

# VISION ZERO ACADEMY

STRIVING  
FOR EXCELLENCE IN  
TRANSPORT  
SAFETY



## Human Factors

*Human Factors: Design principles*

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# Human Factors in the transport system

The human perspective with a “system understanding”

1. The road-user
2. The infrastructure
3. The vehicle

Always three “demands” to consider



# Humans - The road user

The road-user is a great creature with unique fantastic features but also with some limitations.

In addition, we have very large intra and interindividual differences (gender, fitness, and most importantly familiarity).

These features and limitations are displayed in an activity that could be interpreted as an irrational behavior but is usually completely rational (for the individual).

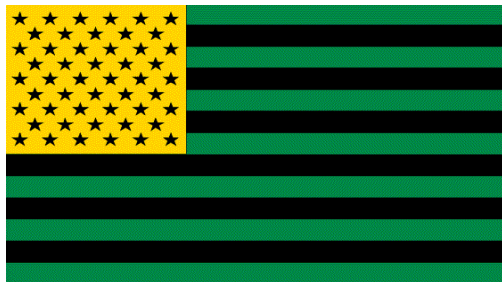


# Examples of different "cognitive processes"

- Sensation - road sign example
- Perception – road marking or delineator post
- Attention – multi tasking: gadget use
- Memory – familiarity: all situations
- Cognition – planning and prediction - crossings
- Meta cognition – know your limitation

**IMPORTANT: These explain behaviour – we act on data driven and conceptually driven information**





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- Road signs – often to strong retro-reflexion
- You get Blinded by the light – Especially elderly



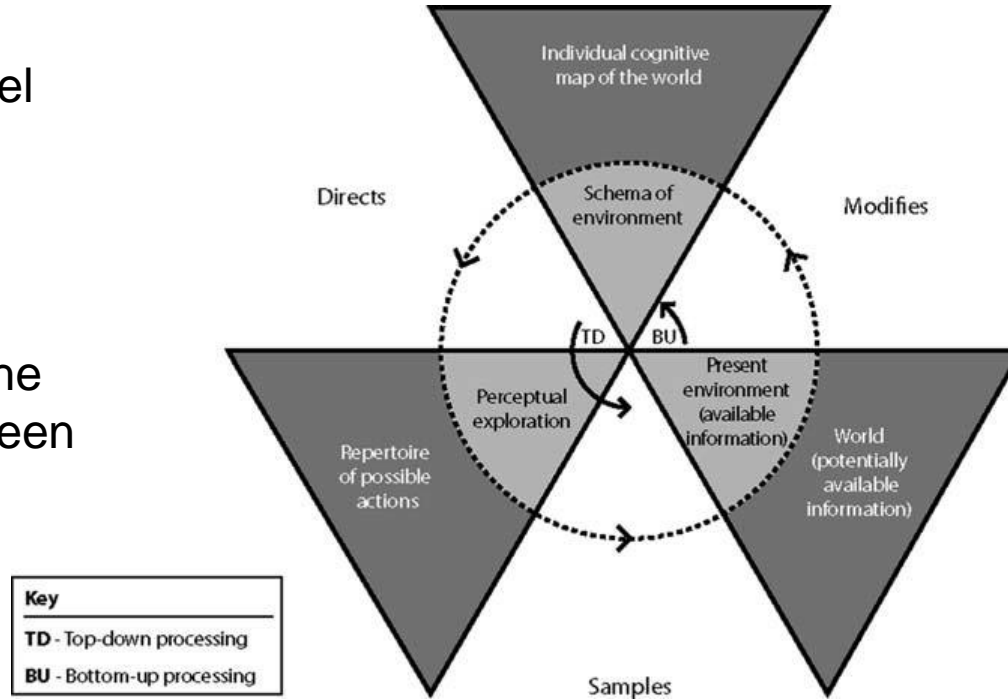




# Model for datadriven and conceptual processes

Perceptual model  
Neisser, 1976

With a focus on  
schemata and the  
interaction between  
humans and  
systems



- Memory: Familiarity

For example : This is only a few

Design of roundabouts

Navigation: Less need of signs or speed recommendations

Overtaking of trucks – even longer ones



## *Attentional problems: Limitations of Humans*

Target attraction: Selective attention: Signs etc.

Gadget use : Divided attention

Driving speed: Affects processing speed

## "Time saving bias" example

Imagine traveling with a car between two places every day and the stretch is 20 kilometers.

You usually drive this stretch at an average speed of 110 km/h. But you are late for a meeting.

You must save exactly three minutes on this stretch. What average speed do you need to drive in to compensate for the 3 minutes you lost?

*Answer: 150 km/h*

The total stretch is 150 km, and you are re-building the road. How much time will you save?

<u>Alternative</u>	<u>Stretch A</u>	<u>Stretch B</u>
Old speed	30 km/h	50 km/h
New speed	60 km/h	120 km/h

Cognitive: B save 1h and 45 minutes

The correct: A save 2 h and 30 minutes

## Meta cognitive level. Thinking about our own abilities

Drivers rate themselves better than average (Svenson, 1966)

Example: Drivers with visual field loss drove in the simulator

Passed: Overrated themselves as normal people

Failed: Overrated themselves significantly more



## The concept of "human error" – an important remark!

The use of the concept of human errors becomes strange in investigating safety issues within complex socio-technical systems.

When the real causes of safety issues are profound system factors such as organizational decisions, design, equipment, management surveillance and procedures (Woods et al., 2010; Dekker, 2014; Stanton and Harvey, 2017) are vital.

Attributing an individual's action as a "human error" is a failure to prevent systematic causal relationships.

There is a need for effective interaction between human and technology, i.e.  
**sociotechnical systems**

# Fitness to drive

- Timo Tervo : 80 % of fatalities due to traffic medicine (Finland)
- Elderly – dementia – detection? **Cognition**
- Sleepiness/fatigue – detection but counter measures? **Meta cognition**
- Alcohol – same numbers with BAC above 0,02 – but what do we do?  
Cycling? – **Several aspects**
- Medical symptoms – visual deficits – **Several aspect**

# Automation

Humans are really bad at monitoring - Wakefulness problems

- Monotonous condition
- With low possibility
- Against a background of non-critical signals
- During a long period of time
- Occurs unpredictable

Mackworth, 1950

- Performances go down as an effect of "Time on Task"

# United Human Factors researchers:

- **A Human Factors perspective on Automated Driving**
- Kyriakidis, M., De Winter, J. C. F., Stanton, N. A., Bellet, T., Van Arem, B., Brookhuis, K., Martens, M., Bengler, K., Andersson, J., Merat, N., Reed, N., Flament, M., Hagenzieker, M., & Happee, R., 2017

# Automated cars

Developers and decision makers should not predict that automation can replace a human driver, nor can they assume that the driver will understand the limits of automation.

Developers and decision makers and researchers must carefully make sure what role road-users should have in automated vehicles.

How should the system support if the driver is responsible for the control of the vehicle.

**Conclusion: As in other domains, traffic safety depends on the combined performance of human and automation and high-performance constructions will depend on recognizing and supporting new roles for the driver**

Merat and Lee, 2015

# MaaS: Mobility as a Service

- You can change modal choice (Andersson et al 2020)
- You need to consider the mobility capital of users (Kaufmann, 2004)
- Free PT card increase PT use – reduce bicycling
- Free floating electrical cars – increase car use
- Several technical solutions – app based – shop and go – no effects obtained so far



# Bicycling during acute alcohol intoxication

- It is accepted to bicycle while intoxicated
- Stability is affected at relative low levels of BrAC (0.3 promille)
- Both yaw and roll is affected – sensation and perception
- Cognition is affected – working memory
- Decreased ability is not considered - meta cognition

Andersson et al 2020

# Conclusion: Human Factors-Design principles

- Humans are fantastic and adapt accordingly
- Humans have cognitive limitations
- Always an interaction between road-user, infrastructure and vehicle
- We need to look from a sociotechnical perspective
- All social and technical solutions will change behaviour
- We need to consider the new role for the road-user
- We need to understand the mobility capital for all groups of road users

# Thank you

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