

Trust, Experience and Behavioural Adaptation to In-Vehicle Technology

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Research Problem

- Studies reporting a safety benefit of vehicle technology do not consider the long-term impact.
- Safety and security may be impacted by behavioural adaptation over time.
- Trust and experience is expected to play a role in behavioural adaptation.
- Determinants of trust and the role of experience in interaction with in-vehicle technology need to be understood.
- Four key papers in press or submitted aim to investigate these research problems.

Paper 1 Determinants of Trust in Automated Systems:

- INTRODUCTION:** Hypotheses about trust in autonomous systems (AS) are sometimes theoretical and sometimes empirical.
- AIM:** To test competing hypotheses about how trust in AS is formed.
- METHOD:** Predictions from AS trust literature were tested using validated scales measuring influence of dispositional trust, social trust, personality, tendency to anthropomorphise and effects of experience with AS age, sex, and education in a self-report study (N=300).
- RESULTS:** Trust in regulators and system manufacturers and experience significantly correlated with trust in AS. No other predictions were upheld.
- DISCUSSION:** With no personal experience, trust may be determined by social trust in the makers and/or regulators of AS technology. Trust may be sensitive to the sample selected and measurement methods used.

Paper 2: Experience with Automated Systems

- INTRODUCTION:** Humans are adept at learning from experience and altering behaviour to better suit the environment, but we have little or no inherited understanding of AS.
- AIM:** To develop principles for how experience with AS should be measured.
- METHOD:** A survey study (Study 1: N= 209) and a field study (Study 2: N=22) of the use of adaptive cruise control (ACC) was conducted.

Overall Conclusions:

- Trust in AS is dependent upon experience and trust in regulators and manufacturers
- Safety effect of ESC is not well founded due to methodological issues
- Safety predictions are suspiciously large for various automated vehicle features
- If automated vehicles were as effective as claimed, there would hardly be any crashes at all
- Further research to investigate behavioural adaptation to automated vehicles is warranted
- How users adapt to AS can compromise safety and security

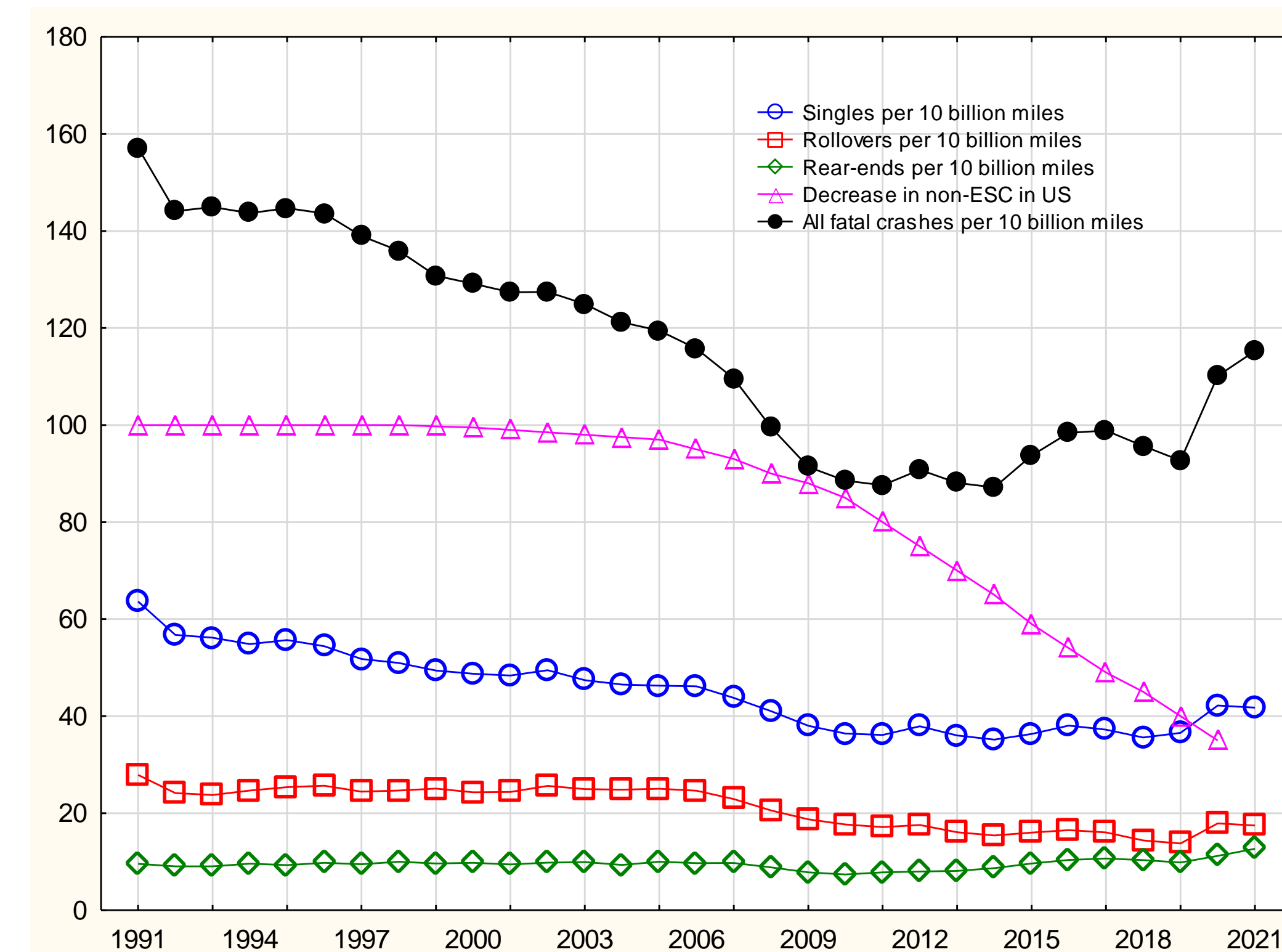
- RESULTS:** Study 1, ADAS use strongly correlated with trust in AS and similar scales, while experience with other types of AS was not. Study 2, Trust in AS correlated with experience as in Study 1.
- DISCUSSION:** Experience with AS is a multifaceted concept and must be fully investigated to construct a validated scale.

Paper 3: ESC Meta-analysis

- INTRODUCTION:** Electronic Stability Control (ESC) improves manoeuvrability and claims to reduce several types of crashes.
- AIM:** To estimate average effects of ESC on different types of crashes for all available studies and possible moderators.
- METHOD:** A meta-analysis of ESC effects on crashes investigated whether reported effects were created by the method selected. The number of samples was increased by averaging values within samples.
- RESULTS:** Safety effects were similar to previous meta-analyses but methodological faults in the studies could not be determined due to heterogeneity of effects, small number of studies and lack of information about certain characteristics.
- DISCUSSION:** Methodological problems may inflate effects and these results call into question the conclusions which have calculated or discussed expected benefits of ESC at the national level.

Paper 4: Effects of ESC on Fatal Crashes

- INTRODUCTION:** ESC empirical studies show strong effects on some crashes types but drivers choosing vehicles with ESC may be more safety-conscious.
- AIM:** To investigate whether decreases in crash types have taken place at the same rate as ESC has increased, while other crash types would not follow this trend.
- METHOD:** US Fatal crash data and ESC market penetration data for light four-wheel vehicles, and estimates of yearly miles travelled to follow the trends of different types of crashes over time were compared to predicted effects.
- RESULTS:**



- DISCUSSION:** An over-estimation of ESC effect due to self-selection and behavioural adaptation over long time periods and a diminishing effect of ESC lead to a lower-than-expected effects of ESC on safety.
- A similar effect could also operate with the introduction of AS.