Designing Cognitively Digestible Changeable Message Signs (CMSs)

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Global Objective

- Design to facilitate improved driver performance
A Model of Human Information Processing

Wickens, 1984
Research Objectives

• Phase 1: Investigate driver compliance/understanding of messages on Changeable Message Signs (CMSs)
• Phase 2: Develop and test CMS messages designed for increased driver comprehension and compliance
Experimental Design for Both Phases: Participants

- Participants—120 licensed drivers per phase
- 40 participants in each of three age groups—18-24, 32-47, and 55-65
- In each age group—20 females & 20 males
- Participants recruited from Twin Cities metropolitan area
  - Reported regularly commuting on interstate highways
- Participants reimbursed for participation
STISIM Driving Simulator
Experimental Design: Test Scenarios

- Participants drove 20 miles on 4-lane freeway before encountering Target message.
- In scenario nine overpasses occurred at irregular intervals.
- CMS sites on five of the nine overpasses
  - Condition A: First 4 sites blank
  - Condition B: First 4 sites had non site-specific, non time-critical message
- Two guide signs with information about distances to upcoming exits.
- Participants drove simulated roadway twice (site-specific, time-critical message on one drive and time-critical, non site-specific message on other drive)
STAY WITH YOUR VEHICLE WHEN STALLED
Target Message Traffic-Related
CMS: Phase 1
Driver Compliance with Message in Phase 1

• Number of participants who took Thompson Exit in Phase I: 67/120 (55.8%)

• Age—significant effect ($p < 0.05$)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Younger Group (18 to 24 years old)</th>
<th>Middle Group (32 to 47 years old)</th>
<th>Older Group (55 to 65 years old)</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Took Exit</td>
<td>14</td>
<td>24</td>
<td>29</td>
<td>67</td>
</tr>
<tr>
<td>Did Not Take Exit</td>
<td>26</td>
<td>16</td>
<td>11</td>
<td>53</td>
</tr>
<tr>
<td>Totals</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>120</td>
</tr>
</tbody>
</table>
Participant Explanations for Not Taking Exit Phase 1

• 53 participants did NOT take the exit
  – 19 were confused by the message  
    • Some thought crash on Wyoming Exit  
    • Others understood crash on the freeway, but thought a lane was still open
  – 19 saw the message but did not think it applied to them
  – 12 did not notice the message
  – 3 did not respond to the question
Traffic-Related CMS: Phase 2
Speed Data:
Approach to Thomas Exit CMS

![Bar chart showing speed data for different age groups in phases 1 and 2.](chart.png)
Driver Compliance with Message: Phase 2

- 112/120 (93.3%) took Exit in Phase 2
- Driver age: No difference in compliance

- Illustrates effect that clearer, less ambiguous message has on driver behavior
Amber Alert: Phase 1
Results for Amber Alert: Phase 1

- Only 2/120 had perfect recall immediately following CMS message
- 10/120 (8.3%) recalled some vehicle information and at least 5/6 alphanumerics on license plate
- No age-related effect for recall of Amber Alert Message
- 32 participants did not know what Amber Alert referred to.
Amber Alert in Phase 2
Speed Data:
Approach to Abducted Child CMS

Phase 1
- Younger Drivers: 60
- Middle Age Drivers: 60
- Older Drivers: 50

Phase 2
- Younger Drivers: 60
- Middle Age Drivers: 60
- Older Drivers: 50
Results for Amber Alert (Abducted Child): Phase 2

- 86/120 (71.7%) participants recalled enough information to allow them to tune to the correct radio station
- No effect for participant age
- All knew what abducted referred to
How Can We Use these Findings?

- Findings clearly show that signs that are more “cognitively digestible” (easier to understand/less ambiguous) lead to increased driver comprehension and compliance—across all age groups
Thanks!

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