

VOLVO



Zero Prototypes - a technical or mindset barrier?

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Driving simulators: Transforming the way we test and think

Paradigm shift in the way we develop vehicles

Assess vehicles and identify flaws in a much faster and repeatable environment

This allows us to develop vehicles which is safer, more advanced and more aligned to our mission

How do we leverage this advantages?



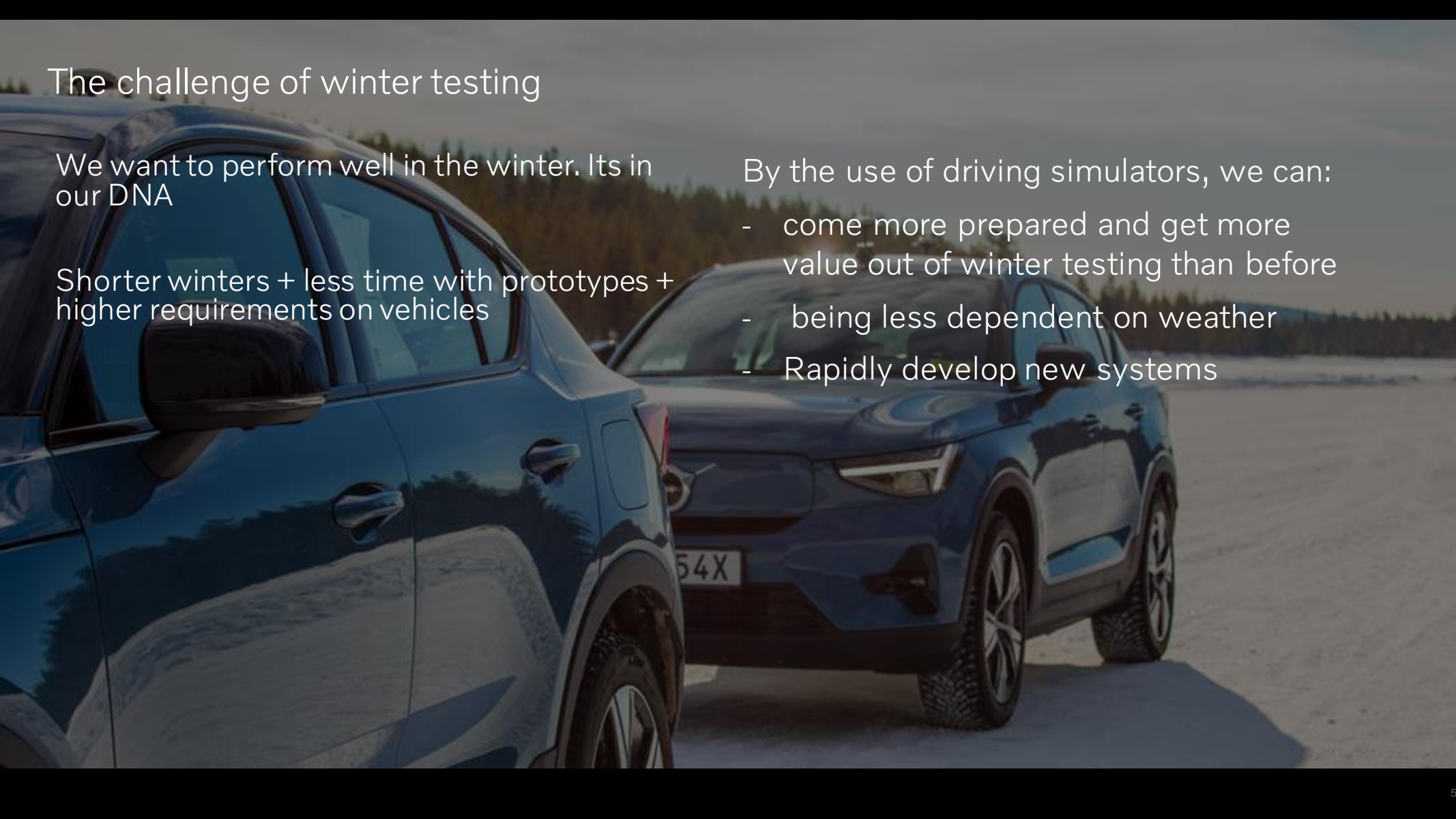
The challenge of winter testing

We want to perform well in the winter. Its in our DNA

Shorter winters + less time with prototypes + higher requirements on vehicles

By the use of driving simulators, we can:

- come more prepared and get more value out of winter testing than before
- being less dependent on weather
- Rapidly develop new systems



The challenge of winter testing

Simulators require the use of test drivers, drivers used to physical testing

How do help them change their mindset to embrace virtual testing as a tool in their toolbox?

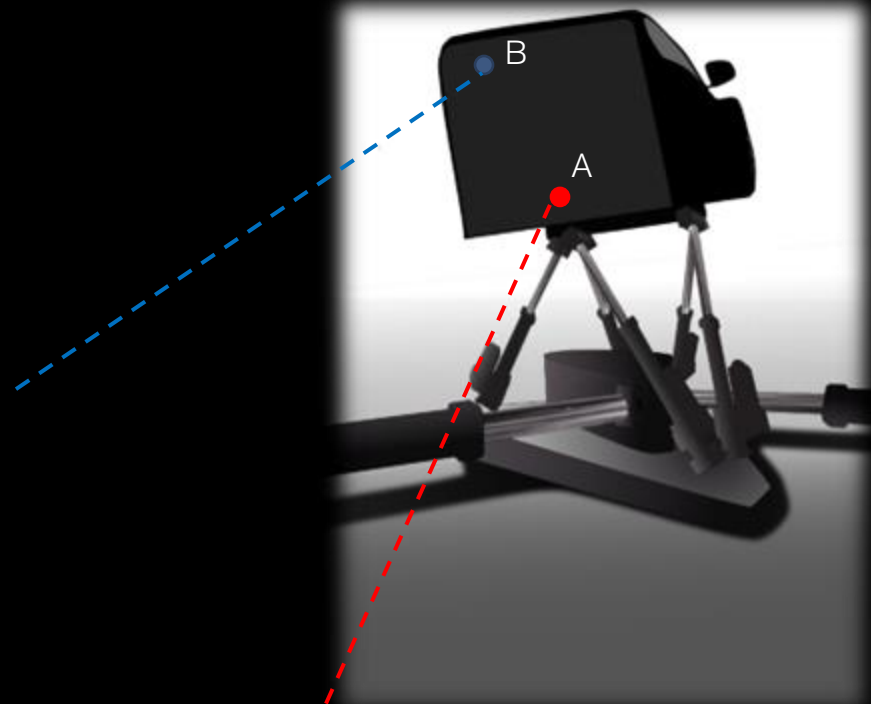
Motion cueing: key element to help test-drivers accept the simulator as a tool

2020 Volvo Cars and KTH set out to understand how to objectively tune motion cueing



The challenge of winter testing

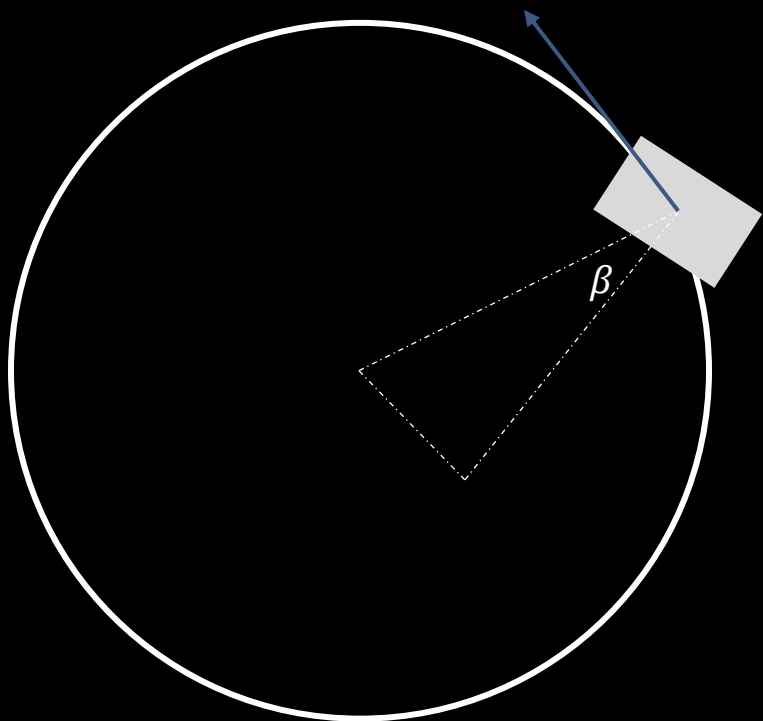
- “Setting B significantly easier to drive fast through the slalom”
 - “Setting B is easier to rely on feedback, this setting is fun to drive”
 - “Setting B is easy to drive and quick to adjust to”
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- “Setting A had long time lags, felt understeered and had bad roll feedback”
 - “Setting A is hard to control, excessively jerky in yaw, feels like there is a mismatch in impressions”
 - “Lag between lat-acc and roll made me motion sick (setting A)”
 - “Feels like too much yaw compared to real life”



Slip feedback in winter test conditions

Setting B: Baseline motion cueing

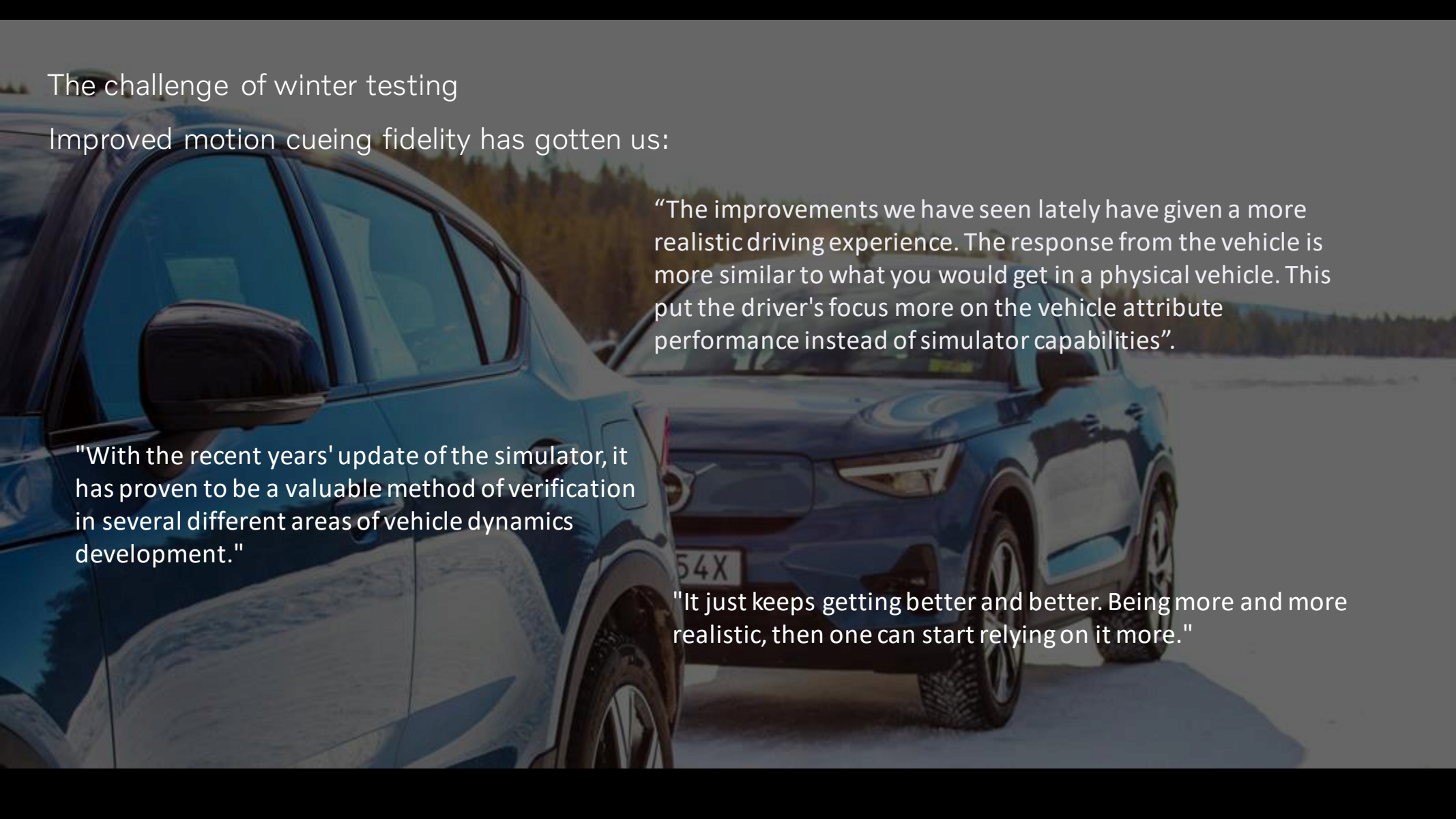
Setting C: No filter on body slip β + objective tuning of cueing gains (6 of 6 drivers preferred this cueing)



“(Setting B) is like impossible to correctly guess β, feels very delayed in catching the car, generally (Setting B) is tiring my brain. In my opinion (Setting C) was amazing compared to (setting B)”

“(Setting C) natural basically all the time, (setting B) feels very sluggish all the time.”

Prefer (setting C) realistic when the car loses grip. Easier to predict/react to the car rotating (compared to B)

A blue Volvo SUV is parked in a snowy field. The car is the central focus, with its rear and side visible. The background shows a line of trees and a hazy sky. The entire image has a semi-transparent dark overlay to make the text legible.

The challenge of winter testing

Improved motion cueing fidelity has gotten us:

“The improvements we have seen lately have given a more realistic driving experience. The response from the vehicle is more similar to what you would get in a physical vehicle. This put the driver's focus more on the vehicle attribute performance instead of simulator capabilities”.

"With the recent years' update of the simulator, it has proven to be a valuable method of verification in several different areas of vehicle dynamics development."

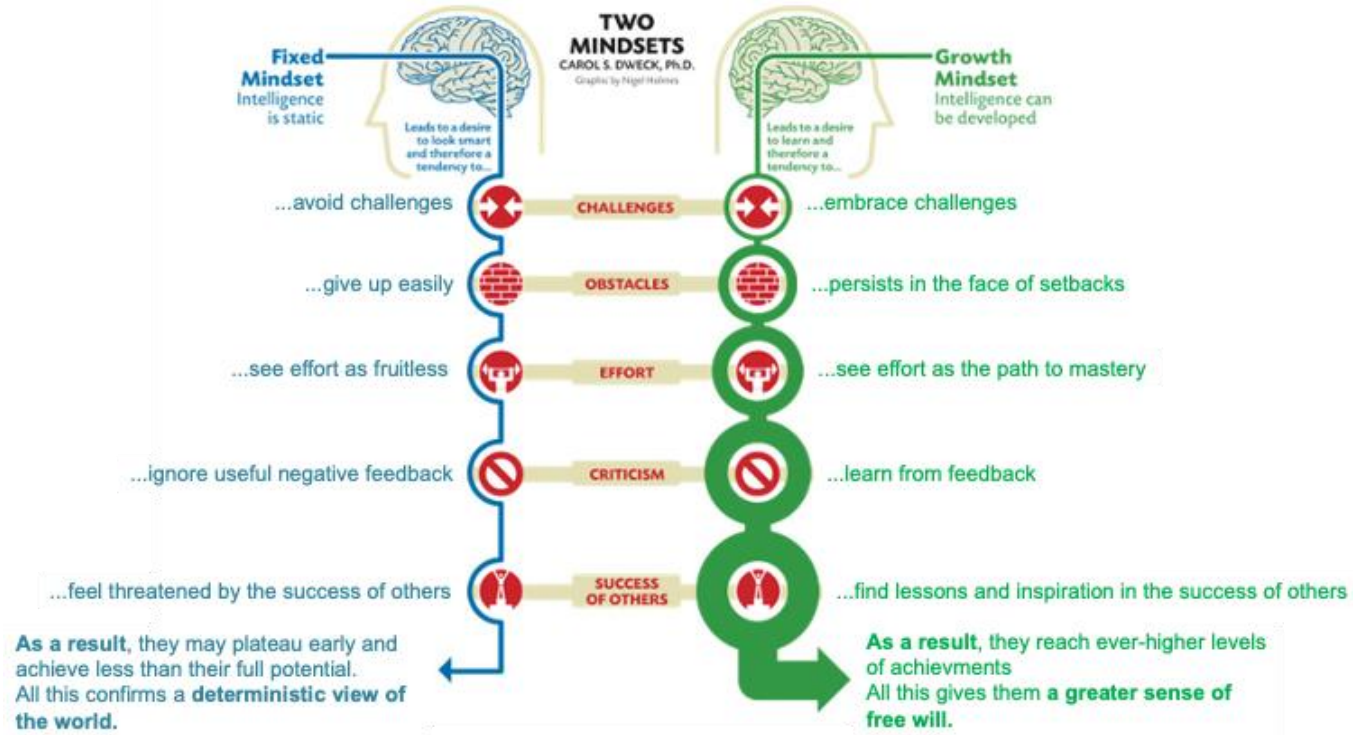
"It just keeps getting better and better. Being more and more realistic, then one can start relying on it more."

Summary

- Designing our future cars to be even more fit for purpose requires simulation methods, models & tools that cover more load cases with a higher accuracy
- This requires a willingness to expand the circle of control by daring to explore the unknown...



A growth mindset will enable for us to take attribute optimisation and simulation to the next level



How will you expand your comfort zone?

