic results of this project concerning their simulator's use in driving teaching context. They also wanted to see how accessible their mission creation process was for newcomers. Their distant participation did not alter the direction or the values upheld by this thesis since work started in 2024.

---

## GRADING AND EVALUATION

Regrettably, the game currently only has a very basic driving learning mode. Thanks to 250 hours dedicated to creating missions, we now have the necessary support for this study. This being said, we could not add a grading system in this short amount of time. The missions are

scripted for the most part but moving traffic. This method allows us to have a point of comparison between learners, unlike a random open world.

Due to time constraints, we decided to focus on a post-session evaluation. In the appendices, we have compiled all [observations with their corresponding timecodes](#). At the end of each session, we also had learners complete a [self-assessment questionnaire](#) to attempt to quantify their confidence level as the sessions progressed.

As our driving skills were not sufficient to evaluate the learners' level, we consulted with a professional in the field. This way, we were able to judge the progress level of our learners in comparison with driving school students. We organized two calls: during the building phase and after the experience.

Post session analysis Self-assessment form Professional driving instructor feedback
---

## EXTERNAL RESOURCE(S)

Among the external resources we mobilized, we contacted a driving school instructor. We discussed with him the difficulties encountered during learning, the points on which we could focus our attention during the research, and potentially which direction to explore to best assist learners. Although we could not rely on his presence during the sessions, we obtained his feedback after the sessions to get his insights on the participants' progress.

## SESSIONS ORGANIZATION

The sessions will number three per participant and will be limited to a maximum of one session per day to avoid overloading the learners (see our [driving teacher meeting notes](#)). We had planned for a total of maximum two hours per session, but in practice, they lasted on average one hour and ten minutes approximatively (with the first session being the shortest and the last one the longest).

The vehicle we chose to use is BeamNG's take of a compact western European economic car, the Cherrier Vivace (Figure 3). It has 110 horsepower and is front wheel drive like most driving

school vehicles. It is a manual car too, as this is still the most used transmission system for driving licenses in Belgium.



Figure 3

For the environment, we chose « Italy » (Figure 4). It is the only large European map in BeamNG as of July 2025, which was an important factor considering this study is being conducted in Belgium with mostly Belgian citizens. Maneuvering can be challenging in Italy: In the mountains, the roads are narrow, and visibility is limited. However, the map also has a highway and more open routes. The elevation changes add another level of difficulty, but the view is worth it.



Figure 4

The idea was to choose a “Driving Center” location in Norte (northern village of the map). With this setup, we have something immersive with a repetitive starting and finishing zone. This way, we can test different scenarios through the map while maintaining some sort of routine, hoping it would give the students good driving habits.

<p style="text-align: center;"><u>Vehicle</u> Cherrier Vivace 110 M</p> <p style="text-align: center;"><u>Map</u> Italy (If Not Specified)</p> <p style="text-align: center;"><u>Transmission Mode</u> Realistic Mode</p>
---

The first session will be exploratory first. Then the students will learn to manage a car through different environments. Second session will focus on parking and low speed maneuvers and will also be the first time driving with traffic enabled. Finally, third one will take the students to a tour of the whole map while still managing the traffic, ending in a parking exercise.

**My goal is to not interfere with the experience, or at least less is better. This implies teaching everything needed through the game. I will still be available if help is needed or if the player has some major difficulties.**

---

## FIRST SESSION | 45 MIN

---

### INTRODUCTION – 5 MIN

The first session begins with a [presentation](#) on the controls (pedals, gearbox, steering wheel, buttons on the steering wheel) and the user interface (task list, checkpoints, parking spots). Since the learners are not necessarily video game players or educated on the basic controls of a vehicle, it seemed necessary to cover this at the beginning of the test.

---

### LESSON 0 – 15 MIN

#### **Grid Map – Traffic OFF**

The learner will start by familiarizing themselves with the controls on BeamNG's « Grid Map V2 ». They will also quickly experience the realistic physical response of the game. This way they can manipulate and feel the pedals and the steering force feedback and vibrations without stress or constraints. This idea comes from the first step of the Rally School from Richard Burns Rally which let the player try the car in an open environment freely without having to worry on any objective.

I believe this introduction is conducive to fostering the learner's discovery and excitement, keeping them motivated to improve their hand-eye-foot coordination without overthinking it.

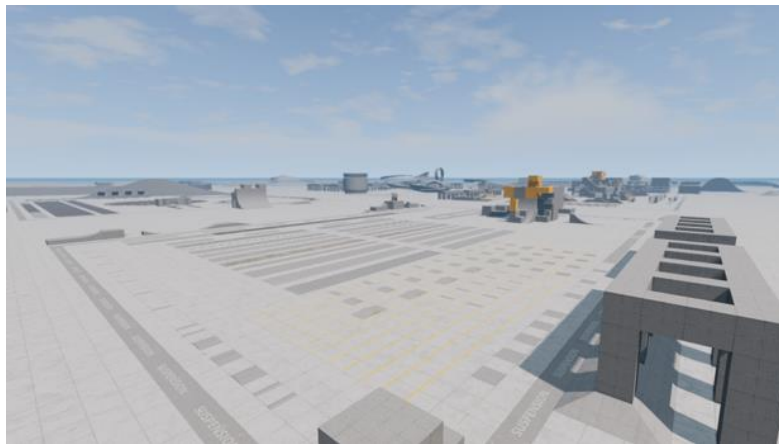


Figure 5

*Grid Map is a physics test map with the only limit being imagination. It is the perfect playground to test the physics of the game by crashing into everything.*

The Lesson starts with a task list that the user needs to complete to start the mission. The list is arranged like the following:

- Maintain the CLUTCH
- Start the ENGINE
- Use the BRAKE
- Use the THROTTLE
- Get in FIRST GEAR

If the player does not hold the clutch at the start, they will not be able to progress through the task list. They will then need to press the clutch again and restart the car. Additionally, when accelerating for the first time, they must use the clutch and accelerator simultaneously. If this is not done correctly, the task list will remain on the screen. This setup is not ideal, but it was the best we could implement given our constraints. We will discuss the technical limitations further in the [designated section](#).

Then, the student will be able to move freely around for 10 minutes to get a better understanding of the driving experience.

Depending on everyone's learning speed, this first stage should last between 10 to 15 minutes.

---

## LESSON 1 – 25 MIN

### Traffic OFF

The learner will now learn how to manipulate a car through a fictional small European city.

### TASKS

---

#### 1. In a straight line (Italy port)

- 1.1. While stopped, maintain the clutch and engage the first gear.
- 1.2. Relax the clutch progressively to let the car start rolling.
- 1.3. Use the gas to compensate for the lack of power.



Figure 6

- 1.4. Turn right at the end of the pier in direction of the docks.



Figure 7

#### 2. Reverse

- 2.1. At the end of the road, stop the vehicle.



Figure 8

2.2. Turn around by using reverse (Figure 9). If the player isn't parked correctly on the spot, the game displays a top view of the vehicle to better visualize the situation (Figure 10).



Figure 9



Figure 10

### 3. Back to Office

3.1. Follow the guide and get to the driving center office. Also, the player should still respect one-way roads, for which I set a trap up (Figure 12). It proved to be very effective later.



Figure 11 – Driving through Norte



Figure 12 – Without visible checkpoints, the driver should go forward. Here, the road in front is a one-way road and the driver should follow the main axis on the right.

### 3.2. Park in the parking space in front of the office.



Figure 13



Figure 14 – Using the far left camera angle to judge distances with the parked car.



Figure 15 – This first parking spot is wide and tolerant, but it won't be the case for the following exercises.

## MISSING

---

- Gameplay/UI
  - Graphic implementation of steering/pedals when instructed.
  - Oral instructions (like the ones currently used in rally mode).
  - Visual instructions other than checkpoint.
  - Count every time a gear is missed for post-session result.
  - Count the amount of clutch being massacred (even when the car gets respawned, not go back to 0) for post-session result.
  - A smoothness score: a statistic measure of each pedal input and steering to see if jerkiness lowers through time and sessions.

---

## SECOND SESSION | 1H30

### INTRODUCTION

Recap of the last session and introduction of the day's session (map & traffic).

---

## LESSON 2 – 90 MIN

### Traffic ON

This time, the player will have to navigate through traffic in direction of the airport. This includes a highway section. Once at the airport's parking, the driver will have to park in front/rear-facing parking spots with some cars parked around. Then, the player will have to follow directions until reaching Norte to then park at the “Driving Center” location.

### TASKS

---



1. Start the car.
2. Exit the Driving Center parking.



Figure 16

3. Follow the checkpoints until reaching the airport's parking challenges.



Figure 17



Figure 18

4. Parking in all five parking spaces respecting orientation.

4.1. The first parking space (Figure 19) has a car on the side and must be entered in reverse (watch for the [P] symbol on the orange decal to know which orientation to choose).



Figure 19

4.2. The second parking spot (Figure 20) also has a car on the side and must be entered going forward.



Figure 20

4.3. The third parking space (Figure 21) is sandwiched in-between two vehicles and must be entered by going in reverse.



Figure 21

If the player gets in the spot in the wrong orientation, a message will be displayed on the screen saying: « Wrong Way! » (Figure 22)

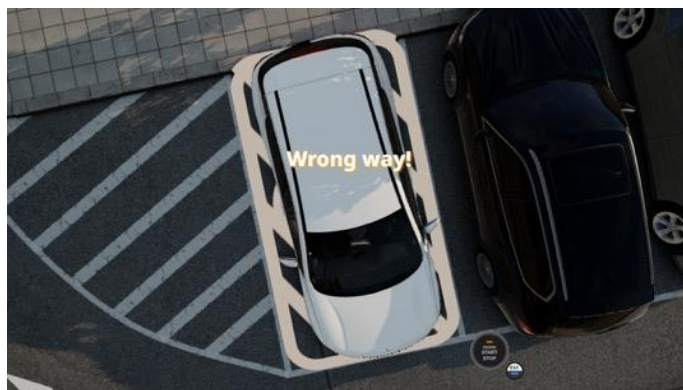


Figure 22 – Wrong Way!

4.4. The fourth parking spot (Figure 23) is also between two cars and must be entered going forward.



Figure 23

4.5. The fifth and final parking space (Figure 24) has only one car on the side and must be entered forward, but it has a twist: this spot is the first of the row and there is a curved wall on the other side, making it very difficult to maneuver.



Figure 24

5. Drive to the Norte by following directions to the city.



Figure 25



Figure 26

6. Once in Norte, follow the checkpoints to reach the Driving Center.



Figure 27



Figure 28

7. Park in the dedicated parking spot (Figure 29) in the right orientation.



Figure 29

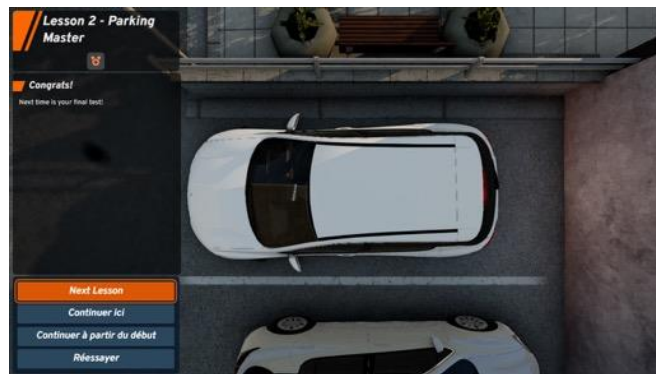


Figure 30

## MISSING

---

- Gameplay/UI
  - 100% score if no car is touched, loses 12.5% per contact (tbd).
  - Penalize if stops are not done well (if the car doesn't stop to 0kph).

---

## THIRD SESSION | 1H45

---

### INTRODUCTION

Recap of the last session and introduction to the day's session.

---

### LESSON 3 (FINAL EXAM) – 105 MIN

This is the final boss, a somewhat chill drive through Italy's scenery. We'll head to Citta Vecchia, then Castelletto, and come back to the office in Norte. Once at the office, we'll train parking again. There will be 4 different spaces, the last one being a parallel parking exercise.

## TASKS

---



1. Start the car.
2. Exit the Driving Center parking.



Figure 31

3. Drive through the following checkpoints until reaching the driving center.



Figure 32



Figure 33 – Crash prompt « Press [linked button] to fix your vehicle »

4. Once back to the Driving Center, park in the different spots in the right orientation.
  - 4.1. First parking spot (Figure 34) has a car on the left and a wall on the right. It must be entered by going forward.



Figure 34

- 4.2. Second parking spot (Figure 35) is on the other side of the parked car and must be entered in reverse.



Figure 35

- 4.3. Third parking spot (Figure 36) is on the other side of the parking lot and must be entered in reverse. Again, the spot is in-between a car and a wall.



Figure 36

4.4. Fourth and last spot (Figure 37) is a parallel parking exercise like the one from [Lesson 1](#). Only this time the spot is much narrower, forcing the player to be more precise with the inputs.



Figure 37



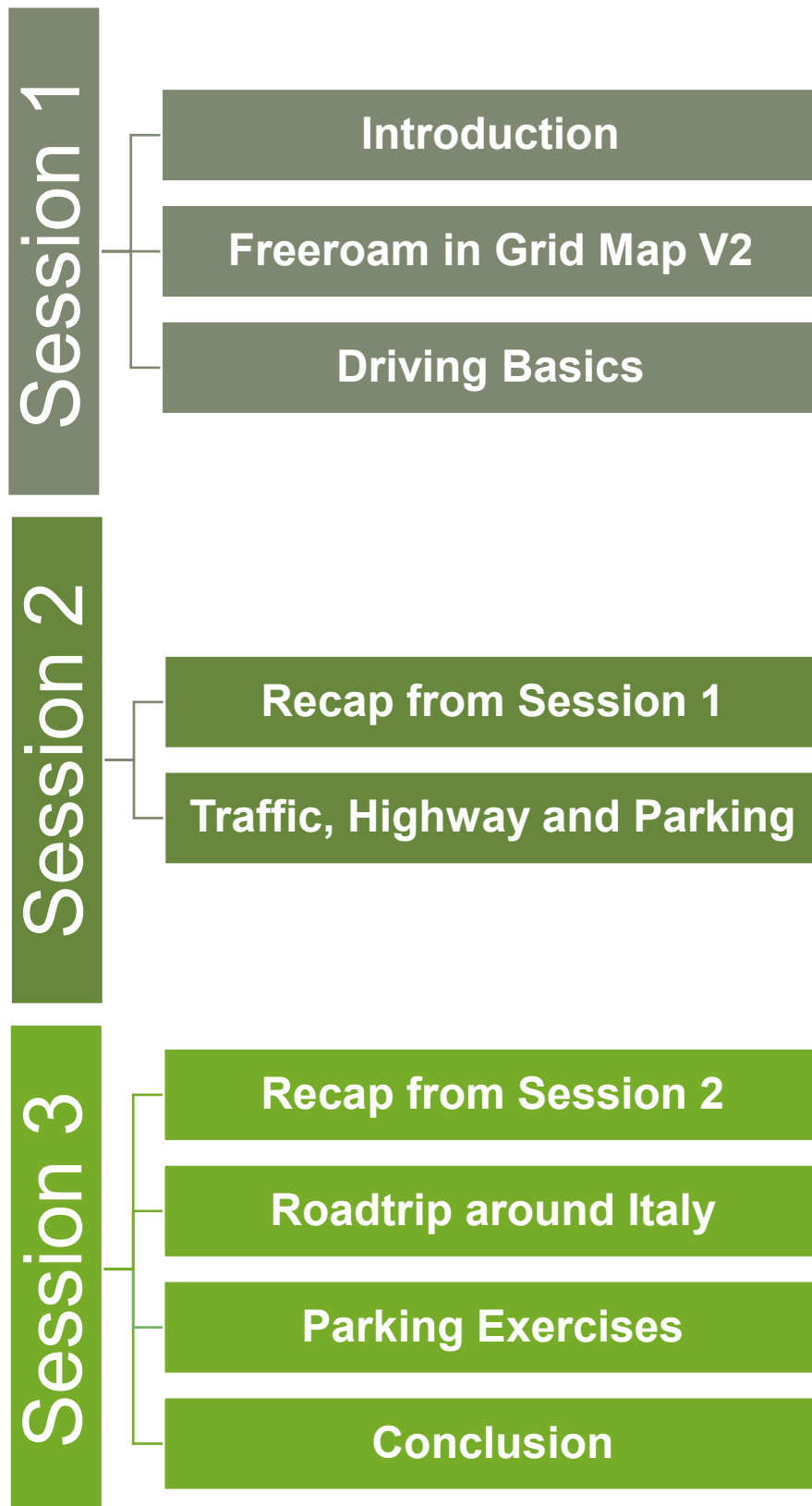
Figure 38

## MISSING

---

- Gameplay/UI
  - Automated traffic cars for close calls (passes a stop, speeding, abrupt lane change, etc) to see reaction of the player

Discussion with the learner regarding the sessions and their overall feelings.



# HYPOTHESES

## RISK PERCEPTION AND ANTICIPATION

1. The use of driving simulation improves risk perception and anticipation in new drivers.

## EYE-HAND AND EYE-FOOT COORDINATION

2. The use of driving simulation improves the smoothness of hand-eye and foot-eye coordination in new drivers.

## IMPROVEMENT IN SELF-CONFIDENCE

3. The use of a driving simulator increases the self-confidence of new drivers in their driving abilities.

## IMPROVEMENT IN MOVEMENT PRECISION

4. The use of a driving simulator improves the precision of driving movements, such as parking and low-speed maneuvers.

## IMPROVEMENT IN REACTIVITY TO EMERGENCY SITUATIONS

5. The use of a driving simulator improves the reactivity of new drivers in simulated emergency situations.

## IMPROVEMENT IN DISTRACTION MANAGEMENT

6. The use of a driving simulator improves the ability of new drivers to manage distractions while driving.

## COMPARISON WITH TRADITIONAL METHODS

7. The skills of learners using the driving simulator are equivalent or superior to those of driving school students with the same number of driving hours.

# RESULTS

## FABRICE

### SESSION 1

During his first session, several observations were made. Initially, he was not very familiar with the pedals and confused the clutch pedal. However, we had reviewed – perhaps too quickly – all the controls with a [presentation and visual support](#). This oversight made the initial starts and gear changes somewhat complicated. Often, he would forget to engage the clutch during gear changes and when stopping. Consequently, the car would frequently stall, and he would strain the gearbox quickly – even to the point of completely destroying a gear during Lesson 0. Yet, the haptic and sound effects dedicated to gear shift failures were fully functional. Additionally, he did not realize when he reached the rev limiter and would remain stuck in first gear at X km/h without shifting to a higher gear. Even when starting or at low speeds, he tended to rev the engine up to the limiter and then abruptly release the clutch, causing the vehicle to accelerate suddenly.

Regarding maneuvers, Fabrice showed certain difficulties in managing space and distances. The camera management with the joystick did not make the exercise easier: by turning the camera completely inside the vehicle, the view was slightly off-axis since the camera was positioned at the driver's head level. Fabrice also did not push the camera all the way, making it even more off-axis. He positioned himself far from the other vehicles which did not facilitate the parallel parking maneuver. For this maneuver, he needed my assistance to guide him into the parking space.

Visual cues were also a point of difficulty: He did not see the second checkpoint of Lesson 1 at the end of the pier and continued straight ahead.

Fabrice deliberately crashed in Lesson 0 for fun, which was not the case for all participants. He approached the exercise with a lot of patience, which could be detrimental during the parking maneuver exercise: sometimes it is easier to go back to the starting point rather than trying to correct initial poor maneuvers. This is also a behavior that other learners exhibited.

Finally, some of the mentioned problems might perhaps be corrected with a haptic motor under the gear lever – for miss-shifts – or a motion rig system to feel the jerks when the car stalls for example.

---

## SESSION 2

During Fabrice’s second session, several trends and behaviors were observed, highlighting both significant progress and persistent challenges.

The learner began with a perfect start but later struggled with stalling on an incline. Struck by panic – albeit to a limited extent – he got confused with the gears and engaged second instead of first, leading to an accident. Later, on the highway, he remained in third gear at high RPM for an extended period, which may indicate a lack of understanding of gear-shifting principles relative to the car’s speed.

Regarding checkpoints, he again had difficulty distinguishing them – it is worth noting that this feedback was passed on to the BeamNG teams, and the icons have already been updated in the latest release, so we can expect new checkpoint designs to appear *soon*. He also struggled to understand the directional signs to reach Norte, resulting in multiple roundabout loops and U-turns.

Low-speed maneuvers remained challenging, with difficulties in positioning correctly and poor steering control. From my point of view, it is highly likely that the camera management – whose rotation is rather slow – disoriented him in choosing his direction. As such, I am not certain that a triple-screen setup would resolve this issue. However, I believe that VR could be a viable solution in this context.

Continuing with camera management issues, he often forgot to recenter the camera by pressing the joystick. This oversight forced him to manually adjust the camera, resulting in an off-axis view. He also failed to gauge distances from obstacles and did not realize that the airport parking lanes were one-way.

Despite these challenges, Fabrice showed signs of improvement. He managed to park after several attempts and eventually used the left side view – simulating the driver leaning out the window. He still required guidance on a few occasions. Perhaps dedicated, step-by-step exercises could be beneficial.

In summary, this second session revealed progress but also areas for further improvement.

---

## SESSION 3

Fabrice's third session brought new progress and confirmed some of the previously identified difficulties.

Although not mentioned earlier, Fabrice improved in maintaining his lane. He tended to turn the steering wheel for too long and then overcorrect by straightening it. Now, he only struggled with tight turns or hairpins but stayed well within his lane despite the lack of road markings on the narrow mountain roads.

This third session was a real test of hill starts. He stalled several times but demonstrated adaptability after a few unsuccessful attempts. I also taught him a hill-start technique using the handbrake, given the steep slopes available in the Italy map.

Traffic was another particularly challenging element to manage on these small roads. He had a minor collision with a car that failed to yield his right-of-way – he was not at fault and hardly avoidable. Additionally, due to the difficulties with camera management, intersections became a game of chance given the lack of visibility. It is also worth noting that, because camera movements are rather slow, other learners were sometimes caught off guard by traffic despite careful observation. Therefore, I would argue that this issue stems more from the physical limitations of the setup than from the learner. A triple-screen or VR system would resolve this problem.

On steep inclines, Fabrice primarily used first gear to feel more comfortable. In my opinion, in this context – with steep roads that we do not encounter in Belgium but are common in my home country – using first gear is not always a mistake, especially with vehicles that have low-torque engines.

The final maneuvers were also challenging, as he repeated mistakes from Session 2: he would turn the steering wheel the wrong way and persist too long when sometimes returning to the starting point could have helped him approach parking more effectively. Nevertheless, he succeeded with a little help from my side.

Overall, Fabrice showed progress in managing hill starts and maintaining his trajectory. However, maneuvers remain a challenge, as well as smoother than in previous sessions.

---

## CONCLUSION

Our analysis of Fabrice's sessions reveals notable progress in his driving skills despite some persistent challenges. Basic understanding is now acquired, including hill starts and lane maintenance. However, low-speed maneuvers remain difficult, and distance management and camera control are areas that still require some work.

## KARIMA

---

### SESSION 1

During her first session, Karima demonstrated a certain ease with the base controls. Starting the vehicle did not pose a problem. However, clutch and accelerator management was not yet mastered: she sometimes released the clutch too abruptly, causing the car to stall. She displayed exploratory curiosity by attempting to climb obstacles and deliberately causing accidents to test the vehicle's reactions, describing these experiments as "satisfying."

Checkpoints and road signs proved challenging for Karima; she occasionally missed checkpoints and overlooked "no-entry" signs. Her imprecise trajectories led to avoidable collisions. During parking maneuvers, she struggled to estimate distances and position herself correctly without assistance. Despite multiple attempts, she required guidance for parallel parking.

Camera management was also a weak point, in part due to forgetting to recenter it. Like Fabrice, she tended to persist with poorly initiated maneuvers rather than starting over.

During this session, I taught her the hill-start technique using the handbrake, which she quickly mastered.

---

### SESSION 2

Karima made progress during her second session, though some challenges persist. She is more confident but not always attentive, and her spatial management is sometimes not optimal.

Gear shifting, starting, and lane maintenance were generally good, but parking maneuvers remained a challenge. Poor distance management and camera control led her to collide with obstacles. For example, she hit a wall while reversing, even as she verbally acknowledged the risk. From my perspective, this specific case stems from the absence of consequences upon contact, which could be addressed with a scoring system based on vehicle damage or impacts. I also taught her how to straighten her steering wheel by turning it fully to the lock and then centering it twice. This technique was also taught to the other learners.

She also drove off the road due to a lack of anticipation for the turn and misreading signs. In her defense, reading signs from a distance on a 1080p screen is not always easy due to poor pixel density. During this part of the session, she also missed the airport roundabout exit, forcing her to make a U-turn further ahead. She handled the situation calmly.

Overall, Karima showed a tendency toward overconfidence, leading to several sometimes severe accidents. She eventually adjusted her speed when entering turns for the remainder of the drive.

In summary, Karima has improved in mastering controls and basic techniques like hill starts but still needs to work on distance management, patience, and better observation of her surroundings.

---

## SESSION 3

Karima's third session highlighted improved confidence and reduced risk-taking. She started without difficulty and demonstrated better gear control, smoothly shifting from first to second on steep roads – a sign of adaptation to the engine's power and road conditions. However, she continued to struggle with maintaining her trajectory, particularly in tight turns and on narrow roads, where she tended to scrape against obstacles or drive over the opposite lane. These errors were often due to late steering corrections or poor estimation of available space.

Starting remained effortless, and she also handled gear changes more effectively, adapting to slopes and turns.

Regarding traffic, she adapted much better, for example by braking preventively when approaching a traffic jam in Fastello. Despite this, she had several minor collisions in a row at a particularly tricky mountain turn. Apart from this isolated case, she drove cautiously overall.

Hill starts no longer pose a challenge for her: nearly every attempt was successful. However, parallel parking remains difficult, and she required my assistance. As before, she tried to "save" a poorly initiated maneuver rather than restarting, often complicating the task.

In summary, Karima's third session shows progress in reactivity and confidence, but camera management and distance judgment remain challenges to surpass.

---

## CONCLUSION

The analysis of Karima's sessions reveals clear progress: basic controls and techniques such as hill starts are among her strongest skills, but maneuvers and distance management remain her most persistent challenges.

Her initial ease during the first session and her early overconfidence have gradually adjusted, which aligns with the results of her self-assessment questionnaires – which started strong but stayed moreover at the same level afterwards. While she can still improve her patience and precision, her progression is following a strong, positive trajectory.

## SEBASTIEN

---

### SESSION 1

During his first session, Sébastien started without difficulty and generally managed gear shifts well. Although he was fairly comfortable with the controls, he quickly encountered challenges with lane maintenance: he swerved frequently and struggled to keep the vehicle in a straight line. He also tended to underuse the steering wheel, turning too little during turns or maneuvers.

Camera management was also a challenge for Sébastien: he often forgot to recenter it, further disrupting his spatial perception. He stalled multiple times, including on inclines, often due to poor gear selection, like shifting too early and ending up in fourth gear at 40 km/h. However, following restarts went smoothly.

His impatience was the factor that worked most against him. He would sigh and try to rush when struggling with maneuvers. When he finally succeeded in parking, he expressed visible joy, highlighting his motivation to overcome obstacles. Signs and checkpoints also posed

problems during the lesson, as he missed several indications and took the notorious one-way trap.

Improving his gear management and patience were the main focus areas for future sessions.

---

## SESSION 2

During this second session, Sébastien confirmed his abilities considering starting and gear management, but his struggles with lane maintenance and frustration persisted.

His overconfidence led him to drive up to 100 km/h on a small road, resulting in accidents or loss of control, particularly in turns. His difficulties in maintaining his vehicle's trajectory worsened on the highway, where he frequently drove over adjacent lanes. Parking maneuvers remained problematic, with collisions into obstacles and vehicles partly due to poor distance estimation and insufficient steering.

These perception errors were also reflected in his confusion with directional signs, leading him onto the wrong route. Nevertheless, he effectively applied my occasional tips, such as the steering wheel recentering technique, and clearly expressed great satisfaction upon success, indicating his motivation remains intact.

This second session highlighted the need to improve his anticipation, further moderate his frustration, and enhance his camera usage and gear management based on context.

---

## SESSION 3

The final session revealed progress in traffic management but still highlighted Sébastien's impatience and lack of precision.

His biggest challenge stemmed from inattention during gear changes: on multiple occasions, he collided with an obstacle or veered off course while shifting. When questioned, he finally explained that he was distracted by the gear display on the dashboard. He wanted to ensure he had selected the correct gear and focused on the display rather than the road. Maintaining his trajectory remained complex, especially on the particularly narrow and technical route.

Once again, Sébastien took a one-way street and struggled to adapt his speed to conditions, such as descending in neutral. Despite these errors, he was receptive to guidance, particularly during parking exercises, where he ultimately succeeded with assisted coaching.

---

## CONCLUSION

Sébastien has definitely improved, though several major points still require attention, particularly patience and focus.

From the first session, Sébastien demonstrated ease with gears and starting, but weaknesses in maintaining trajectories, camera management, and a tendency toward impatience complicated his maneuvers. These challenges persisted in the second session, where overconfidence and inattention – especially to signs – resulted in trajectory errors and avoidable accidents. His lack of patience often led to accidents, and in his haste, he would repeat the same mistake shortly afterward to make up for lost time. Nevertheless, his motivation remains high, as evidenced by his positive reactions to successes.

Inattention during gear changes is potentially his greatest challenge. As previously [discussed with the expert](#), learner inattention during gear shifts is a common issue in driving lessons. Adapting speed to driving context is another area where the learner has improved but still requires careful attention.

Overall, Sébastien has made technical progress, but certain shortcomings prevent him from feeling fully at ease and ensuring safe driving.

## VÉRONIQUE

---

### SESSION 1

Véronique's first session focused on methodical learning and caution. She used the first few minutes of Lesson 0 to familiarize herself with the controls at her own pace, repeating stops and starts. She preferred to avoid accidents, as these caused her anxiety.

Véronique also asked many technical questions, reflecting a desire to understand the mechanical implications of each input. However, she showed gaps in distance estimation and

steering, particularly by turning the wheel for too long in turns, leading to overcorrections like Fabrice. She also struggled with the user interface, missing checkpoints multiple times.

U-turn and parallel parking were difficult, mainly due to poor distance management but also confusion – such as accelerating instead of braking. She took the one-way trap like most other learners. Though she expressed some frustration, she enjoyed overcoming her challenges and demonstrated perseverance like when she got stuck on a curb against a tree and took her time to free herself.

This session highlighted Véronique's need to work on the fluidity of her movements, camera management, and more rigorous observation of visual cues. Her composed and thoughtful attitude and her questions indicate a willingness to improve, but reinforcing her precision and confidence in maneuvers would be beneficial.

---

## SESSION 2

The second session confirmed Véronique's caution behind the wheel, but challenges in coordination and spatial perception persisted. Starting and gear shifting were no longer issues, but maneuvers remained a hurdle. In the driving school parking lot, she hit a wall due to poorly adjusted steering and misjudgment of her surroundings. The camera was still a weak point, as she struggled to manipulate it, especially when looking backward. This difficulty led to poor steering, often turning the wrong way without realizing it.

Checkpoints were again problematic: she missed some due to inattention or, actually extreme focus on the center of her vision. However, she quickly corrected trajectory or speed adjustment errors. Her limited steering radius, already noted in the first session, was confirmed again. I believe I identified the issue when I noticed she kept her hands fixed on the wheel, preventing her from steering more than a hundred degrees on each side, sometimes even straining her wrists to gain a few extra degrees. This behavior made maneuvers even more complicated.

While consistent improvement was notable, her steering and camera movements still hindered progress in certain areas.

---

## SESSION 3

In this third session, although Véronique remained as cautiously prudent as usual, other difficulties became more pronounced, especially early on.

Hill starts became a challenge, overcome after applying a few well-executed tips, and parking maneuvers – particularly parallel parking – remained a significant obstacle. She still struggled with distinguishing left from right in reverse and required assistance for parking exercises.

However, her lane keeping skills improved and became much more stable, though tight turns and steep descents revealed gaps in anticipation and steering control. She also unknowingly drove in neutral several times. Again, this error was linked to one of the behaviors mentioned by the expert regarding excessive force on the gear lever.

Her responsiveness to traffic improved too, narrowly avoiding an accident thanks to well-calibrated anticipation.

---

## CONCLUSION

Véronique made steady progress throughout the sessions. Her cautious and patient approach allowed her to tackle challenges calmly and with enjoyment. Her eagerness to learn proved to be an asset despite the difficulties she encountered. Her interest in technical details affirmed her desire to learn everything possible to fully understand driving.

However, steering management, distance estimation, and visual information perception were persistent challenges that complicated her learning. These difficulties endured throughout the sessions, although gradual improvements were observed. Her perseverance likely helped her overcome these obstacles.

Complex maneuvers required the most attention. Her hesitation between left and right did not diminish, but her steering radius management improved positively, as did her lane keeping skills.

In conclusion, Véronique developed more stable and methodical driving but still needs to work on the fluidity of her movements, better spatial awareness of the vehicle and its environment, and smoother camera use.

## DISCUSSION

Throughout our research, we directly and indirectly addressed numerous skills related to driving education, as well as gamification and user experience. Our goal was to qualitatively measure the acquisition of essential driving skills in new drivers, with the potential to replace the initial hours of traditional driving school instruction. The results reveal significant insights but also major limitations that nuance our observations.

### NOTABLE IMPROVEMENTS

#### RISK PERCEPTION AND ANTICIPATION

Every learner showed clear progress in these areas between the first and third sessions. For example, Sébastien adjusted his speed to traffic conditions on multiple occasions, as did Karima. Each learned to adapt to traffic and maintained safe following distances naturally. These observations align with Corneloup's findings in 2019, which highlight that simulators enable the development of risk perception skills in a controlled environment. However, the improvement in anticipation remained somewhat limited by the absence of real-world consequences for errors – no physical or material damage – a factor Quan et al. (2023) identify as crucial for skill transfer to real-world driving.

#### EYE-HAND AND EYE-FOOT COORDINATION

All learners showed positive evolution in this domain. For instance, by the third session, Fabrice stalled far less frequently when stopping, and Karima quickly adapted to hill starts, a complex task for new drivers, according to our expert. Véronique also reduced jerky movements, confirming Li et al. results from 2016, which state that even limited exposure to a simulated environment improves visuomotor coordination. Challenges persist, particularly in lane keeping and left/right distinction, as observed with Véronique, Sébastien, and Fabrice.

#### IMPROVEMENT IN SELF-CONFIDENCE

Initially, learners were generally quite confident despite their lack of training, echoing Deery's 1999 study on new drivers' overestimation of their abilities. Over the sessions, their confidence

normalized, with standard deviations much closer to the average the self-assessment forms (Figure 39). They also displayed clear signs of enjoyment, laughing or exclaiming, though frustration was evident in cases like Sébastien and Véronique. This positive engagement may be linked to the gamification of the process (Hatakka et al., 2002).

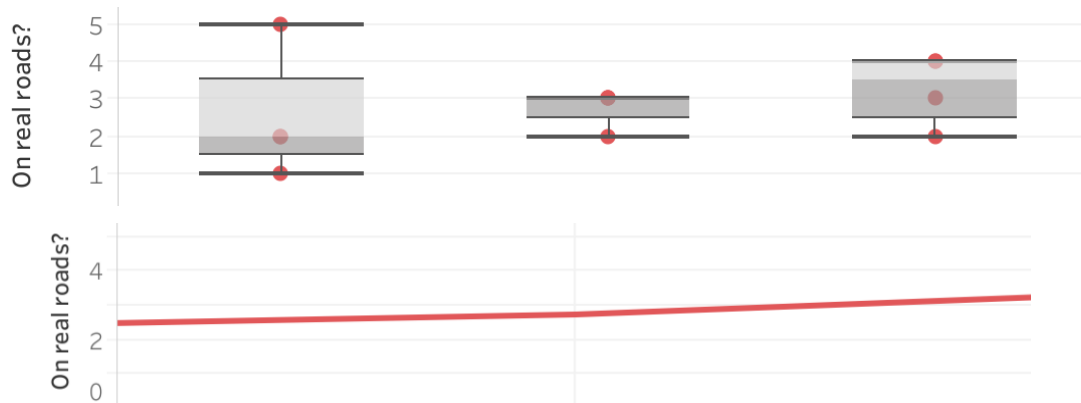


Figure 39

## IMPROVEMENT IN MOVEMENT PRECISION

Steering and camera management remained challenging, particularly for Véronique and Sébastien, who underutilized the steering radius in the first two sessions. While camera management may not directly translate to real-world application, proper steering – including full use of the available steering radius and maintaining lane position – should be transferable. These aspects improved to varying degrees for each participant but often remain a challenge for the future. Low-speed maneuvers proved especially difficult, likely due to the lack of stereoscopy and the limited field of view (72°). Bornard’s 2012 thesis recommends a minimum 120° field of view, achievable only with triple-screen or VR systems.

## IMPROVEMENT IN REACTIVITY TO EMERGENCY SITUATIONS

Emergency response is a partially resolved issue. For example, Fabrice executed a flawless emergency braking in the final session, but others, like Karima and Sébastien, still struggled with spatial awareness of their vehicle’s dimensions, occasionally colliding with walls or vehicles without braking to avoid impact.

---

## IMPROVEMENT IN DISTRACTION MANAGEMENT

Though it was not a widespread issue, Sébastien was frequently distracted by the gear display on his dashboard, leading to multiple accidents and off-road incidents. While the display mimics a real vehicle, simplifying it could reduce distraction risks. On the other hand, this could serve as training for new drivers to focus on the road rather than focusing on distractions.

---

## COMPARISON WITH TRADITIONAL METHODS

Driving simulators offer significant advantages over traditional methods, particularly in allowing learners to master basic skills in a controlled, safe environment. However, limitations such as the lack of rearview mirrors and altered speed perception require pedagogical adaptations. A hybrid approach, combining simulation and real-world driving, appears optimal for developing both eye-hand-foot coordination and anticipatory skills. Our driving instructor noted that learners in simulation can acquire reflexes as quickly but emphasize the importance of real-world exposure for safe driving. Thus, while simulators provide efficiency and safety benefits, their integration should be complemented by on-road sessions to ensure proper skill transfer and, most of all, proper distraction and prediction management.

## LIMITATIONS

This exploratory study has several limitations. The small, convenience-based sample – due to the use of personal equipment at home – may introduce bias. The absence of a control group – constrained by time and cost – would require tracking our learners through a traditional driving school cycle alongside a control group for comparison. From a hardware perspective, the restricted field of view complicated in-car visibility management. The lack of a motion rig may have also limited immersion, particularly during stalls, where learners did not always realize the car had stalled.

Many of these limitations could be addressed in future iterations of this study with greater financial resources or through commercial collaborations with driving schools and simulation equipment manufacturers, though this could introduce transparency challenges.

The session format could be improved by adding specific training scenarios, such as lane-keeping exercises or emergency situation drills. This could also optimize resource allocation:

for example, using VR simulators for low-speed maneuvers and triple-screen setups for the rest of the fleet to reduce costs. Step-by-step parking missions could also be introduced to help with these complicated tasks. An automated scoring system would be beneficial too, tracking errors in trajectory, gear shifts, stops, speeding, and accidents.

Of course, integrating simulators into driving schools will also require instructor training in tool usage and basic maintenance.

While our study confirms the value of simulators for acquiring basic driving skills, it also underscores the need to embed them in a hybrid curriculum, combining virtual and real-world training. The findings open doors for further research, particularly on skill transfer and simulator tool optimization.

## CONCLUSION

Automotive simulation represents a technological advancement in driver education, providing a safe and controlled environment for acquiring essential skills. This study aimed to assess the effectiveness of driving simulators in improving eye-hand-foot coordination and other critical competencies in new drivers. The findings revealed significant improvements in risk perception, anticipation, and movement precision. However, certain limitations – such as hardware constraints and the relevance of mission design – require careful consideration.

The results suggest that while driving simulators offer undeniable advantages in terms of safety and efficiency for learning basic skills, they cannot fully replace traditional driving instruction. A hybrid approach, combining simulator use with real-world driving sessions, appears to be the optimal solution for an effective learning. This method leverages the strengths of both approaches while mitigating their respective limitations.

The study's limits, including its small sample size and lack of a control group, highlight the need for further research to validate and expand these findings. Future studies could examine the impact of simulators on different learner profiles and more precisely evaluate the transfer of simulation-acquired skills to real-world driving. Additionally, the integration of advanced technologies, such as triple screen and motion rigs, could enhance immersion and simulator training effectiveness.

In conclusion, this study confirms the value of simulators for developing foundational driving skills and emphasizes the benefits of their integration into hybrid training programs. The results pave the way for future research on simulator optimization and their incorporation into the driver education curriculum, offering promising prospects for improving the safety, efficiency, and accessibility of learning to drive.

# BIBLIOGRAPHY

## AI – LARGE LANGUAGE MODELS

Mistral's Le Chat was used for assistance in French to English translation. All text exported from this large language model was verified by me to ensure their fidelity to the original text. It was also used for explaining technical terms, searching for scientific articles, and for brainstorming and planning this project.

Adding to this, I am very fond of emdashes and I will not stop using them only because LLM's tend to use them too.

## GENERAL BIBLIOGRAPHY

BeamNG GmbH. (n.d.). *Levels*. BeamNG Documentation. Retrieved July 19, 2025, from [https://documentation.beamng.com/official\\_content/levels/](https://documentation.beamng.com/official_content/levels/)

Bellet, T. (1998). *Modélisation et simulation cognitive de l'opérateur humain: Une application à la conduite automobile* [Thesis, Paris 5]. <https://theses.fr/1998PA05H032>

Blacker, K. J., Curby, K. M., Klobusicky, E., & Chein, J. M. (2014). Effects of action video game training on visual working memory. *Journal of Experimental Psychology: Human Perception and Performance*, 40(5), 1992–2004. <https://doi.org/10.1037/a0037556>

Bornard, J.-C. (2012). *Développement d'un modèle du conducteur automobile: De la modélisation cognitive à la simulation numérique* [Phdthesis, Université Sciences et Technologies - Bordeaux I]. <https://theses.hal.science/tel-00779706>

- Chen, Y., & Tsai, M.-J. (2015). Eye-hand coordination strategies during active video game playing: An eye-tracking study. *Computers in Human Behavior*, 51, 8–14. <https://doi.org/10.1016/j.chb.2015.04.045>
- Corneloup, V. (2019). *Apprentissage et évaluation des compétences de conduite de haut niveau en réalité virtuelle: Utilisation des simulateurs de conduite pour mesurer et développer les compétences perceptives et cognitives des conducteurs novices* [These de doctorat, Sorbonne Paris Cité]. <https://theses.fr/2019USPCB042>
- Deery, H. A. (1999). Hazard and Risk Perception among Young Novice Drivers. *Journal of Safety Research*, 30(4), 225–236. [https://doi.org/10.1016/S0022-4375\(99\)00018-3](https://doi.org/10.1016/S0022-4375(99)00018-3)
- Deniaud, C. (2017). *Optimiser la validité des comportements observés sur simulateur de conduite: Étude des interactions entre immersion, présence et comportement*. <https://go.exlibris.link/TrQXJblh>
- Gozli, D. G., Bavelier, D., & Pratt, J. (2014). The effect of action video game playing on sensorimotor learning: Evidence from a movement tracking task. *Human Movement Science*, 38, 152–162. <https://doi.org/10.1016/j.humov.2014.09.004>
- Gugura, R., Fischer, P., Tanțău, M., & Tefas, C. (2023). Just five more minutes, mom: Why video games could make you a better endoscopist. *Surgical Endoscopy*, 37(9), 6901–6907. <https://doi.org/10.1007/s00464-023-10167-x>
- Gupta, A., Lawendy, B., Goldenberg, M. G., Grober, E., Lee, J. Y., & Perlis, N. (2021). Can video games enhance surgical skills acquisition for medical students? A systematic review. *Surgery*, 169(4), 821–829. <https://doi.org/10.1016/j.surg.2020.11.034>

- Hatakka, M., Keskinen, E., Gregersen, N. P., Glad, A., & Hernetkoski, K. (2002). From control of the vehicle to personal self-control; broadening the perspectives to driver education. *Transportation Research Part F: Traffic Psychology and Behaviour*, 5(3), 201–215. [https://doi.org/10.1016/S1369-8478\(02\)00018-9](https://doi.org/10.1016/S1369-8478(02)00018-9)
- Hay, M., Adam, N., Bocca, M.-L., & Gabaude, C. (2016). Effectiveness of two cognitive training programs on the performance of older drivers with a cognitive selfassessment bias. *European Transport Research Review*, 20(8). <https://doi.org/10.1007/s12544-016-0207-7>
- Hay, M., Adam, N., Ndiaye, D., Richard, B., Bocca, M.-L., & Gabaude, C. (2015). L'immersion sur simulateur de conduite accroît-elle les bénéfices d'un entraînement cognitif dédié aux conducteurs seniors ? Présentation méthodologique. *RTS. Recherche, Transports, Sécurité*, 2014(04), 245–256. <https://doi.org/10.4074/S0761898014004038>
- Howard, J., Bowden, V. K., & Visser, T. (2023). Do action video games make safer drivers? The effects of video game experience on simulated driving performance. *Transportation Research Part F: Traffic Psychology and Behaviour*, 97, 170–180. <https://doi.org/10.1016/j.trf.2023.07.006>
- Li, L., Chen, R., & Chen, J. (2016). Playing Action Video Games Improves Visuomotor Control. *Psychological Science*, 27(8), 1092–1108.
- Quan, C. Y., Mansor, S., Jian, C. J., Rahman, Md. M., Karim, H. A., & Weng, B. K. (2023). Modelling and Evaluation of Driving Simulator for Driving Education in Malaysia. *Journal of Logistics, Informatics and Service Science*, 10(3). <https://doi.org/10.33168/JLISS.2023.0316>

Ruscio, D. (2018). What Driving Abilities Do Racing Video Games Stimulate? Rating the Levels of Realism Experienced in Commercial Racing Video Games. In N. A. Stanton (Ed.), *Advances in Human Aspects of Transportation* (pp. 916–926). Springer International Publishing. [https://doi.org/10.1007/978-3-319-60441-1\\_88](https://doi.org/10.1007/978-3-319-60441-1_88)

*Simulateur de conduite* | Codes Rousseau. (n.d.). public.codesrousseau.fr. Retrieved July 11, 2025, from <https://public.codesrousseau.fr/supports-apprentissage/conduite-en-voiture/oscar-simulateur/>

Sue, D., Ray, P., Talaei-Khoei, A., Jonnagaddala, J., & Vichitvanichphong, S. (2014). Assessing Video Games to Improve Driving Skills: A Literature Review and Observational Study. *JMIR Serious Games*, 2(2), e5. <https://doi.org/10.2196/games.3274>

Velasco, P. (2025, February 18). Verstappen: Sim racer to Formula 1 driver would be a beautiful story. *GRANDPRIX247*. <https://www.grandprix247.com/2025/02/18/verstappen-sim-racer-to-f1-driver-would-be-a-very-beautiful-story/>

# APPENDICES

## DRIVING TEACHER MEETING NOTES

### MEETING #1

Here is a summary of the notes taken during a meeting with a driving school instructor before the sessions took place:

During driving tests, frequent **failures** are often due to several factors. **Blind spots**, for example, can be better managed with virtual reality or triple screens. **Speeding** is often the result of students' difficulty in **performing multiple tasks simultaneously**. **Right-of-way priorities** and the management of **pedestrian crossings**, in terms of visibility and predictability, also pose problems.

On a technical level, the use of the **clutch and accelerator for starting**, finding the friction point, is crucial. It is also important to stay **within the lines of your lane**. Regarding braking, it is required to **brake before changing gears** to effectively use engine braking. Understanding **priority lanes** is crucial: one should not stop unnecessarily for a right-of-way priority. He asks if it is possible to adapt the signs to **match Belgian signs**. He also suggests exercises with the **hierarchization of priorities**. From most important to least important as follows: qualified agent (police officer, etc.), traffic light, stop sign, right-of-way priority. Students tend to **look too much at their gear lever**. It is advisable to also teach them to use it lightly, **without forcing the gears**.

For **parking**, instructors ask students to park **next to a parked vehicle** to provide visual landmarks for the students. **Exiting a parking space** is an equally important maneuver.

For **highway access**, it is essential to **accelerate sufficiently** to merge with traffic. The **presence of motorcycles and semi-trailers** in traffic was also mentioned.

It was suggested to **remove some stop signs** to encourage students to **observe road markings** and not just the signs.

The issue of the age of the study participants was raised (we only had young people between 17 to 25 years old at that time). It was also mentioned that sessions should not go above one and a half hour of driving.

The addition of a footrest on the simulators was also mentioned to avoid resting the foot on the clutch pedal (unfortunately impossible on our simulator without significant modifications and a new pedal system).

---

## MEETING #2

**The absence of mirrors** – a limitation inherent to single-screen setups, as triple-screen or VR configurations would expand the field of view and enable visibility of mirrors – presents a significant challenge. Mirrors are critical for:

- Monitoring blind spots
- Anticipating hazards (e.g., rapidly approaching vehicles)
- Proper lane positioning

Learners tend to drive too fast in simulation, partly due to the lack of physical feedback – and, in my view, the restricted field of view (FOV), which consistently distorts speed perception in simulators. The driving instructor suggests that a 30 km/h speed limiter might be necessary to mitigate risky behaviors. “Could this speeding habit transfer to real-world driving and increase the risk of speed-related accidents?” – in my opinion it is unrelated as video games ≠ real life, players are able to make the distinction between driving in GTA V and daily commuting.

Initial braking in driving school is often abrupt ("you'll eat the dashboard"). During the first few hours of real-world instruction, the instructor must constantly alert the learner to environmental elements (e.g., "watch out, red light," "pedestrian"), allowing the future driver to focus solely on basic coordination.

Typically, **4 to 5 sessions** are required for learners to become comfortable with the controls. The expert recommends a **hybrid learning approach**: starting with one hour of real-world driving to expose learners to physical sensations (vibrations, noise, inertia) and, crucially, the overwhelming flood of information experienced on the road before transitioning to simulation. After 4-5 simulation sessions, learners should return to real-world driving. He emphasizes that

the most critical aspect of driving is not coordination but **anticipation and environmental awareness**.

A hybrid approach is essential to develop all necessary skills: simulation allows learners to practice **basic reflexes (eye-hand-foot coordination)** in a controlled environment, while real-world driving exposes them to the complexity of variables (dense traffic, unexpected events, etc.).

Complex maneuvers are introduced only after **10 hours of instruction**, beginning with a single vehicle before progressing to two, to avoid cognitive overload. Some learners graze parked cars or drive on the wrong side of the road—behaviors that should be corrected.

**Hill-start assist**, common in modern vehicles (and worth integrating into simulators like BeamNG), reduces the difficulty of the maneuver but may partially obscure the learning of mechanical reflexes (clutch control, friction point management, coordination with the handbrake).

Explicitly teaching **automatic steering wheel return** is important, as its unexpected behavior can lead to overcorrection. Aligning simulated vehicles with those used in training would ensure a smoother transition. Introducing dynamic elements (unpredictable pedestrians, weather conditions) in lessons would further enhance anticipation skills.

## GAME MISSIONS FOLDERS

My BeamNG.drive missions can be downloaded through my UCLouvain OneDrive server through this link (exp August 16, 2026). Notice these may be broken during future updates (last played August 10, 2025):

<https://gofile.me/7qFDV/LfXItFPvF>

To install them on your own copy of the game, simply **copy** the **“gameplay” folder** from the folder you just downloaded, then paste it in the game folder (location example: C:\SteamLibrary\steamapps\common\BeamNG.drive). If prompted, click **“replace”**. Now the missions should be available in the game.

## SELF-ASSESSMENT FORMULAIRE

### RAW QUESTIONNAIRE

1. Name
2. How would you rate your ability to maintain a consistent speed? (1-5)
3. How would you rate your awareness of surrounding traffic or potential hazards? (1-5)
4. How comfortable did you feel operating the steering wheel? (1-5)
5. When shifting gears, how confident were you in timing and smoothness? (1-5)
6. In terms of parking or low-speed maneuvers, how precise did you feel? (1-5)
7. Were you able to stay focused without getting stressed or overwhelmed? (1-5)
8. How confident do you feel about applying today's lessons on real roads? (1-5)
9. In your own words, what was the biggest challenge you faced today? (1-5)
10. What one change or addition would you make to the training scenarios to enhance your learning? (1-5)
11. Comments or Concerns

# SIMPLE TABLE RESUME

Score stats per Question per Session

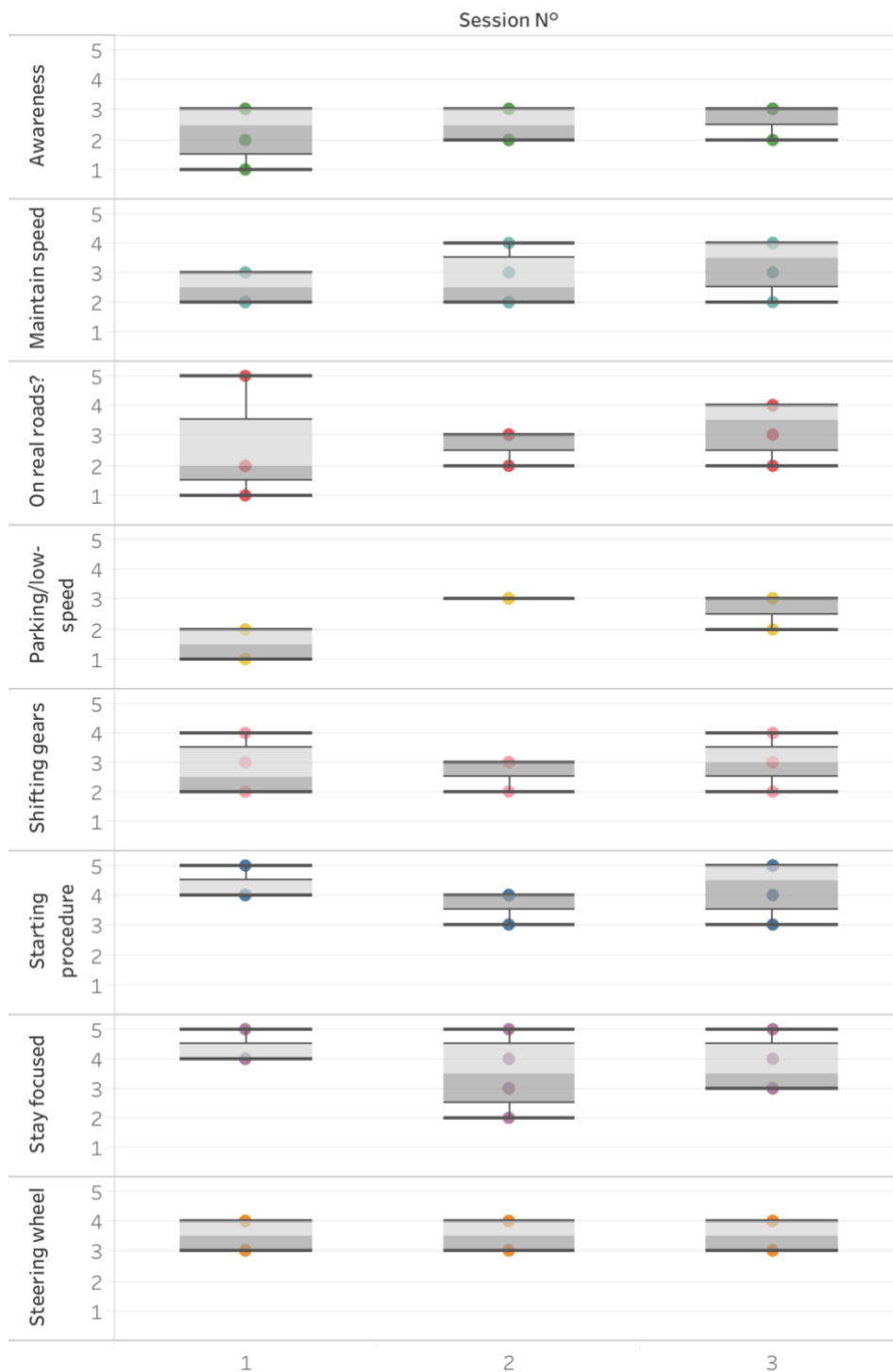


Figure 40

# Score Evolution per Question per Session

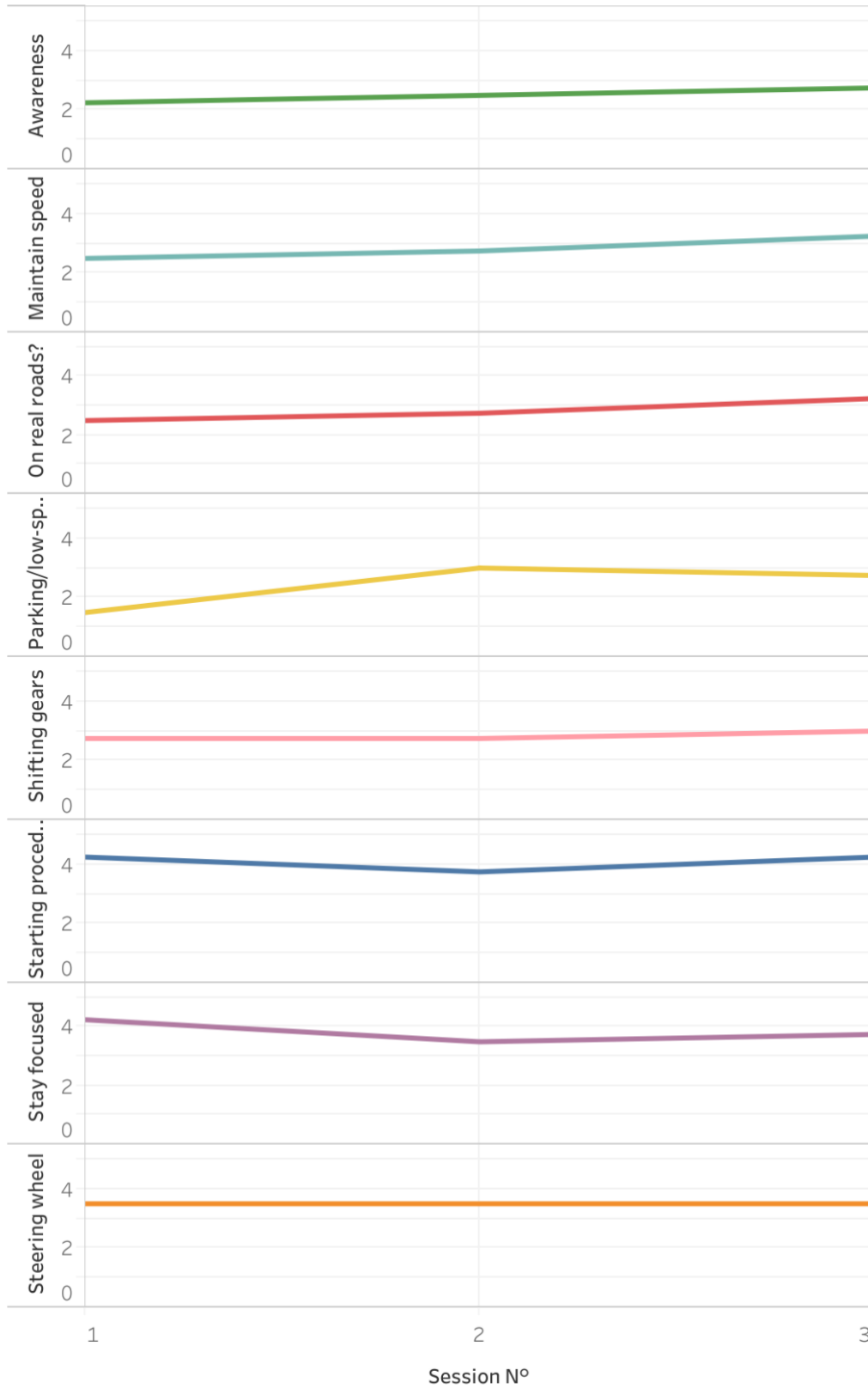


Figure 41

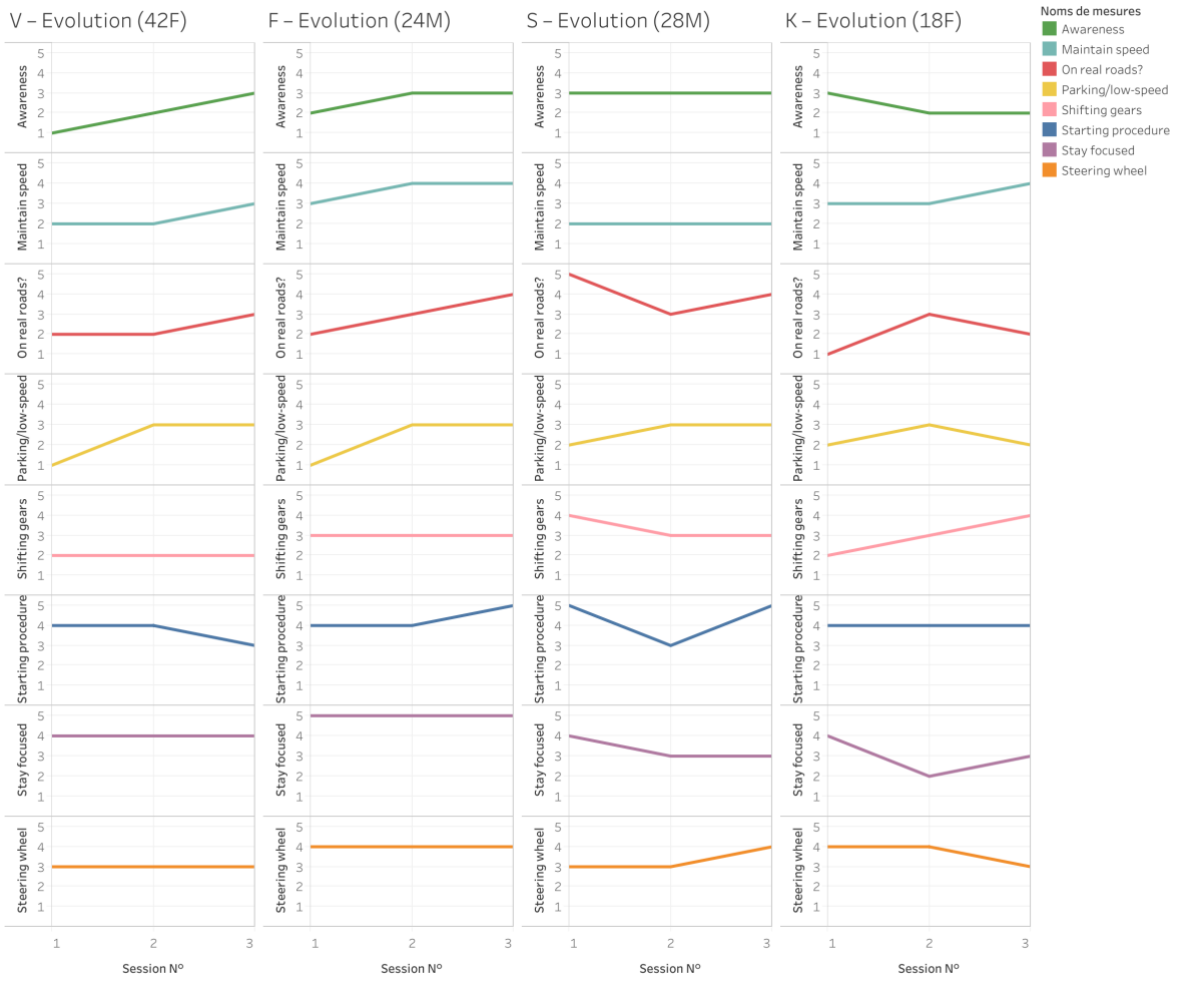


Figure 42



# ***CONTROLS***

- *Pedals*
- *Shifter*
- *Steering Wheel*

# CONTROLS

## Pedals



CLUTCH

BRAKE

THROTTLE

# CONTROLS

## Shifter



6 SPEEDS + REVERSE

# CONTROLS

## Steering Wheel



- FIX Repair Car
- ENG Start/Stop Engine
- ← Left Binker
- Right Binker

# CONTROLS

## Steering Wheel



Look Left and Right by Moving the Joystick

Clic on the Joystick to Center the Camera

# USER INTERFACE

- *Tasklist*
- *Checkpoints*
- *Parking Spots*

## USER INTERFACE

### Tasklist



# USER INTERFACE

## Checkpoints



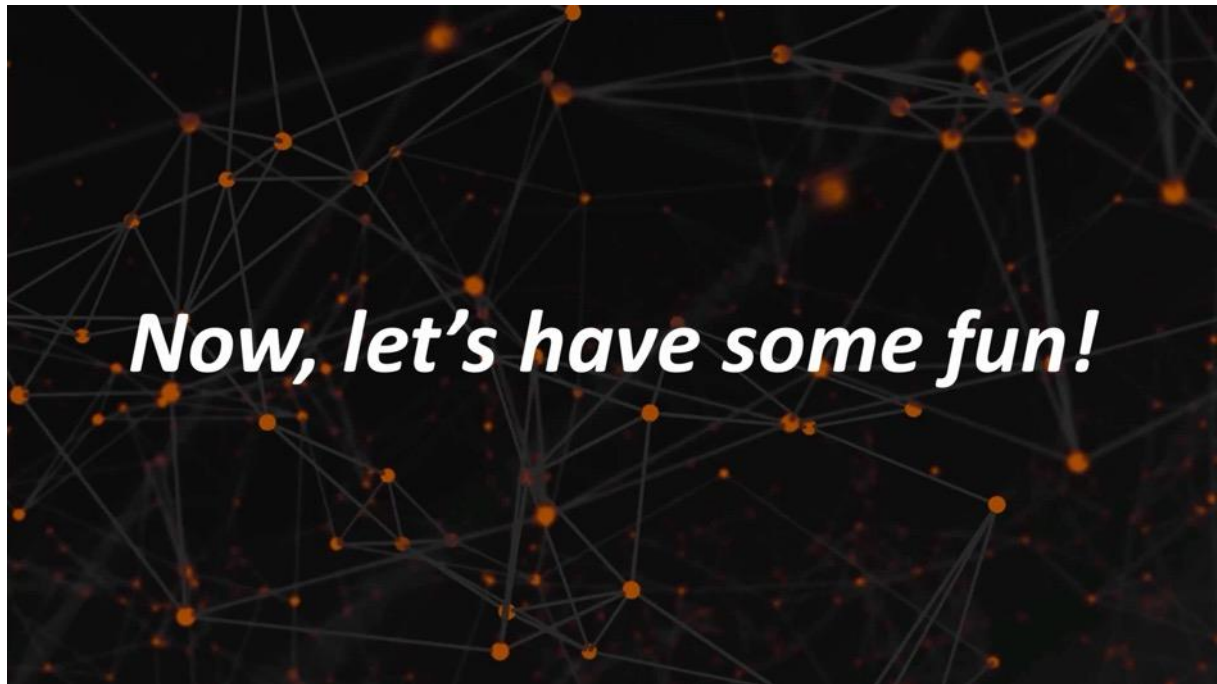
If there's no checkpoint at an intersection, you can assume you have to go forward

# USER INTERFACE

## Parking Spots



Watch for the [P] symbol on the ground to know the orientation you have to park



## SESSIONS ANALYSIS

### SESSION RECORDINGS

Here is a link to a Youtube Playlist with every session recording. Each session has timecodes listed in the description with every significant event:

[https://www.youtube.com/playlist?list=PL-IYCGcqQRwbyebVPMrCEaeolsNZgNvX\\_](https://www.youtube.com/playlist?list=PL-IYCGcqQRwbyebVPMrCEaeolsNZgNvX_)

Videos are available to download through SwissTransfer until 27/6/2026 at 06:22AM:

<https://www.swisstransfer.com/d/3d346610-4b45-4f52-973f-8337bd949e88>

As a backup, video recordings can be downloaded through my personal server through this link (20mbps speed limit, around 6-8 hours to download all files):

<https://gofile.me/7qFDV/lx0I1RlXI>

### WRITTEN ANALYSIS

In case video supports are offline, here are the notes from each session.

## SESSION 1

---

### LESSON 0

---

- 00:18 Does not know what the clutch is, pulls the handbrake
- 01:05 Starts without issue
- 01:20 Forgets to press the clutch when shifting gears the first time (lacks theoretical knowledge)
- 01:37 Often gets stuck at the rev limiter for a while before changing gears
- 03:12 Asks why the brake vibrates, explain the ABS system
- 04:08 I tell him to brake so he learns to press the clutch at the same time
- 07:00 Deliberately crashes
- 09:28 Does not always realize when a gear is poorly engaged despite pedal vibrations and sound ::: I would have liked to integrate a vibrator under the gear lever for more realism and clarity

### LESSON 1

---

- 13:16 Starts without any issue
- 13:47 Misses the first turn but sees the checkpoint. Attempts to reverse to correct
  - 14:10 Reminder of camera controls
  - 14:30 Stops reversing and makes a U-turn further ahead at an intersection.
  - 15:11 Then turns in the wrong place and hits a barrier.
  - 15:23 He reverses again and this time manages to pass the checkpoint.
- 15:59 Does not immediately understand that he is not properly aligned with the marker ::: better indicators when the position is not precise enough?
- 16:44 Does not immediately understand that the parking sound effect means he has succeeded and should move on
- 17:04 Tries to reverse but gets a bit lost
  - 17:34 He drives forward and takes a turn toward the docks.
  - 17:58 Attempts a complicated U-turn and eventually returns to the parking space
- 19:20 Often forgets to press the clutch when stopping AND when starting
- 20:04 Uses the rev limiter a lot and then sometimes abruptly releases the clutch ::: perhaps because he does not feel the jerks as he would on a "motion rig"?
- 20:42 No message when he misses a checkpoint
- 20:57 Has to re-engage gear when the vehicle respawns.
- 24:29 Shifts to the wrong gear (3rd instead of 1st) and adapts by applying more accelerator
- 26:29 Tries to park in the parallel space going forward, then I tell him to do it in reverse
  - 27:24 Struggles with camera management: uses it jerkily or does not position it fully backward, which can make interpreting the vehicle's angle more complex
  - Restarts the maneuver about ten times to get closer to the car: I then decided to modify the level so the respawn point allows focusing on the parallel parking maneuver rather than the U-turn
  - He always positions himself far from other vehicles and maneuvers while keeping a large safety distance ::: Difficulty estimating distances?
  - 34:58 Slightly hits a car ::: consequence system? fewer points? final report for the instructor?
  - Finally succeeds with my guidance: when to turn the wheel and in which direction

## SESSION 2

---

### LESSON 2

---

- Starts without issue

- 1:12 Stalls on an incline. He was in first gear, panicked, then shifted into second—resulting in an accident. Afterward, he continued without problem.
- 3:01 Hesitates on the highway when catching up with traffic and driving faster. Hesitated to shift gears (remained in 3rd at 4000 RPM)
- 04:13 Misses his gear shift after the roundabout and does not notice he missed a checkpoint
- 05:56 When entering the parking lot, he does not see that he passed by the checkpoint ::: Checkpoints need to be more visible (already discussed internally with the BeamNG team)
- 07:22 Does not always realize when he stalls ::: A "motion rig" would help him notice
- 11:39 When he engages poorly, he compounds mistakes. For example, he turns right instead of left or uses reverse instead of drive, without realizing he is complicating the task.
- 14:41 I gave him a tip: align with the lines in front of him to park straight
- 17:30 Does not reflexively recenter the camera and parks slightly crooked ::: possibly because the camera is slightly offset when not centered with the dedicated button?
- 18:08 Keeps RPM very high (rev limiter) while attempting slow parking maneuvers. Then, as soon as he wants to slow down, he releases the clutch... causing strong jerks
- 19:55 Exits the parking space in the wrong direction ::: road markings should be sufficient to indicate it is a one-way road
- 21:06 I helped him again, this time for the third parking space (reversing between two cars). I also suggested using the left side view since the virtual camera extends outside the car and helps assess proportions differently
- 23:02 I provided another tip to check if the steering wheel is straight: turn fully to the lock and then return twice to center = steering wheel centered
- 38:13 Struggles to initiate the maneuver for the last parking space ::: generally, this parking exercise (+ parallel parking) could be clearer, perhaps with a "step-by-step" approach rather than leaving the player to solve the problem alone
- So, I gave him instructions to help him park (steering and car position)
- Difficult to judge the distance between his car and obstacles (like a wall behind the vehicle) ::: likely due to the lack of stereoscopy
- 46:08 When he was supposed to follow signs to Norte, he took the first roundabout exit knowing it was wrong. He preferred to go further and make a U-turn ::: perhaps to avoid endangering other users or himself by braking abruptly?
- He did not fully understand the signs, so he made several roundabout loops to be sure (and made the same mistake again)
  - After that, he correctly followed the highway exit by reading the signs
- 50:26 He took a turn because he saw a checkpoint in the distance, which unintentionally led him in the right direction ::: a system to hide checkpoints for a certain time?
- Struggles to stay in his lane, whether in urban, peri-urban, or highway areas ::: perhaps also unaware that blue markings, etc., are for parking
- 58:27 After multiple attempts at the last parking space in Norte, I guided him to park by explaining how to better analyze the situation using the "top-down view"

## SESSION 3

---

### LESSON 3

---

- Starting without any problems, including gear shifts and observing checkpoints.
- 01:38 Always struggles a bit with lane keeping, especially in turns.
- 02:58 Later on, he stalled on an incline. He stopped and, by leaning on the car behind him, managed to perform a hill start.
- 04:27 Right after, another hill start: he struggled again and—unintentionally—used the car behind him for assistance.
- 06:40 A bit later still, he stalls on an incline again and manages to pick up speed without assistance after two unsuccessful attempts.
- 09:09 A collision occurs, with a car failing to yield to the right-hand priority that the player was benefiting from.
- 10:18 Difficult to see traffic at intersections ::: triple screen/VR would solve this problem.
- 11:55 Another stall on an incline, this time because he shifted into second gear while going up a steep hill at 20 km/h. Again, he had difficulty picking up speed.

- 17:00 In the mountains, he sometimes attempts to shift into second gear but realizes the engine is less flexible, so he mostly drives in first gear.
- He maintains his lane well in the mountains. He clips [the edge] once or twice in places where the game's AI pushes boundaries slightly, putting him in a bad position.
- When on certain inclines where the car struggles to climb, he partially engages the clutch and accelerates to help the car move upward.
- 28:43 He made a mistake and took a turn when it wasn't necessary ::: should an off-route zone system be implemented so the player receives a message and is then automatically teleported if necessary? (Note: ensure this isn't too punishing for the player).
- 30:49 He stalls on an incline again in Castelletto, so I am teaching him a technique for hill starts using the handbrake.
- 34:00 He also manages lane keeping quite well during the hairpins while descending from Castelletto to the highway.
- 36:18 Generally speaking, he always struggles when steering hard into a turn: he tends to straighten up too late, leading to an over-correction in the opposite direction afterward.
- 58:42 The last parking maneuver was also problematic; he had to restart many times (16 minutes). He still has issues turning the wheel the right way or heading in the right direction.
- 1:15:27 Just before succeeding, he can be seen using his hands to visualize which direction he needs to turn the steering wheel to park properly.

---

## KARIMA

### SESSION 1

---

#### LESSON 0

---

- 06:14 The mission start did not work as intended: normally, if the player uses the accelerator and clutch correctly, the task list disappears. Here, she used only the clutch, and the car started anyway, leaving the task list visible
- 08:26 Intentionally crashed to test right at the first minute
- Manages gears without major issues
- 10:25 Attempts to climb an obstacle without success
- 10:51 Releases the clutch too abruptly at start, then quickly adapts for subsequent attempts
- 16:28 Crashed several times again, finds it "satisfying"

#### LESSON 1

---

- 18:49 She started without any issues
- 20:02 She saw the checkpoint in time and turned to the correct spot, only a bit late which led her to hit a wall
  - 20:53 During her maneuver to get back into the right direction, she reversed until hitting a wall without realizing it, stalling twice while trying to force it in reverse
- 22:55 In "top-down" view, the player cannot see RPM, so cannot know if they stalled
- After one or two adjustments, she managed to park then make a U-turn and park again on the marker
  - 27:43 She also forgets to re-center the camera
- 29:34 She didn't see a checkpoint ::: again, a zone system to automatically warn the player would be needed
- 30:52 She stalled twice on incline, I used this opportunity to explain the hill-start technique with the handbrake. She succeeded immediately
- 34:28 Turns too long during tight turns, like Fabrice
- 35:09 Took the wrong direction (she was talking and marked a pause as if thinking, then let herself be carried by inertia into the wrong direction)
- 37:36 Groundmakers are not clear enough at the end for parking
- 39:42 Again, no reflex to reset the camera straight
  - 49:09 She ended up slightly blocked against the car next to her after brushing it
- I assisted her step-by-step for the parking maneuver afterward, and she parked relatively quickly

## SESSION 2

---

### LESSON 2

---

- No problems with starting, maintaining speed, staying on lane, or shifting gears.
- 5:01 Didn't brake enough at the roundabout arrival after the highway and entered "gently" into the car in front
- In the parking exercise, she does fairly well
  - 14:00 While reversing to exit the second parking spot, she hit the wall behind her (while saying "I'm going to take the wall, I'm going to take the wall")
  - 16:43 At the third parking spot, she touched the green minivan on the first attempt and again on the second try while trying to correct without leaving the parking spot
  - 22:23 For the fourth spot, I told her to bring her front bumper closer to the car in front so that it's easier to park after her first attempt
  - 30:13 She also had difficulty with the fifth parking spot, so I drew a diagram for her to visualize the exercise differently
- 31:53 I gave her the tip to center her steering wheel by going all the way to the stop and coming back twice with the wheel straight like Fabrice
- 36:42 When she was supposed to go toward Norte, she took the first exit of the roundabout without much thought
- 37:18 She properly engages the clutch every time she starts
- 40:34 When exiting the highway, she didn't slow down enough, lost control of her car, and hit a car coming from the opposite direction
- 41:11 At the intersection after the highway exit, she didn't see the checkpoint or signs and simply didn't react, driving straight into the field in front of her.
  - 42:07 At the next intersection, she slowed down much more and read the signs
- 42:53 After the bridge, just before the gas station, she over-corrects multiple times in a row and ends up with a head-on collision with a car from traffic
  - 43:05 Meanwhile, her accidents entertain her, emphasizing that it's interesting and fun
- 44:35 At the last turn to enter Norte, she slowed down well and read the sign more quickly than before. She also made the decision to follow the direction quickly.
  - 44:40 She still says the signs are difficult to read ::: VR? Not sure if triple screen resolves the issue
- 45:10 Later, she stalled on incline and managed to restart using the handbrake technique
- 47:09 At the end when she has to park at the "driving school center," she does it almost immediately

## SESSION 3

---

### LESSON 3

---

- No issues with starting the car. A bit of trouble exiting the parking lot (precisely with the car parked in front and the turn angle)
- 5:28 On the route from Norte to Fastello, she remained primarily in first gear.
- 8:52 She stalled on an incline (she stopped properly but tried to restart without realizing she was still in second gear), but managed to restart using the handbrake technique
- 11:44 Approaching Fastello, there was a traffic jam as usual there. She slowed down early, indicating she was attentive to what was happening ahead
  - 12:12 Indeed, once the traffic cleared, she hit the tree at the edge of the road, which is the scenario that usually causes the traffic jam with AI.
- 14:40 On small roads, she has some trouble staying on her lane. The AI doesn't help either by taking too much space on the road
  - 14:54 After hitting a rock on the side of the road due to her position, she preferred to drive with the steering wheel twisted until the next checkpoint rather than go back to fix her vehicle
- 17:17 In the village in the mountains, she narrowly avoided a car coming from the opposite direction that cut her off at the last moment
- 17:55 She reset the car and made a hill-start with the handbrake technique, succeeded on the first try

- 18:25 She had a front collision with a vehicle coming from the opposite direction. She didn't tighten enough to the right when taking her turn
- 21:24 She had two accidents again because she didn't tighten enough to the right
- Every time she reappears, she performs a hill-start without any mistake
- 24:39 She has another accident at the same turn and for the same reason but decides to continue with the slightly damaged car
- 29:59 She drifts too far outside the turn and hits a wall
- Sometimes she crosses in traffic with large American pickups and reacts quickly to give them more space, avoiding being hit
- In general, she tends to turn her steering wheel for too long during turns, briefly exiting her lane resulting sometimes in a collision with a wall or vehicle
- 38:58 She stops on incline behind a traffic jam and engages the clutch before stopping. Afterward, she just forgets to shift back to first gear for starting but once she stalls, she shifts back to first gear and successfully starts without issues
- Since a few minutes ago, she mainly uses second gear instead of first like at the beginning.
- 55:24 She stops behind another car while keeping a safe distance but forgets to engage the clutch to prevent stalling  
::: She probably didn't see the stop sign, reason for the car in front stopping
- 1:09:33 She doesn't know if the next parking spot is in the parking lot or on the street ::: transition from "driver" camera to a cinematic orbiting camera around the concerned parking spot to spatialize the next objective?
- 1:12:00 During the entire parking maneuver, she shows precision in managing accelerator and clutch: few jerks
- 1:19:00 Like other participants, she tends to try turning a failed attempt into success rather than restarting from scratch. Generally, in observed examples here, restarting often allows for proper parking.
- Then I assisted her to park the vehicle in reverse and she parked it

---

## SÉBASTIEN

### SESSION 1

---

#### LESSON 0

---

- 07:40 Started without issue
- 09:38 Shifted gears without major problems
- Nothing particular to report. Apparently good control management; simply drove

#### LESSON 1

---

- 19:21 Started smoothly
- 20:20 Did not see the checkpoint on his right; had to warn him, and he returned to the last passage point
- 22:47 Despite the reset, missed the checkpoint again and returned to the previous passage point once more
- 23:50 On the third attempt, took the turn but too wide, stopping smoothly before hitting the roadside barrier. Then initiated reverse
  - 24:40 While moving forward again, collided with the paseo wall
  - 25:31 Struggled to stay on trajectory and swerved slightly
- 26:45 Provided advice on recognizing when the car is about to stall
- 28:30 Explained how to make a U-turn since he was having difficulty and reminded him how to center the camera
- 30:07 Had trouble positioning himself properly for parking and struggled with low-speed maneuvers, so I explained simply
- 32:50 Barely turned the steering wheel, making low-speed maneuvers much more difficult
  - 33:11 Sighed and quickly lost patience
  - 34:40 When he finally managed to park, he exclaimed with joy and raised his arms
- 35:34 Stalled twice on an incline at the first stop sign
  - 36:01 Managed to restart the car by applying more accelerator
- 36:32 Focused so much on gear changes that he did not stay in his lane and missed the next checkpoint
- 41:19 Again, did not turn the wheel enough, forcing him to stop and maneuver

- 41:51 Stalled on the incline: while driving at 5 km/h, he tried to shift into second
  - 42:14 Restarted on the incline without major issues
- 42:43 Shifted much too early again
  - 42:55 Which caused him to stall a little further on
- 44:12 Waited too long to brake and did not even turn the wheel ::: probably saw at the last moment that the street ended and the checkpoint was to the left
- 44:49 Focused too much on gears and forgot to watch the road, resulting in a head-on collision with a tree at 37 km/h
- 45:10 Shifted from second to neutral while driving; did not seem to be looking for third or first gear
  - 45:16 Tried to accelerate in vain since the car was in neutral
- 45:59 Frequently used the clutch without apparent reason, perhaps to brake, but it is a bad habit I did not notice at the time ::: perhaps have a screen above the setup displaying steering wheel and pedal inputs
- 46:07 Shifted into fifth while driving at 30 km/h
  - 46:32 Recovered well from the situation: was under-revving and downshifted from fifth to first to regain power (he was driving at 20 km/h uphill)
- However, he turned left when there was no checkpoint (so he should have continued straight)
- 47:18 Still constantly using the clutch, which is not a good habit
- 48:02 Stalled again on the incline since he was driving in fourth at 24 km/h
- 49:08 Took the famous one-way trap
- 51:23 Used fourth gear for a low-speed maneuver
  - Just afterward, I explained that he would have to park in reverse, not drive forward
- 57:31 Tried several times but did not use the cameras much and entered the parking space almost perpendicular to the street
  - 58:11 Even reversed onto the sidewalk until the entire car was on it, but the action amused him and made him laugh
  - More likely to respawn rather than try to adjust, unlike other learners
  - 01:02:34 Could have simply turned the wheel fully to the right, but he barely turned it. This happened several more times afterward. ::: Seems to struggle understanding the extent of the available steering radius
  - 01:03:08 Finally turned fully to the right to position the car correctly in the parking space, ending the session

## SESSION 2

---

### LESSON 2

---

- Slight difficulty starting: got a bit stuck against the wall to his left, then decided to go into the parking lot on the right to make a U-turn more easily
- 03:39 Still struggled with lane maintenance
- 03:48 Was overtaken on the right since he was in the wrong lane, then tried to merge back by downshifting from fourth to first with mixed success: missed the first shift, then succeeded
- 04:21 Entered the highway properly but, distracted by his gear change, drifted left until he sideswiped and then hit the guardrail head-on
- 05:32 Managed the highway fairly well, even if he did not stay perfectly in his lane
- 06:46 Took liberties and overtook on the left at the roundabout entrance, then drove on the hard shoulder and overtook another vehicle (with a collision) before passing the checkpoint at the roundabout exit
- 07:04 Again drifted to the left and narrowly avoided a head-on collision with a pickup
- 07:34 Almost missed the turn to enter the parking lot ::: perhaps not looking far enough ahead, so lack of anticipation?
- 08:21 Entered the parking space the wrong way but did not see the text ::: perhaps a red overlay to make it very easily understandable?
- 13:16 Was very happy to have managed to park
- 15:23 Stalled every time he stopped
- No issues exiting the first two spaces
- 22:22 Minor issue exiting the space: turned the wheel fully and scraped the minivan on his right
- 29:06 Wanted to make a U-turn to enter more easily

- 29:42 Minor collision with a parking wall: was turning well, then straightened, which led him into the wall
- 30:20 Tried to enter the space in one go but hit the car next to him
  - Tried a second time and hit the same car again
- 33:31 Once properly aligned, he exclaimed, "Who's the boss!"
- 34:16 Hit the wall behind him
- Used the technique to straighten the steering wheel several times: lock, then twice to center
- 37:15 Overconfident, drove at 100 km/h on the small road before the roundabout, missed his gear change, and noticed the turn too late: frontal collision with a wall at 80 km/h
- 40:03 After stalling, tried to restart, but the car rolled backward down the slope, and he did not brake. He stalled several times in a row
- 41:47 Gave him the tip for hill starts using the handbrake, but he did not use it
- 43:05 Took the first exit ::: again, confusion with signs, as with others
- Also forgot to remind him about driving with one hand on the wheel, which he often did
- 47:21 Did not look at the signs on the highway and was brought back to the roundabout. This time, he analyzed the signs better and immediately took the correct exit
- 50:00 This time, he was not caught out by the incline and downshifted from fourth to first to avoid stalling
- 50:24 Gained confidence and, just after overtaking a pickup despite the solid white line, took the turn correctly but was carried by inertia and nearly hit the guardrail on the next turn
- 50:58 Entered the turn too fast and hit the barrier in front of him at 50 km/h
- 52:21 Missed the right turn. Was surprised not to have seen a checkpoint, as at the second-to-last intersection ::: alternating between "find it yourself" and the checkpoint system can confuse players
- 54:21 Laughed at the car that crashed in front of him, then missed his gear change and stalled on the incline
- 55:05 Passed by the checkpoint ::: I placed the checkpoints so that players must stay in their lane. However, the AI tends to encroach on the other lane, making the situation dangerous for the player, who swerves to avoid both the AI vehicle and the checkpoint
- Again, a system to force the player to return if they miss a control point would be needed
- 56:33 A vehicle was stopped in front of him, and he braked well to a stop. He congratulated himself
- 57:06 While arriving at the parking lot, misjudged the entrance and hit the left wall head-on
- 57:37 Parked in the space on the first try in forward, unfortunately, he was supposed to park in reverse...
- 59:41 While trying to park in reverse, hit the wall behind him
- 01:03:52 Guided him to park in reverse

## SESSION 3

---

### LESSON 3

---

- 01:16 Passed by the point that was on his left at the intersection
  - 01:26 Made a fairly clean U-turn, even though he stalled, but without stress or abrupt maneuvers
- 02:47 Braked in time to avoid hitting the car in front ::: note that my brake is too hard, and testers would brake faster with a properly adjusted brake (for economic reasons)
- 03:17 Downshifted on the incline, seeing that the car was not moving well in second
- 03:41 Braked again in time to avoid hitting a car
  - However, he let the car roll backward when doing his hill start, which is extremely dangerous
- 03:59 Mostly drove with one hand on the wheel; finally reminded him to keep both hands on the wheel as much as possible
- 06:31 Traffic jam on the incline; panicked a bit and had trouble finding the right gear. I explained that he needed to brake to avoid damage
  - 07:06 Reminded him of the handbrake technique, and he used it without issue
- 11:29 Major inattention issue when changing gears. He told me it was because he was watching the speedometer to know which gear he was in (gears are not marked on the gear knob). This is one of the issues the expert had previously mentioned to me
- 12:37 Again, major inattention when changing gears, causing a crash at 40 km/h into a facade. He had to respawn in the town below
  - I confronted him about this right afterward, asking how it happened, but he did not know himself
- 15:03 "Was that my fault?" He had a head-on collision and clearly did not realize he was in the middle of the road, not leaving much option for oncoming traffic

- 16:33 Same issue, accident while changing gears. A little later, he told me he thought it was because he was looking at the speed display on the car's dashboard
- 18:06 This time, he crashed because he let himself drift too far to the right and hit a rock
  - And he still let his car roll backward when doing his hill start
- 24:15 Hugged too far to the right to avoid traffic in the village and hit a wall
  - Told him to go to the checkpoint since it was not far and the car would be repaired there
- 30:17 The rest of the incline went well; still struggled with lane maintenance and hit a wall but continued with his damaged steering to the next checkpoint, slightly reducing his speed
- 31:47 Unfortunately, he hit a vehicle head-on. Decided again to continue despite the damage to avoid the incline again (the last respawn point being in the village)
- 35:15 Assisted him a bit with a hand on the wheel, telling him to look far ahead
  - 35:52 Hit a roadside wall by drifting too far to the right
  - Hit the walls several more times, so I told him to go slower to take the time to analyze and position himself well
- 40:16 At the barrier, took the one-way street in front without realizing he should have turned right
- 44:39 Took a wrong turn like Fabrice
- 48:23 Took the tight turn at the Castello exit and ended up on the opposite lane, facing an oncoming vehicle. Quickly turned the other way and hit the roadside wall
- 48:58 Drove downhill in neutral; told him to use engine braking, and he lost control of the car again, drifting left while focused on his gear change, ending in a head-on collision with an oncoming vehicle
  - Tried again and shifted into fourth. Told him to go down in second, and he crashed in the same place. Told him to use second as much as possible for this descent
  - He rushed; I asked, "Why are you rushing?" and he said he did not mean to, so I invited him to use the brake more, that he could drive at 5 km/h if he wanted
- Nothing special until the parking lot except for lane maintenance
  - For parking, I coached him through the different spaces for his camera and steering wheel management
- 1:15:45 Did not immediately find the final parallel parking space; I had to tell him where it was
  - 1:17:39 Almost parked in one go!
- Guided him to park, and he finally managed despite some frustration during the process

---

## VÉRONIQUE

### SESSION 1

---

#### LESSON 0

---

- 07:53 Starts without any issues
- 13:00 From this point onward, she drives exclusively on the empty part of the map gridmap while deliberately avoiding accidents
- She asks some questions to better understand: for example, why we use the clutch, why we change gears at 2500 RPM
- Then she practices stopping and restarting several times until the end of Lesson 0

#### LESSON 1

---

- 20:42 Starts without any issues
- 21:38 Misses the checkpoint on her right (she didn't see it completely) and returns to the last reappear point
- 22:26 I tell her "do you see the checkpoint?" She says yes but continues straight again as if she hadn't seen it. She returns to the last appear point
- 23:18 Turns toward the checkpoint but instead of doing it slowly, she continues accelerating (the accident amuses her)
- 23:58 Rubs against the wall slightly again but manages without major damage. This time, it's more a question of steering management than pedals
- 24:26 Parks successfully on the marker from the first attempt

- 24:46 She looks around carefully to plan her U-turn maneuver
- 25:37 She starts her reverse maneuver very well
- 26:18 However, she has a bit more difficulty positioning her car on the second parking marker (about 2.5 minutes to achieve this)
- 29:20 Stops at the first stop sign without issues, then starts in hill without problems
- 29:40 “Am I going straight?” While looking in the direction of the checkpoint just ahead ::: again, checkpoints are not easily identifiable (already submitted to BeamNG)
- 29:56 Here, she stalls four times while trying to restart after the stop
- 30:37 She manages to start the car successfully
- 31:00 She almost misses the left turn and passes barely
- 31:25 She almost misses the left turn and passes barely
- 32:02 She turns her steering wheel for too long ::: would a chassis on hydraulics help alleviate this issue by feeling lateral G-forces?
- 32:14 She drifts too far to the right and hits the edge of the sidewalk slightly
  - She ends up blocked against the tree: she tries in reverse but doesn’t apply enough throttle. After several attempts, she tries going forward without understanding she’s blocked against the curb (which is too high to pass over). So she tries again in reverse with success but stalls 1-2 meters from her starting point, enough to free herself from her initial problem
- 34:25 She hits a wall on her right at the start, thinking her steering wheel was straight.
- 35:35 Another example where she turns her steering wheel too long and then has trouble staying in her lane. She zigzags for about thirty meters
- 37:05 She discusses and passes by a checkpoint
  - 37:17 She starts her U-turn and accelerates instead of braking, resulting in a double accident
  - 38:00 She stalls twice during a hill-start in reverse
- She makes an effort to stop when she can
- 40:57 She takes the wrong-way
- 42:32 She slowly moves into the parked car by making a U-turn in front of the driving school
- 43:05 She parks in the space in forward gear. I didn’t tell her anything, wanting to see how she would manage and if she would think about entering in reverse

## SESSION 2

---

### LESSON 2

---

- 01:00 Started without issue
- 01:44 Kept her steering wheel turned right instead of left, and once moving, decided to turn left. Result: she crashed into the wall in front of her
- 02:34 Due to her somewhat failed parking exit, she also had trouble rejoining the street
- Joined the highway without major issues
- 05:04 Was not very stable on the highway, perhaps also because she was looking at her speedometer
- 06:33 As before, completely missed the checkpoint, which took up almost a third of the screen
- 06:55 Made a U-turn without issue
- 08:25 Carried away by speed, missed the last checkpoint before the parking steps, then hit a wall on her right
- 10:10 Did not notice that the P was the other way around and parked forward. Once stopped, she noticed and reinitiated the maneuver in reverse
- 13:35 Tried to reverse by turning right, then left, but only turned the wheel one way in the other direction, so the car kept turning right, and she did not understand why
  - 14:28 Put her camera forward and found her bearings again
- 15:32 Told her how to park in reverse, but she still struggled with steering
- 20:10 Managed to park in the second space ± easily on the third attempt
- 24:10 Really struggled with the rear camera, turning the wheel the wrong way
- 26:00 Positioned herself too far to the left of her car ::: I think the interior camera is very misleading since it is not centered
- 28:36 Parked without issue on the second try in the fourth parking space
- 32:30 Again limited her steering radius by keeping her hands gripped on the wheel, as if she could not let go, preventing her from making tight maneuvers

- 35:27 Really struggled with steering management and its mechanical constraints
- So I coached her a bit, and it went a little better
- 39:28 Did not see that she was about to go the wrong way, like other participants
- 41:57 Found the correct roundabout exit on the first try
- 43:37 Looked carefully at the sign
- 43:52 Gave her a tip to stay better in her lane, but she was carried away by the feedback and ended up in an accident
- 46:59 After passing the highway exit checkpoint, forgot to look at the signs at the next intersection
- 48:38 Missed the correct turn but realized it immediately
- 50:56 Just passed the checkpoint but stalled on the incline ::: did not have the reflex to engage the clutch on the incline
- 52:39 The sequence of turns here clearly showed that she still had difficulty managing the steering wheel in tight turns ::: perhaps due to the lack of stereoscopy?
- 54:50 Ended up stuck in the wall and had to respawn ::: one of BeamNG's rare and hard-to-fix issues
- 56:54 For the last parking space, she had to fiddle a bit but parked without making too many mistakes, just still struggling with "which way should I maneuver?"

## SESSION 3

---

### LESSON 3

---

- 00:17 Stalled twice in a row right at the start during her first reverse
- 00:51 Got stuck in the parking lot against the wall at the entrance, forcing her to maneuver to get out (took 4:30 to exit the parking lot)
- 06:52 An AI car ran a stop sign at the last moment, and she reacted just in time to avoid an accident (and found it amusing)
- 08:45 At the stop, attempted a hill start but rolled back too far, so she braked to avoid an accident. Then I explained the handbrake technique
- 12:15 Had traffic in front and stalled while stopping. While stopping, she engaged the clutch, but once the car was stopped, she suddenly released the clutch
- 12:32 Unable to restart with her classic starting technique, she remembered the handbrake technique. However, she released the pedals before releasing the handbrake, which caused her to stall again. Once I explained in more detail and she tried a few more times, she finally managed to start
- 17:23 Started in second, then stalled on the incline
  - 17:46 Tried again with the handbrake. I made her split the stabilization of the clutch and accelerator and the release of the handbrake. It worked
- 21:24 Tried to shift into second on the incline but missed the gear change and stalled. Managed to restart using the handbrake technique
  - She missed the gear change on the incline again and restarted the car using the handbrake technique on the third attempt
- 24:25 Decided to turn left for no apparent reason
- 27:53 Stopped because of traffic and used the handbrake technique to restart, which worked on the first try!
- 30:37 After another handbrake start, stalled on the incline while shifting gears. Again succeeded in a handbrake start
- 34:58 Same case as with Karima: she hit a vehicle in that famous mountain turn, with no technical damage in this case
- 42:30 Stalled starting in second, but up to that point, her descent had been going superbly
- 50:13 On the incline, tried to shift into second but missed and ended up in neutral. Reacted well and engaged the clutch before stopping. However, she stalled once when starting
- 52:00 Stopped and wondered if she was on an incline ::: problem with a fixed chassis
- 53:53 Managed to start on a slight incline in second. So even if she was still distracted, at least she clearly improved in clutch and accelerator management
- The rest of the descent went smoothly. The only thing to note was still steering management in tight turns
- 1:07:05 Tried to shift into second but missed and rolled in neutral for several hundred meters due to the slope. Once past the roundabout and on the highway, she realized it and accidentally put it in reverse instead of first
- Otherwise, she maintained her trajectories much better until the office

- 1:18:37 Gave her advice for the first parking space, telling her to get closer to the parked car next to her to avoid scraping the wall
- 1:24:40 Entered the second space in forward when she was supposed to do it in reverse. Even I did not notice it directly
- 1:42:16 Managed to park in the third space with my guidance, but with relative difficulty. Particularly, she struggled with her left and right in reverse ::: perhaps it would be easier for her in real life if she could look front and back in a fraction of a second to find her bearings instead of having to manage a camera... so maybe VR? What about motion sickness with a motion rig setup?
- 1:47:46 Finally succeeded in parallel parking with a few tips (in 6 minutes)

