Field study investigating first time interaction with four automatic gear shifter concepts and their impact on safety

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BACKGROUND
Shift-by-wire technology enables new and creative shifter designs and space-saving solutions. The development towards an extended variation of gear shifters could have impact on safety in case drivers mis-use the gear shifter or if a confusing design creates mental demand and distraction from the road environment. These issues are particularly of concern in case of first encounters with new gear shifters – as in a car-rental-scenario.

PURPOSE
In this field study, four cars with shift-by-wire technology and different types of automatic gear shifters – button shifter, rotary shifter, joystick shifter or stalk shifter – were investigated from a usability and safety perspective with drivers that previously had not used the shifters in question. The aim of the study was to investigate advantages and disadvantages with different concepts that are found in production cars today. The one exception was the button shifter that was part of a concept car.

FIELD STUDY
Procedure: Participants interacted with all gear shifters in a counterbalanced order while driving on a test track. Each car session ended with questionnaire and interview questions. All interaction was recorded on video.

Measures: Guessability (instructions needed), glances towards device, selection errors, Subjective rating of possibility to keep eyes on road, Subjective rating of likeability.

RESULTS

- **Instructions needed - objective (Guessability)**: The least instructions was needed with the button shifter to complete a task.

- **Glances towards shifter – objective**: The amount of glances toward device was more frequent with the joystick shifter and the stalk shifter than with the rotary shifter when Drive mode was to be selected. The joystick shifter had more frequent glances than the button shifter when Drive mode was to be selected.

- **Selection errors - objective**: The amount of selection errors (not force-or placement related) were more frequent with the joystick shifter and the stalk shifter than with the button shifter.

- **Likeability rank - subjective**: When the gear shifters were compared based on subjective likeability the joystick shifter was the most preferred and the stalk shifter was the least preferred.

CONCLUSIONS

- Subjectively the most likeable
- Objectively difficult to use and understand without instructions
- Subjectively hard to use without looking at the buttons
- Objectively the easiest to understand and use
- Objectively easy to understand and use – but not in combination with stalk paddles in Manual mode
- Subjectively least preferred
- Subjectively and objectively difficult to use and understand
- Diversity between different measures
- The subjective ratings complemented the objective usability data

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Figure 1. Description of gear shifter concepts.

Figure 2. The least instructions was needed with the button shifter to complete a task.

Figure 3. The amount of glances toward device was more frequent with the joystick shifter and the stalk shifter than with the rotary shifter when Drive mode was to be selected. The joystick shifter had more frequent glances than the button shifter when Drive mode was to be selected.

Eyes on road (subjective): The participants rated the button shifter as the most difficult to use without taking the eyes off the road.

Figure 4. The amount of selection errors (not force-or placement related) were more frequent with the joystick shifter and the stalk shifter than with the button shifter.

Figure 5. When the gear shifters were compared based on subjective likeability the joystick shifter was the most preferred and the stalk shifter was the least preferred.