Safer Teen Car: Safety Feedback to Teen Drivers

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PROJECT TEAM

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- **Westat**
  - Prime Contractor
  - Researchers: Neil Lerner, James Jenness, Rick Huey
Background

• NHTSA Project “An Exploration of Vehicle Based Monitoring of Novice Teenage Drivers” (2010)
  – Current technologies capable of serving as surrogate
  – Practical to monitor and respond to key behaviors and situations
  – Several categories of driver “monitoring”
• Teen driver crash rates much lower in the presence of an adult passenger
  – Instructive feedback for errors
  – Negative sanction for risk taking
Project Purpose

• Develop a vehicle-based Safe Teen Car prototype that could address the teen driver problem
  – Use “off the shelf” technology
• Conduct an evaluation of driving performance and usability with both parent and teens.
  – Deploy to teens and assess
• Identify if feedback alone is sufficient to influence teen driving behavior
Strategies for Vehicle-Based Monitoring

- Driver Feedback
  - Real time info to driver about errors/unsafe behavior
- Vehicle Adaptation
  - Alter some aspect of vehicle performance based on driver behavior or situation

Programs

- Reporting
  - Record, summarize, and transmit for later review
- Coaching
  - Intermediary interprets and provides explicit guidance
- External Motivation
  - Formal incentives based on monitored behavior
Research Questions

• How well does feedback work?
  – Is it the right feedback?

• How do teens adapt?
  – Limited experience so far

• Can an off the shelf technology be implemented?

• What is feasible?
What Behaviors/Situations Should STC System Address?

- Key teen behaviors
  - Speeding
  - Seat belt non-use
  - Excessive maneuvers
  - Distraction
- Situational factors
  - Passenger presence
  - External environment (darkness, weather)
  - Other risky behaviors

Use of Context to Determine Trigger for Feedback
Safe Teen Car Prototype

• What subsystems were included?
  • Teen driver identification
  • Speeding
  • Seat belt use
  • Excessive maneuver
  • *Cell phone use
  • Context - time of day
  • Passengers

Recognition
Behaviors/Teen Driver Issues
Contextual Factors
Prototype Subsystems

Teen Driver Identification

• Subsystem needs to identify when a teen is driving a vehicle
• Needs to exhibit a high degree of reliability
• Limit the ability to subvert the system
• *Smart Key (RFID)
Prototype Subsystems

Passenger Detection

• Recognize passengers have been detected
• Provide input to other subsystems (e.g., seatbelt, speed, excessive maneuver, context)
• Passive and reliable* and easy installation
Prototype Subsystems

Seatbelt

- Detect driver and passenger seatbelts
- Remind drivers and passengers to buckle seat belt
- Input into other subsystems
Prototype Subsystems

Excessive Maneuver

• Provide warnings when vehicle maneuvers exceed specific thresholds

• Maneuver subsystem feeds into context, passenger, and seatbelt system.
Prototype Subsystems

Speed

- Subsystem compares actual speed to posted speed limit (speed database)
- Provides mild and strong warnings dependent on severity of infraction
- Considers input from other subsystems
Prototype Subsystems

**Cell Phone**
- Attempt to detect and provide feedback restricting Cell phone use

Context
- Daytime and nighttime monitoring
- Influences other subsystem inputs
Preliminary Assessments

• Prior to STC system field evaluation, several preliminary assessment activities took place
  – Subsystem pilot study
Subsystem Pilot

- Field implementation of subsystems
  - Initial assessment, refinements of subsystem
  - Pilot test of field procedures to be used for full system
- 3 subsystem groups
  - Speeding + seat belt
  - Excessive maneuver + seat belt
  - Cell phone use + seat belt
- 30 subjects
  - 10 per subsystem group
  - Testing in both Minnesota and Maryland
Subsystem Pilot Effort

- Developed data acquisition system
- Developed initial ways of implementing subsystem in participant vehicles
- Developed detailed methods for recruiting, training, data monitoring, IRB, analysis
- Based on experience, refinements made in all aspects for full field evaluation of complete STC system
Selected Pilot Findings

- Reduction in some speeding measures
- Increase in miles traveled while belted
- No effect seen for excessive maneuver subsystem
- No effect seen for cell phone detection system
- Generally positive response from parents
- Cellphone use detection system unreliable
  - Misses and false alarms
  - Annoyance
  - Additional search for better technologies unsuccessful
  - Therefore this subsystem dropped from further study
Full STC Evaluation

- Field deployment of refined and “full” STC
- Assessment of complete STC system
  - Determine STC effectiveness with all subsystems
  - Determine if teens may adapt to STC
  - Identify any carry-over effects after STC removal

- All subsystems presented to teens
  - Teen driver identification, speeding, excessive maneuver, seat belt, passenger detection, and driving context
Full STC Evaluation

• A total of 30 dyads (teen and parent participants)
• Participants had system installed and then proceeded with a number of baseline and trial treatments:
  – 2 Weeks baseline (STC data collection active/no feedback)
  – 6 weeks of trial (STC system activated with feedback)
  – 2 weeks of transfer (STC system feedback deactivated)
• Data analysis segmented into 2 week partitions
• Comparisons of exposure time within each of the subsystems (for drivers only and drivers+passengers)
Overall Findings

- Some reduction in speeding measures (miles speeding)
  - Less speeding at night compared to daytime
  - Less speeding at 5-10mph over the speed limit when STC initially activated
  - Less speeding at 10-15mph over the speed limit when STC initially activated
  - Increase in speeding for 10-15mph over the speed limit when STC feedback deactivated
Overall Findings

• Reduction in per mile excessive maneuvers at night
• Reduction in per mile excessive maneuvers when STC was initially activated
• Generally (overall) a strong seat belt compliance rate, (some lower rear-passenger seatbelt compliance)
• Overall positive response by both teens and parents to the STC system
(Combined drivers and passengers; combined daytime and nighttime)
Speeding and Location

(Combined drivers and passengers; combined daytime and nighttime, *Sig. interaction, non-sig follow up comparisons)
Speeding and Context

(Combined drivers and passengers)
Excessive Maneuver

(Combined drivers and passengers)
Seatbelt Compliance

(Combined drivers and passengers)
Discussion

• Real-time context specific feedback can influence speeding, maneuver, seatbelt behaviors
• Auditory and Visual feedback appropriate
• Compliance rates for seatbelt use is high (for most)
Discussion

- Good acceptance by teens and parents
- Passenger presence detection needs work
- Detecting cell/smart phones is not trivial (texting, web surfing)
- Automotive manufacturer efforts easier
- Systems, such as TDSS, can use different methods of feedback
Conclusion

• Verifiable proof of concept
• Subsystems appear to appropriate in an effort to reduce teen ‘risky’ behaviors
• Full report available from NHTSA -
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