Introducing Advanced Driver Assistance Systems (ADAS) into drivers' training and testing: The young learner drivers' perspective

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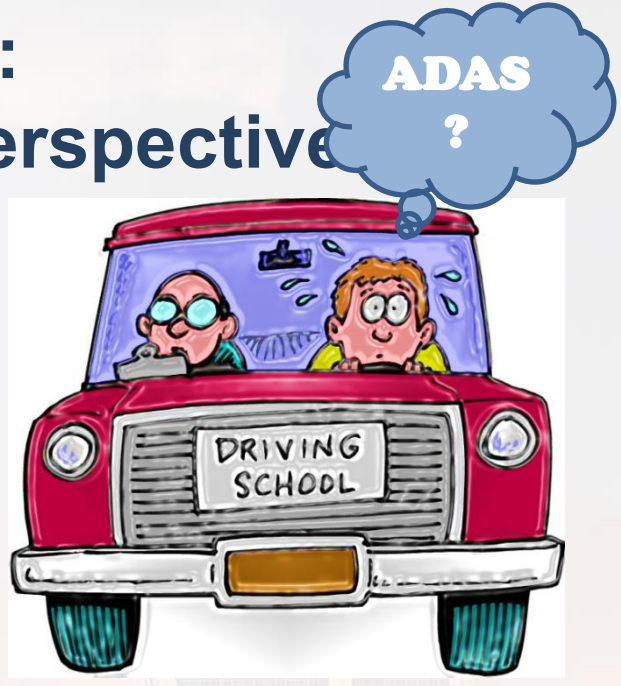

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Contents

Introduction

Worldwide traffic Safety facts:

- **1.23 million road traffic deaths per year**
- **> 50 million injuries per year**
- **# 1 cause of death among those aged 15-29 years**

Novice driver most related causes:

- ***Speed adaptation***
- ***Hazard detection***
- Road type recognition
- Giving right of way

Introduction

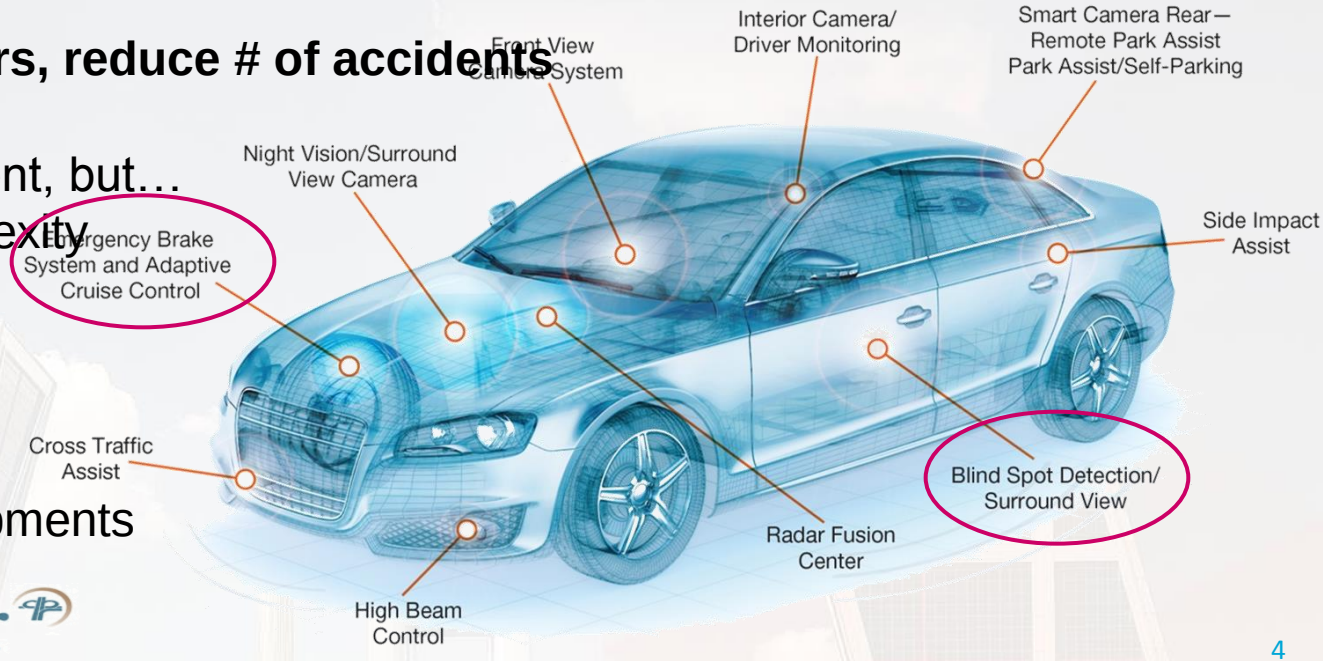
1. **ADAS:**

Different levels of automation (warning-full control of vehicle) to:

- **Mitigate human errors, reduce # of accidents**
- Improve traffic flow
- Protect the environment, but…
- Different levels complexity
- Limitations & Failures

2. **Training & Testing**

- Needs of drivers
- Technological developments

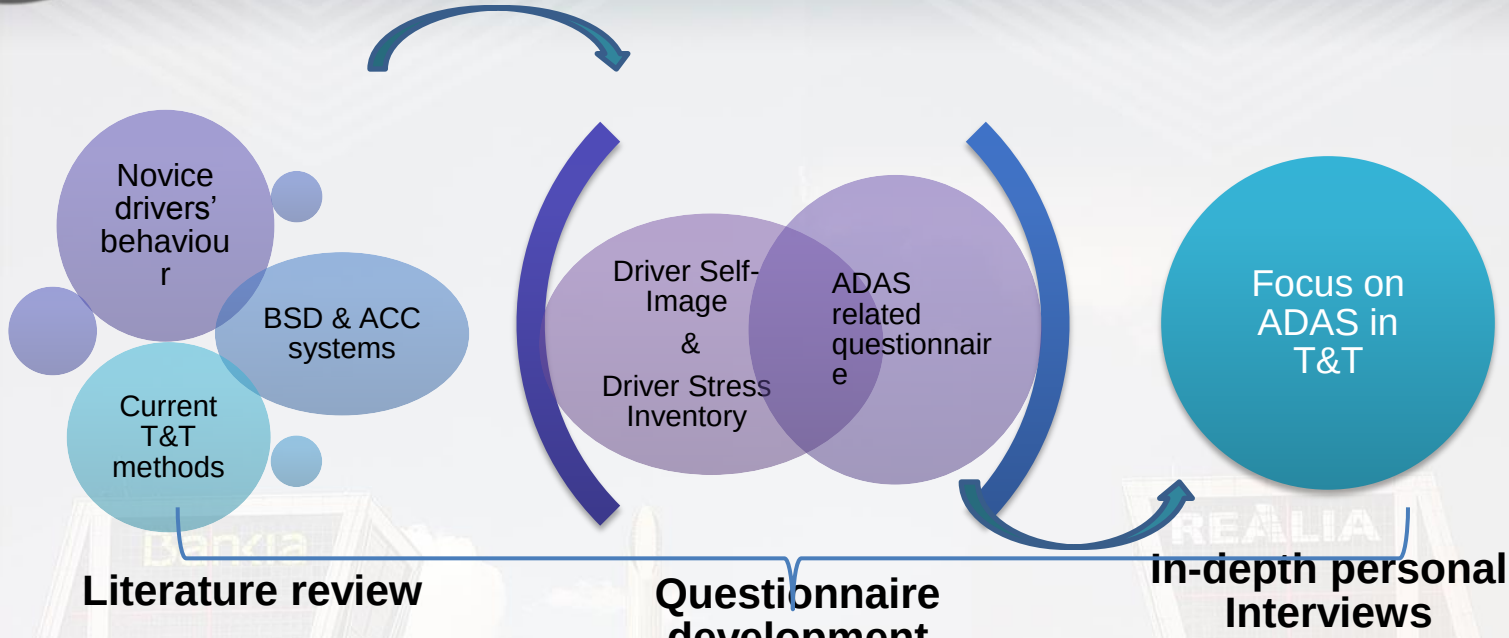


Problem Statement

What is the **learner drivers' perspective** on the Blind Spot Detection (**BSD**) and Adaptive Cruise Control (**ACC**) systems and their **introduction to drivers' training and testing**?

- Systems' characteristics
- Need (familiarity, usefulness, acceptance in T&T)
- Willingness to use & Ease of use
- Drivers' characteristics

Methodology



Data Analysis

(Descriptive Statistics, Factor Analysis, Statistical tests, like Pearson correlation, Friedman tests, MANOVA, etc.)

Methodology

Literature findings

Risk increasing factors

- Visual information collection
- Speed and headway adaptation
- Hazard monitoring

Novice drivers' behaviour

- Inability in higher order tasks (hazard recognition, impulse control)
- Willingness to take risks
- Underestimation of risks-passengers' influence
- Slow eye scanning movements
- Fragmentary perception of events

Drivers' training

- Basic – 3 level task
- GDE matrix – 4th level: "Goals for life and skills for living"
- Advances in:
  - Pre –test practice structure
  - Quality in training
  - Driving test
  - Probationary periods

ADAS (ACC, BSD)

- ACC & BSD: radar systems preferred
- ACC & BSD: reduction fatalities up to 7%
- Concerns:
  - Overreliance
  - Wrong expectations
  - Limitations/Failures
- Introduction to Training & Testing - GDE matrix

Methodology

Questionnaire Development-

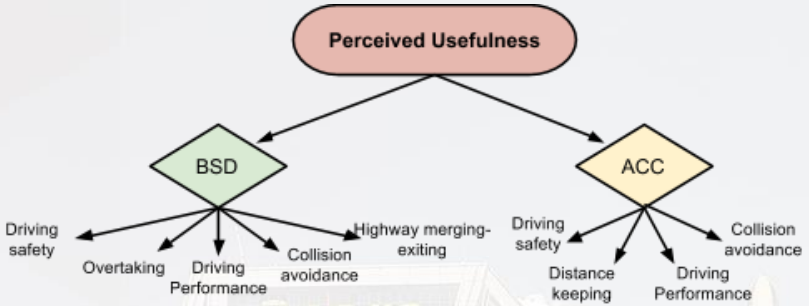
Adaptive Cruise Control: https://www.youtube.com/watch?v=RDSZWFV7qFk

Blind Spot Detection System: https://www.youtube.com/watch?v=NfK9Rm2ShRw

Methodology

Questionnaire Development-Inventories

Participants: 40 learner & 48 experienced drivers



Driver Self-Image Inventory
Driver Stress Inventory

6. Please answer the following questions on the basis of your usual or typical feelings about driving. Indicate how strongly you agree or disagree with each of the following statements.

Does it worry you to drive in bad weather?

Blind Spot Detection (BSD) system VIDEO

At this point you are kindly asked to watch the following video which describes the Blind Spot Detection system

26. Indicate how willing you are to use the Adaptive Cruise Control system in the following situations:

I am willing to use the system...

	strongly disagree	disagree	neither agree or disagree	agree	strongly agree
...in urban environments (30-50km/h)					
...in rural environments (80km/h)					
...in highway environments (100-130km/h)					
...in highly congested situations					

27. Answer the following questions on the training and testing of the system.

	strongly disagree	disagree	neither agree or disagree	agree	strongly agree
It is important to learn about the system before using it					

Please explain why you agree or disagree.

Methodology

In-depth Interviews

- Participants: 4 learner drivers (2 TU Delft students & 2 students from driving schools)
- Content: Introduction of BSD and ACC in training and testing
  (based on results of questionnaire analysis)
- Location: TU Delft, Skype

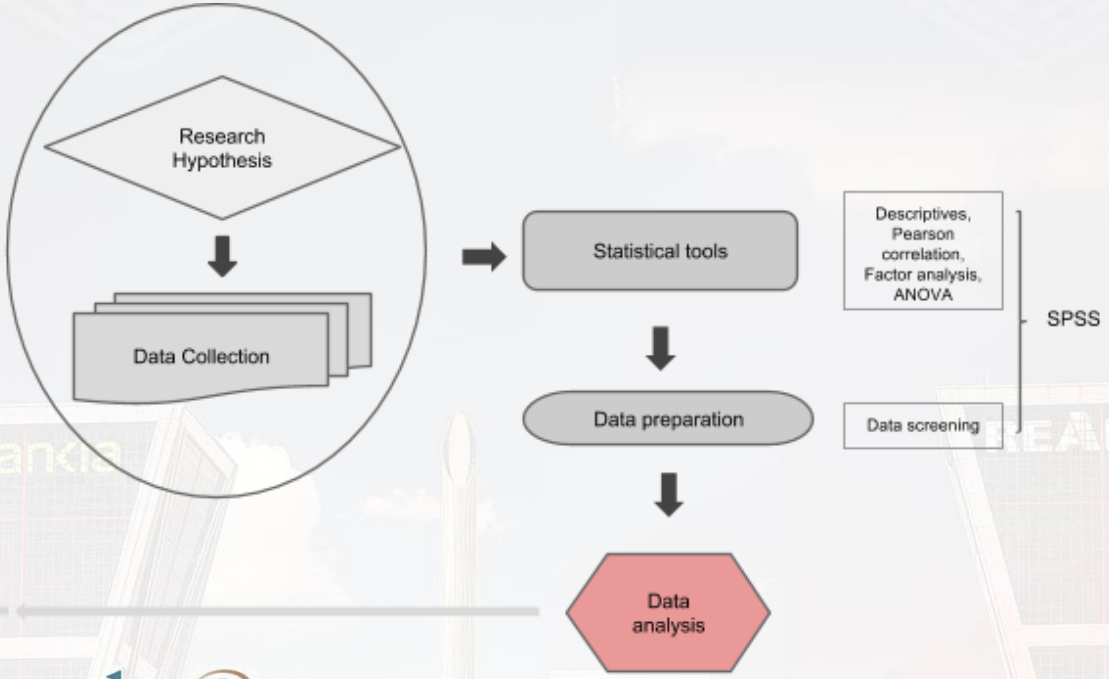
Examples of questions

1.Suppose that the BSD is part of the training and testing procedure. How would you like to be trained and tested on the BSD system?

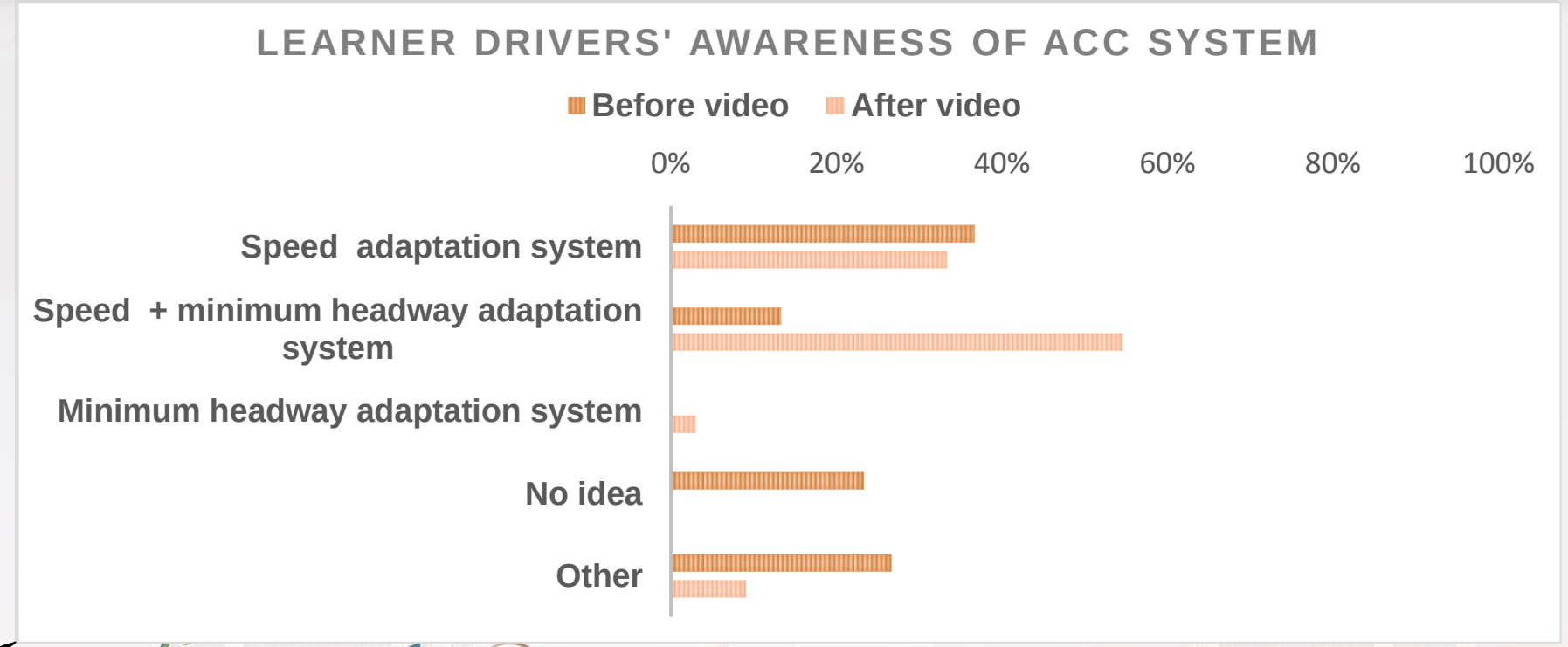
2.If you could choose, with which sequence would you introduce the systems?

Methodology

Data Analysis



Results Questionnaire



Results

Questionnaire

Usefulness & Willingness to use

Usefulness

BSD Overtaking, Collision avoidance, Merging in highway, Driver Safety > Improvement of drivers' performance

ACC Adjustment to traffic conditions > Improvement of drivers' performance

ACC Driver Safety > Improvement of drivers' performance

Willingness to use

BSD Highways, Rural > Urban

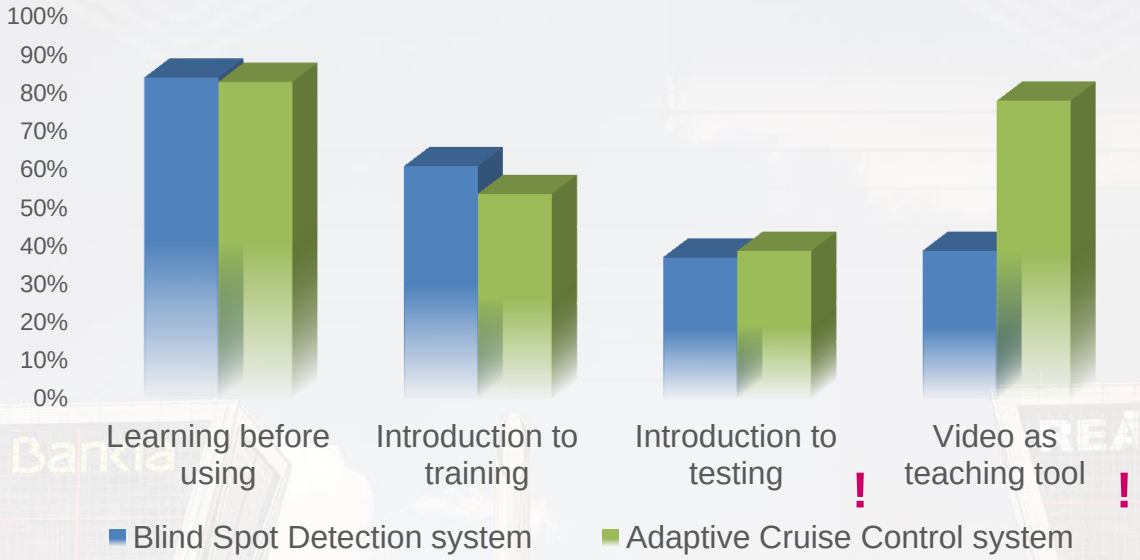
ACC Highways > Rural, Urban, Congestion

ACC Rural > Urban

Results

Questionnaire

Need in Training & Testing



Results

Questionnaire

Factor Analysis

Driver Self-Image Inventory

Confident

Courteous

Impulsive

Driver Stress Inventory

Dislike of Driving

Hazard Monitoring

Thrill seeking

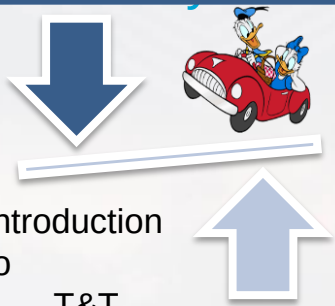
Results

Questionnaire: Driver Profiles & Need of the systems

BSD: Driver Self-Images and introduction to T&T
NO significant correlations!

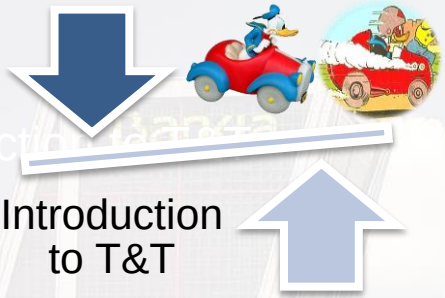
Driver Stressors and introduction to T&T
NO significant correlations!

ACC:

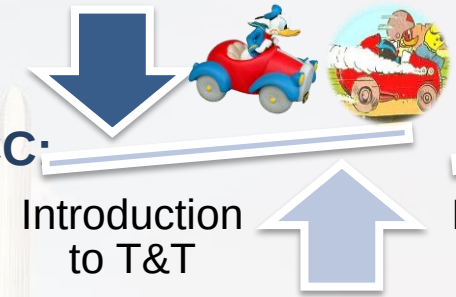


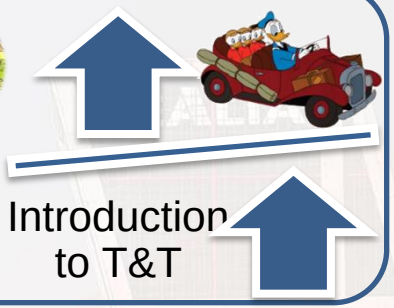
Learners

BSD:



ACC:

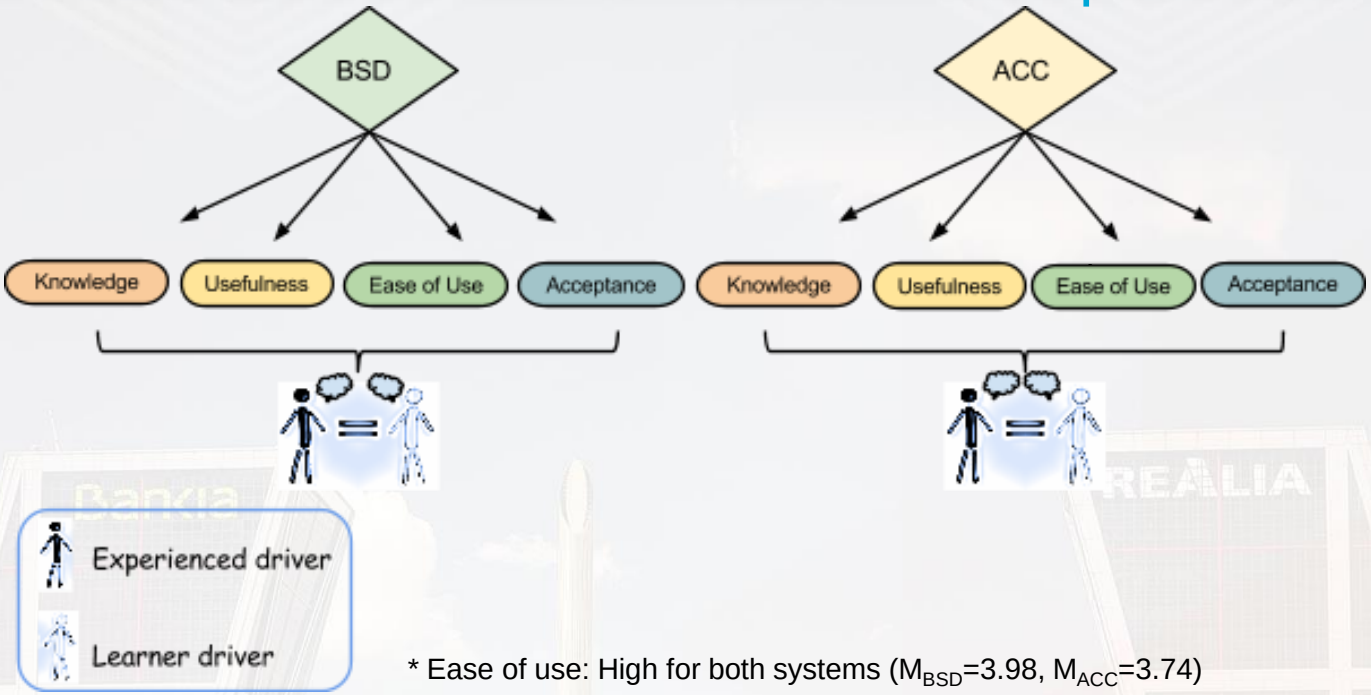




Experience

Results Questionnaire

Differences between learners and experienced



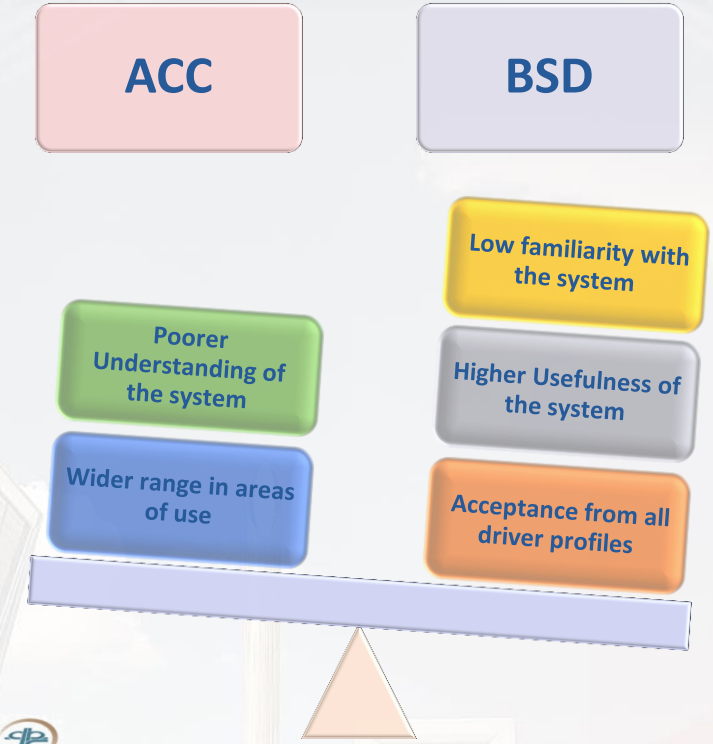
* Ease of use: High for both systems (M_{BSD}=3.98, M_{ACC}=3.74)

"*the BSD system is very straightforward*"
"*the ACC system is easy to use but more complex compared to the BSD system*".

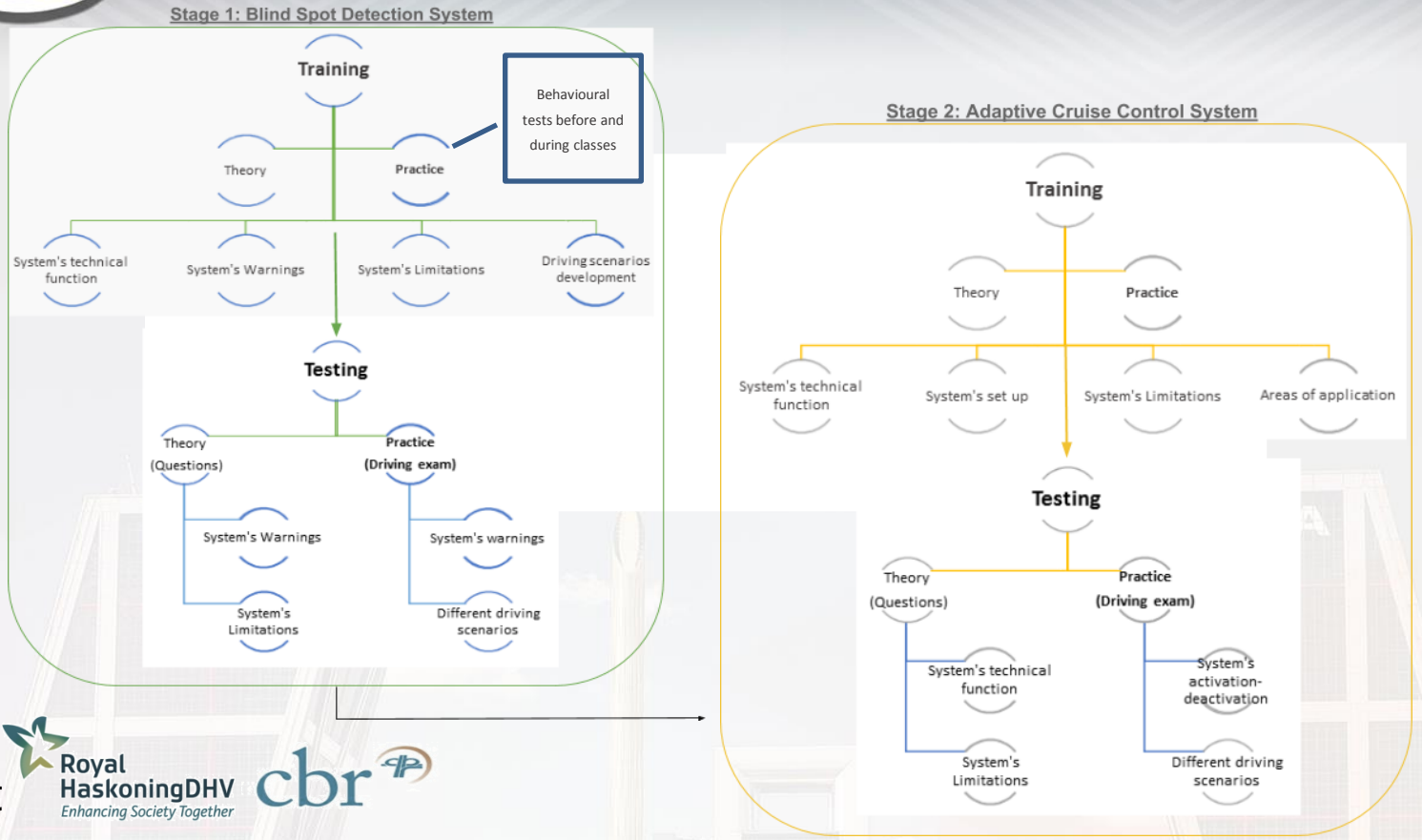
Results Interviews

	BSD	ACC
Assisted driving tasks	1. **Multitasking** (alertness for blind spot) 2. Reduction of mental workload	**Multitasking** (maintaining headway, slowing down in time)
Advantages	Multiple ways of warnings provision	Harmonious traffic flow
Disadvantages	1. **Overreliance** 2. Limitations of the system	1. **Overreliance** 2. More a luxury than a necessity
Preferred training method	**Practice**	**Practice**
Preferred testing method	**Theory**	1. **Theory** 2. **Practice** (Driving exam)
System's introduction most important aspect	**Introduced as auxiliary system**	
Preferred sequence of introduction	1st	2nd

Conclusions



Recommendations



Recommendations (1)

- Practical
  - Used videos
  - Sample size
- For future research
  - Weights on factors affecting attitude to ADAS
  - Simulator and field experiments
  - Perception of other stakeholders

Recommendations (2)

- For future developments/projects
  - Organise a workshop: ADAS in training and testing
    with CIECA/EC stakeholders and other relevant stakeholders (e.g. from academics, automotive and road administrations)
  - Define a project group
    to define best practices leading to adequate training and testing protocol
  - Develop a best practice toolkit
    that meets individual countries needs and requirements

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