

Validation of the Traffic Offense Traits Scale (TOTS)

- A Quantitative and Qualitative Examination Using Cognitive Tasks -

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A small number of drivers repeat traffic offenses again and again, and this poses a serious road safety problem. Effective prevention requires interventions matched to each driver's risk level. The Traffic Offense Traits Scale (TOTS) is a self-report measure of psychological traits linked to repeated traffic offenses. Prior studies (Study 1, $N = 632$; Study 2, $N = 1,050$) showed that TOTS has a stable factor structure and good validity. However, this evidence came mainly from comparing TOTS with other self-report scales, which may bias the results because both rely on the same method. This study tested TOTS validity using cognitive tasks that do not rely on self-report.

We conducted a web survey with 612 respondents. Of these, 311 completed two cognitive tasks: the Balloon Analogue Risk Task (BART), which measures risk-taking, and the Iowa Gambling Task (IGT), which measures learning from feedback.

A confirmatory factor analysis showed good model fit for the seven-factor structure (Robust CFI = .940, TLI = .929, RMSEA = .048, SRMR = .057). All seven TOTS subscales were also related to offense frequency in a stepwise pattern (one-way ANOVA). Five of the seven subscales showed a significant increasing or decreasing trend as offense frequency rose (Jonckheere-Terpstra test; Fig. 1). These results confirm that TOTS is reproducible.

However, BART and IGT scores showed no significant relationship with TOTS scores or offense frequency. This is likely because very few respondents were repeat offenders (only 2.6% reported 3 or more offenses), which limited our ability to detect a relationship.

We then looked more closely at the 19 respondents with 2 or more offenses. Using BART data from each trial, we ran a cluster analysis (Ward's method) based on four features: mean pump count, variability, trial-by-trial trend, and explosion rate. Based on the dendrogram (Fig. 2), four distinct decision-making patterns emerged (Fig. 3). A Low-Variable pattern ($n = 8$) showed consistently low, stable pump counts. An Ascending pattern ($n = 3$) showed pump counts that rose steadily across trials. An Erratic pattern ($n = 5$) showed large, unpredictable swings. An Extremely Cautious pattern ($n = 3$) showed almost no variation at a very low level.

Each pattern may call for a different type of intervention. For example, the Ascending pattern may need an intervention that helps drivers notice they are becoming less sensitive to risk over time. The Erratic pattern may need an intervention that targets impulsivity directly. At a broader level, the four clusters split into two groups: a lower-risk group (Extremely Cautious and Low-Variable, $n = 11$) and a higher-risk, less stable group (Ascending and Erratic, $n = 8$). This was the clearest split found in the cluster analysis.

These four patterns could not be seen by comparing group averages alone. This shows that repeat offenders do not share one single risk-taking style. In summary, the cognitive tasks did not support TOTS's convergent validity in this sample. However, the differences we found between individuals point to a useful next step: designing driver education that is tailored to each person's decision-making style, based on the Risk-Need-Responsivity (RNR) framework used in offender rehabilitation. Future work will test these patterns among actual traffic offenders and with telematics-based, long-term data.

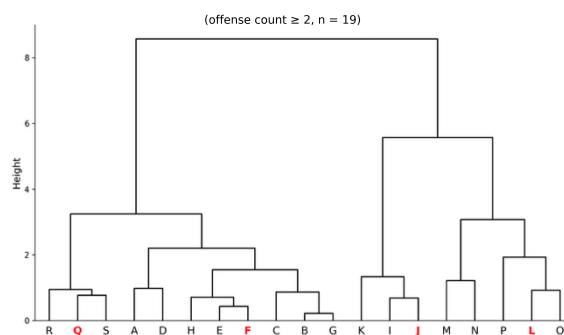


Fig.2 Hierarchical clustering of BART response patterns

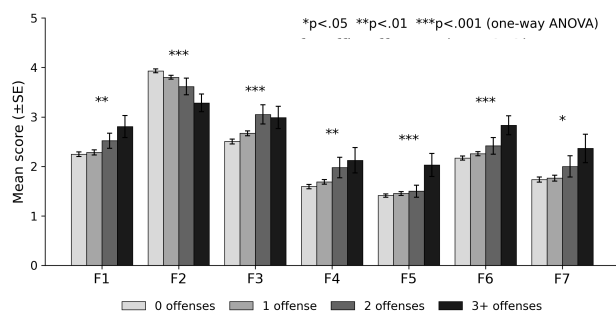


Fig.1 TOTS subscale scores by number of traffic offenses($N = 612$)

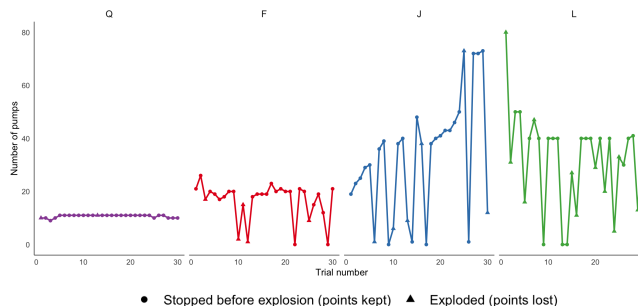


Fig.3 Representative BART trajectories by cluster