Meaningful Human Control – 4 years later

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In July 2022, a set of advanced driver assistance systems (ADAS) became mandatory to be fitted within newly sold cars (Regulation 2019/2144, 2021). With most of these systems being able to warn the driver for hazardous circumstances through visual and/or auditory signals, it is expected that more unsafe situations can be avoided with these ADAS. However, with the introduction of such novel systems, it raises issues such as mode awareness and complacency (Parasuraman & Manzey, 2010; Pless, 2016; Sarter & Woods, 1995). Moreover, becoming out-of-the-loop (Merat et al., 2018) becomes another safety-critical concern with automated driving systems (ADS) such as the automated lane keeping system (ALKS), an SAE level 3 (SAE International, 2018) providing both longitudinal and lateral control during traffic jams driving up to 60 km/h, ultimately taking over the entire *dynamic driving task* ("Mercedes-Benz self-driving car technology approved for use", 2021). This leaves the driver with no meaningful control over its vehicle (see Santoni de Sio et al., 2022 for an overview of Meaningful Human Control [MHC] applied to ADS).

This study is a follow-up on previous work of Heikoop, Calvert, Mecacci, & Hagenzieker (2020), a focus group discussion held in September 2018, in which they assessed the opinions of Dutch professional driving examiners about the developments of ADS and its influence on the (human) driver. The current study describes the results from a new focus group study held in 2022, during which the five consensual findings and two points of discussion from the original study were revisited. The first consensual finding from the 2018 focus group study was the opinion that the current market introduction is flawed. While they agreed no one *is* responsible for ultimately informing the driver in order to have it, they argued someone *should* be, as per the second point of consensus, adequately understand ADAS' functionality, as to avoid hazardous situations, either through mis-, dis-, or abuse of the systems (Parasuraman & Riley, 1997). ADAS being intuitive, easy, and fun to use were consensually being thought of facilitating this understanding, while automation surprise (Bainbridge, 1983) being a serious safety concern, addressing consensus #3 and #4, respectively. To avoid most of such issues, the final consensus reached was to not have drivers monitor their vehicles at all times. Debated, however, was whether the levels of automation were in need of a human-oriented focus, and how the form of ADAS driver training should be given shape.

Four years later, a similar focus group study was organized on February 18th, 2022, in Deventer, the Netherlands, this time with 14 Dutch professional driving instructors as participants. Prior to this focus group study, the participants drove with four different cars, all equipped with the set of mandatory ADAS. Every instructor drove a different car at two separate sessions for about half an hour, to experience these ADAS on public roads during regular traffic. After the first session, the participants gathered to give collective feedback on their experience with the ADAS, after which they started the second session. Thereafter, a final collective feedback round was given, and the focus group discussion started, to discuss the current stance regarding the seven points mentioned earlier.

As a general summary of the results, of the five previously consensual findings, four reached consensus again in the current study. On the fifth, the question whether ADAS should be intuitive, easy, and fun, the arguments were more widespread, raising factors such as appeal, functionality and safety, while also arguing for applying human factors to the design. Mainly due to this focus group discussion reaching much more in-depth discussion than its predecessor, the findings led to a more substantial foundation, and even allowed for developing solutions or paths towards them: aiming for drivers to know about the fallibility of the ADAS, addressing the so-called 'blind update' as a safety concern, and arguing for youngsters to practice monitoring as part of their driver training are some of the ideas resulting from the discussion. The practical experience of driving with ADAS just prior to the discussion led to in-detail recollection of ADAS functionality and the concerns therewith, allowing for an enriched discussion over actual occurring situations in which ADAS could benefit, or rather harm, the safety of the driver, for instance pinpointing an exact moment where an ADAS acted reactively, or noting the still relevant mode awareness (is it on or off?). Regarding the points which previously did not reach consensus, while the second discussion point remained a point of heavy discussion, the first now reached more favour towards (at least investigating the potential of) a human-oriented focus for the levels of automation. Albeit unrealistic, they argued it could be worthwhile, since technology should also ultimately be accepted by its user, the human, in order for it to become a complete success eventually.

All in all, four years later, there were clearer views and more in-depth discussions on the various topics concerning ADAS, but many of the concerns in 2018 are still not resolved in 2022, which raises several flags. There are, however, various signs that these concerns are now reaching common ground (see e.g., European Union, 2022). The practical experience of driving with ADAS enriched the discussion offering fruitful, first-hand professional suggestions of safe implementation and usage of ADAS in traffic.

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