Interview Guide - Expert Interviews

Planned interview duration: 45-60 minutes

Groups of people: Racers **(R)** — Instructors **(I)** — Data Analysts **(D)**

In advance

- ✓ Consent signed & demographic data obtained
- ✓ Recording started

Welcome and introduction

1. **Greeting**:
   Dear Mrs./Mr. [name], you are [age] years old and have worked at [company] as [activity] for [duration]. Is that correct?

   Thank you so much for taking your time.

2. **Interview-framework**:
   As part of my thesis at the Technical University of Munich, I am conducting expert interviews on the topic of “Exploration strategies for the limits of driving dynamics.”

3. **Goal**:
   The aim of the interviews is to shed light on human behavior when driving a vehicle, at the limits of vehicle dynamics, and to derive strategies for exploring the limits, which then can be used in autonomous vehicles.

   In short, I would like to find out how people develop a feeling for the current vehicle limits and adapt their driving style accordingly.

4. **Sample-size:**
   In total, I will talk to 20 experts from various fields about this topic.

5. **Scope:**
   I have prepared a few questions that I would like to discuss with you in the next 45 - 60 minutes. Is the time frame appropriate for you?

6. **Notes:**
   I will write down key notes from your answers in order to record key statements and, if necessary, to be able to follow up.

7. **Datasecurity:**
   I would like to record the interview for qualitative data evaluation. I will then evaluate and process the results. The records are only used in aggregate and anonymous form, which means that you are not identifiable as a person. If I want to refer to you by name, I will ask you for your consent in advance. Do you agree with the recording?

8. Do you have any questions in advance?

Interview

1. Your definition of the dynamic vehicle limit.

I would like to start with the topic “dynamic vehicle limit” and would ask you to briefly define the dynamic vehicle limit in your own words.

“The dynamic driving limit describes the range of the combination of longitudinal and lateral acceleration just before the adhesion limit between road and tires and is therefore a limiting factor with regard to maximum lateral acceleration when cornering, for example.” - Textbook source

2. Describe the driving behavior at the limit

In your work as [activity], you often move vehicles at the limits of vehicle dynamics. Can you describe the vehicle behavior in more detail here?

How does the vehicle behave at the limits of driving dynamics?
How does this differ from normal driving behavior?
Are there any differences or similarities between different vehicles?

3. What types of feedback does the vehicle give the driver?

Vehicle feedback is a fundamental part of driving. Can you describe what types of feedback you experience as a driver?

(vibrations, audible/acoustic, visual, smell, steering wheel feedback, pedals, yaw rate)

How do you assign them?
How do you react to corresponding feedback from the vehicle?
Which type of feedback is most relevant to you? — Why?

4. The saying “popometer”

In motorsport, people often talk about the so-called “popometer.” Can you explain to me what that means?

The popometer describes the buttocks of a racing driver if it gives him information about the behavior of the vehicle or the condition of the track.

What statements can you make with the help of the popometer?
In your opinion, what parameters are required to digitally represent the Popometer?

5. **How do you approach the driving limits?**
   - How do you approach the vehicle limit during the braking phase?
   - How do you keep the vehicle at its limit during the mid-corner phase?
   - What is your strategy at the exit?

   What signs are you looking for?
   Is there a specific procedure?

   Does this happen in stages? (Braking/Entry)
   Targeted destabilization? When and why? (Mid-corner)
   Depends on the following route? (Exit)

6. **How can you tell that you are near or at the dynamic vehicle limits?**

   Describe the feeling you feel when you move close to the vehicle limit.
   How does the vehicle give you feedback?
   How can you maintain this vehicle condition?

7. **How do you determine the optimal line of a track?**

   How do you look for maximum grip on the track? (visual, auditory, vibrations?)
   Which criteria give you information about the current grip?
   How do you vary your line and braking points in search of the most grip?
   How far do you stray from the ideal line?

8. **How do you recognize further vehicle potential or whether you are currently already fully exploiting the vehicle limit?**

   To what extent can you estimate the current, local vehicle limits or identify any potential that still exists?

   On the basis of which criteria does the vehicle limit/potential make itself felt?
   To what extent does this influence further driving manoeuvres/the next turn?
   How much do you adjust your driving style in each subsequent lap?

9. **Can your subjective perception of the current vehicle limit be confirmed by telemetry data?**

   Which data is most relevant here?

10. What steps must be taken when evaluating vehicle data?

From which data do you learn the most about vehicle behavior and the limits?

11. How much does your own assessment of the vehicle limit change when it rains or when visibility is poor?

How far back are you in terms of driving dynamics?
Does this happen in stages?
If so, in how many and in what period of time?
How do you get back to the vehicle limit?

12. How is road-tire contact noticeable in the vehicle?

Now let's move on to the last question:
How is road-tire contact noticeable in the vehicle?

How clearly do you feel the tire wear of individual wheels?
How do you handle single-sided pickup?
How do you adjust your line or driving style as a result?

13. Final task

Last but not least, I would like to ask you to classify various vehicle data in terms of relevance for exploring the dynamic vehicle limits on a scale of 1 (not relevant) to 5 (absolutely necessary).

- Speed x, y
- Accelerations x y z
- Yaw, pitch, roll rate
- Side slip angle
- Tire temperature & tire pressure
- Wheel speeds
- Slip angle & slip
- Steering angle/steering torque
- Gas pedal
- Brake pressure/brake torque

Can you think of any other measurement variables that may be important with regard to the limits of driving dynamics?

Conclusion

1. **Summary**:
   Briefly summarize the conversation.

2. **Additions**:
   We've reached the end of the interview — is there anything else you would like to add?

3. **Evaluation**:
   I will now review and evaluate our conversation afterwards. Can I contact you again if any questions arise during the evaluation? If you want, I'll keep you updated on the progress of the work.

4. If you think of anything important, feel free to contact me at any time.
5. Thank you for the exciting conversation and your perspective on the topic. (If necessary, emphasize which information was particularly interesting or helpful)

- ✓ Recording stopped
- ✓ Thanks for the interview
- ✓ Inquiry contact made
- ✓ Say goodbye

Backup-Questions

Data analysis

1. **How can the driver implement these findings in a meaningful way?**

   What instructions do you give as a race engineer/data analyst?
   How does the exchange take place?

Dynamic vehicle limits

2. **What options are there to control a vehicle at the driving limits?**

Reaction to uncertainties and environmental influences

3. **Describe the difference in grip on the ideal line compared to next to the ideal line.**

   (in terms of tire debris, dust and drying track)

   How to deal with a single-sided pickup?
   Will this influence your next driving maneuvers?
   How high is the grip loss and how long does it last?
   How is the "track evolution" phenomenon felt in vehicles?

4. **What effects do such uncertainties have on you as a driver?**

   What room for manoeuvre do you have if the vehicle limit suddenly shifts due to uncertainties?
   How quickly can you adjust to it?

5. **Do competitors influence your vision of grip levels and vehicle limits?**

   Do you use opponents to explore track conditions?

The ideal round — approach and vehicle limits

6. **Describe the procedure for reaching the time-optimal round.**

Vehicle control learning process

7. **Explain the process of driver training and the methodologies used.**

   Which exercises do you use to achieve results as quickly as possible?
   Which situations have you learned the most from?
   How do you train your feeling for the vehicle?

8. **Describe what you think is the perfect driver.**

   What characteristics does he/she have to have?