# Designing Cognitively Digestible Changeable Message Signs (CMSs)

Kathleen A. Harder, Ph.D.

University of Minnesota

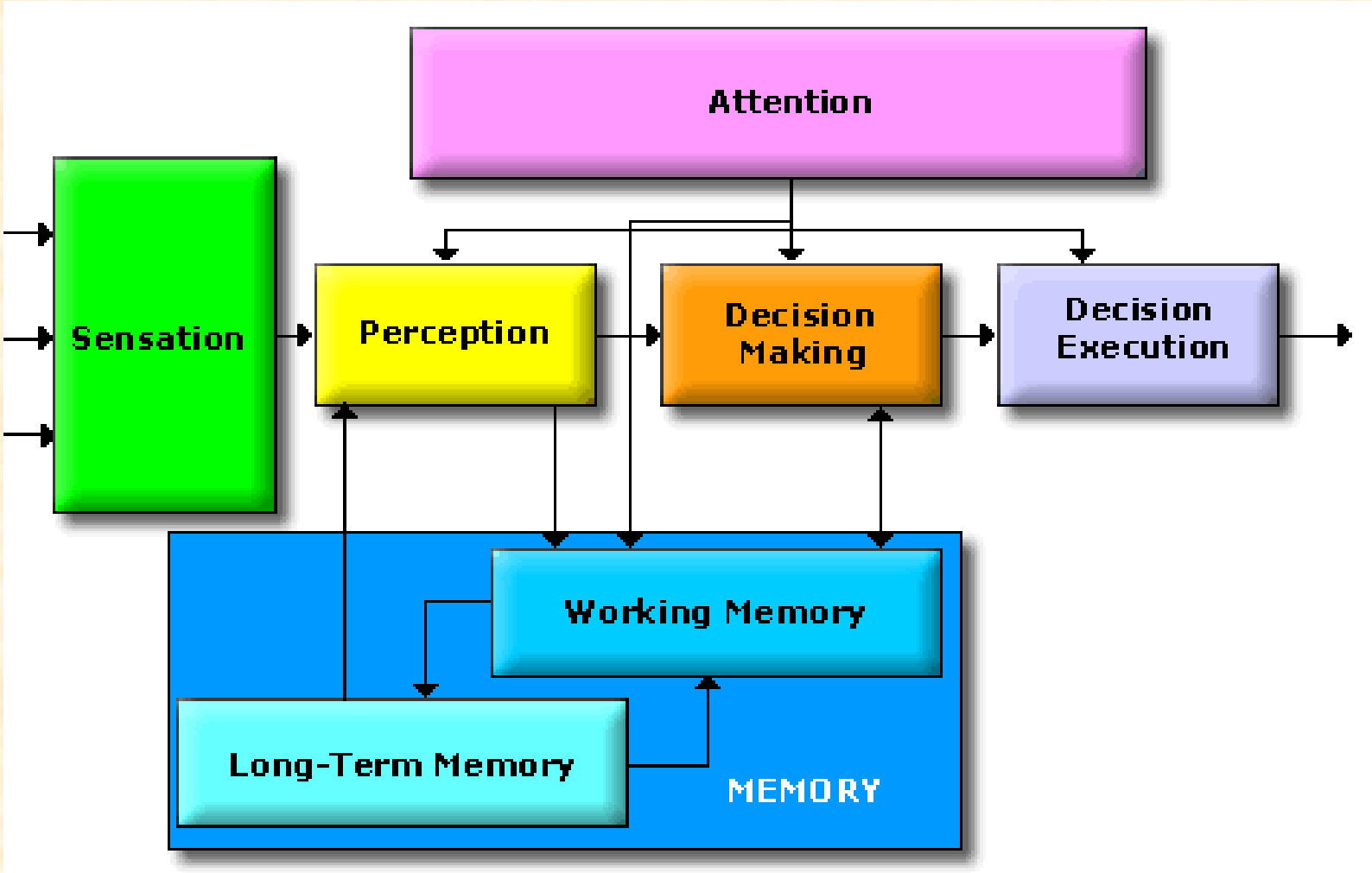
# Acknowledgements


- John R. Bloomfield, Ph.D., co-principal investigator
- Minnesota Department of Transportation—for research funding and collaboration

# Global Objective

- Design to facilitate improved driver performance

# A Model of Human Information Processing




Wickens, 1984

Donald Norman

# 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

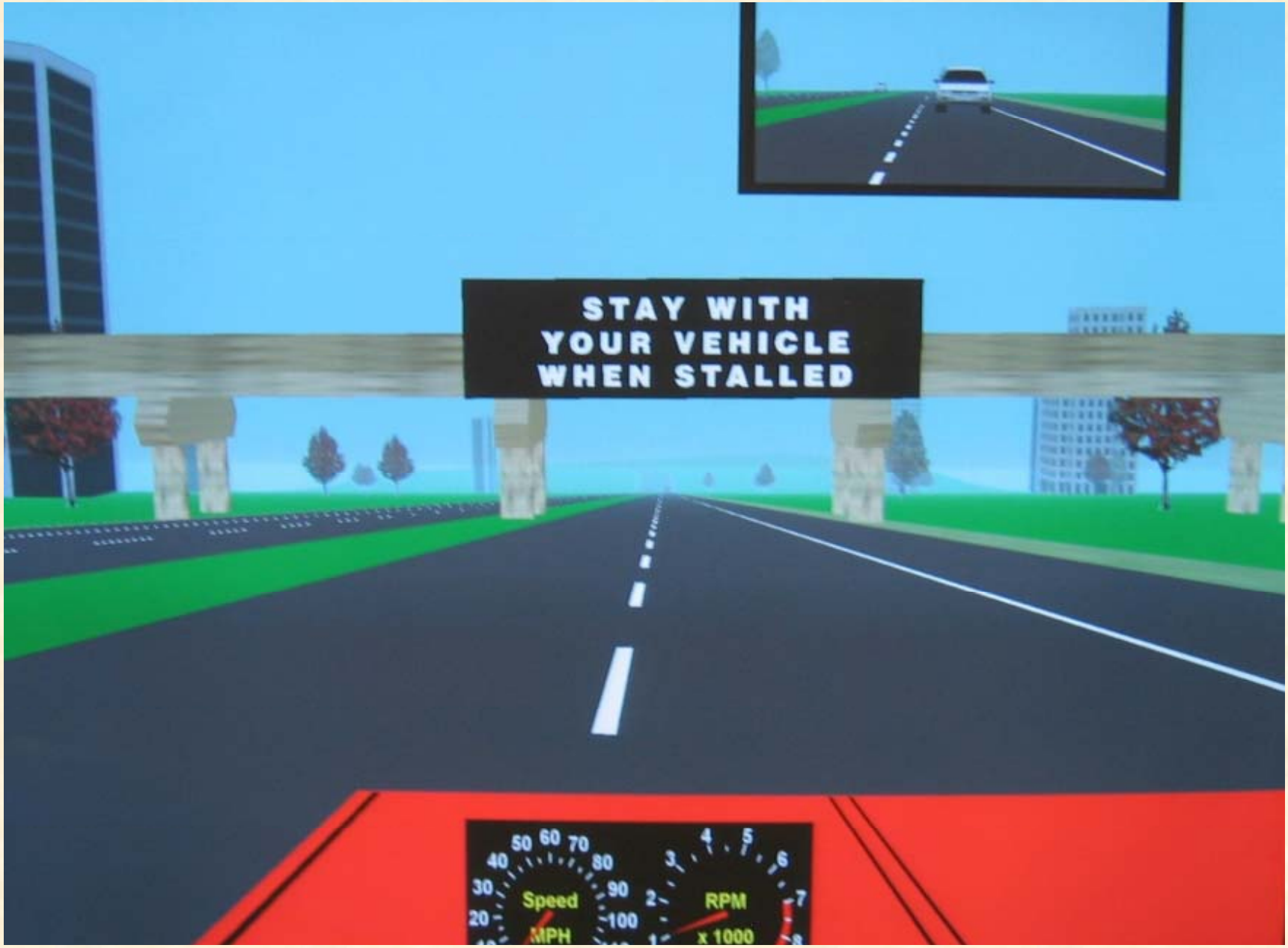
# STISIM Driving Simulator

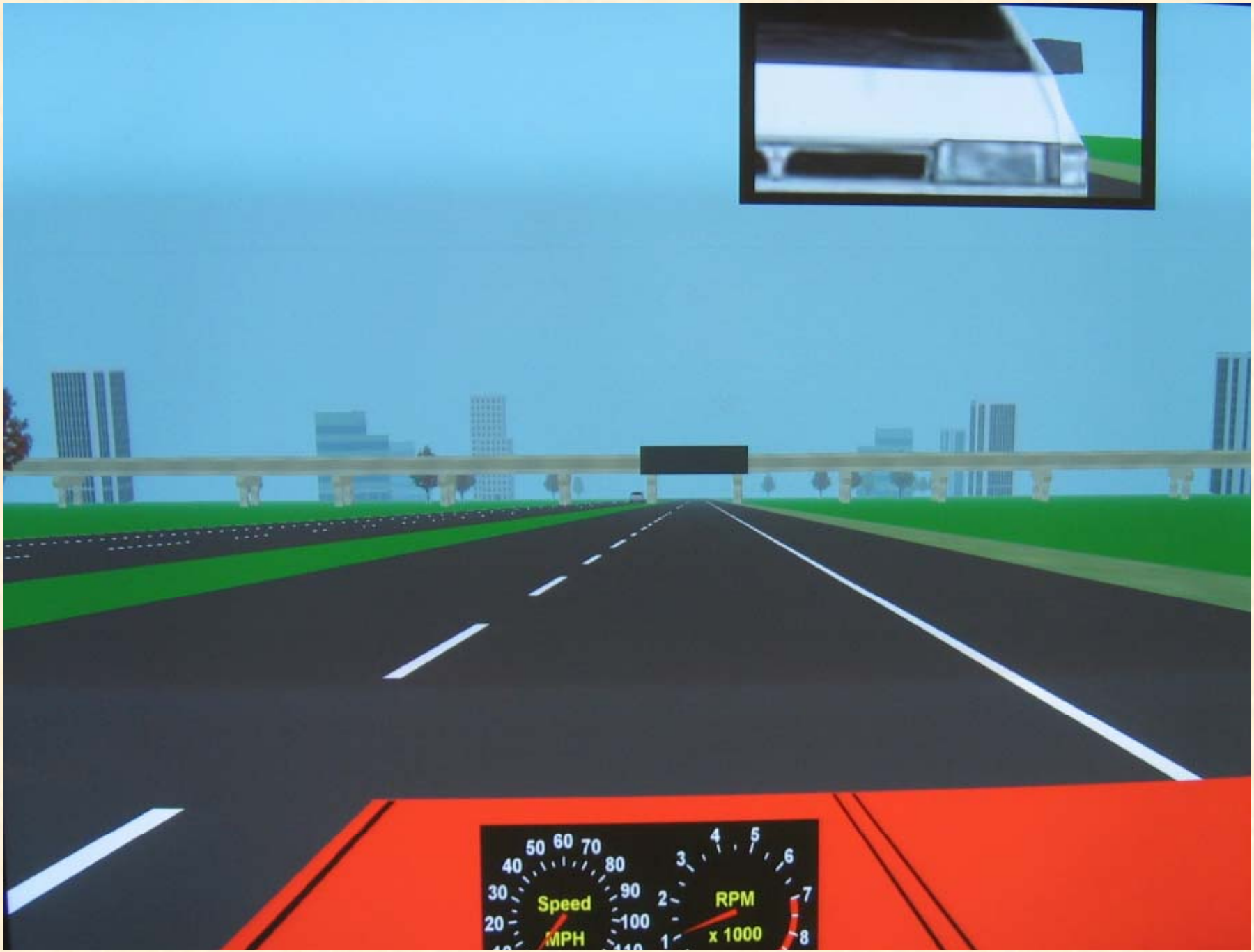
# Experimental Design: Test Scenarios

- 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)

Speed
MPH
RPM
x 1000

Thompson Ave 7
Wyoming Ave 10
Hampton Rd 16


STAY WITH
YOUR VEHICLE
WHEN STALLED
Speed
MPH
RPM
x 1000


Speed
MPH
RPM
x 1000

# 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 ($p < 0.05$)

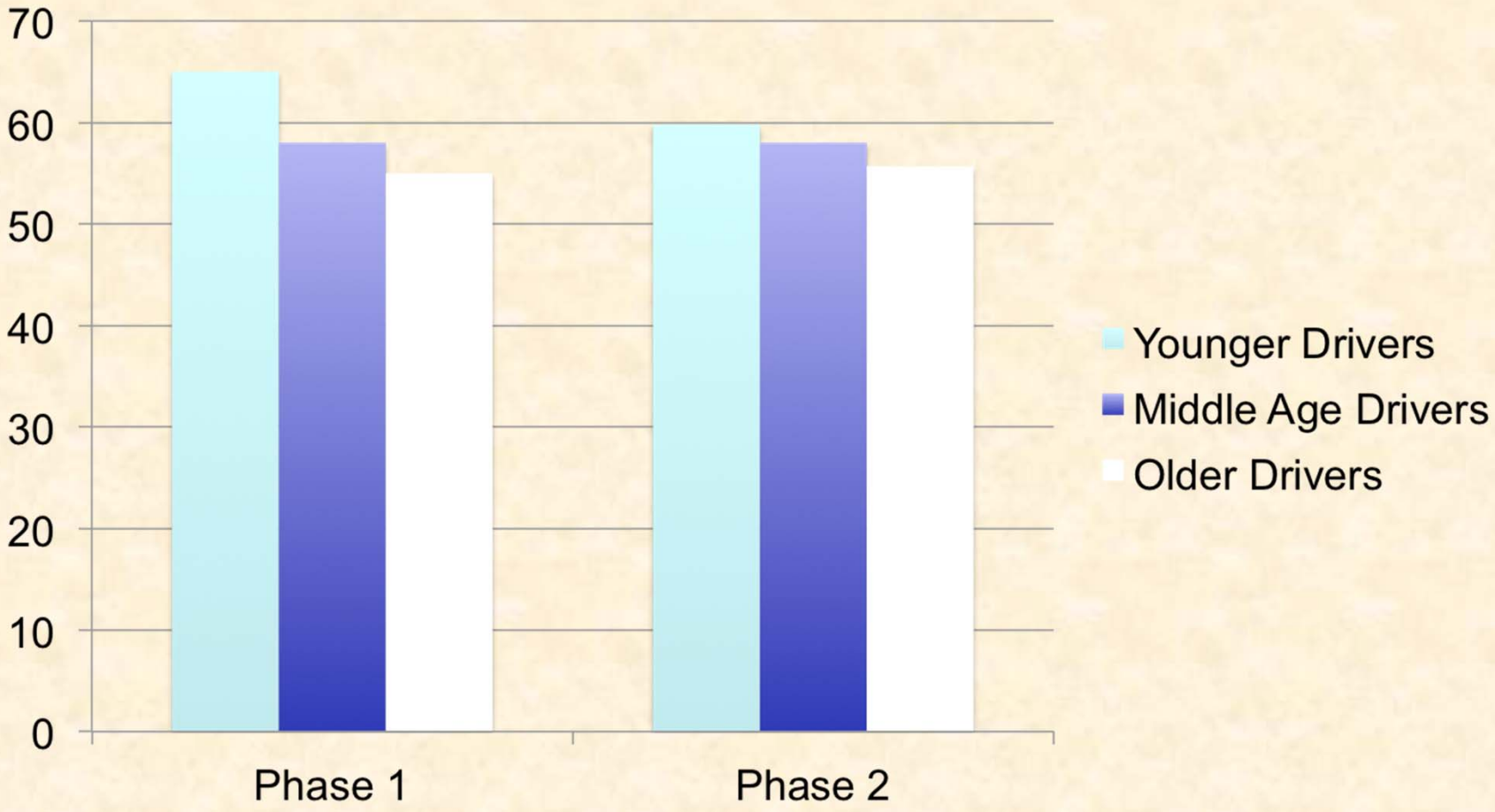
| Outcome | Younger Group (18 to 24 years old) | Middle Group (32 to 47 years old) | Older Group (55 to 65 years old) | Totals |
|---|---|---|---|---|
| Took Exit | 14 | 24 | 29 | 67 |
| Did Not Take Exit | 26 | 16 | 11 | 53 |
| **Totals** | 40 | 40 | 40 | 120 |

# 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



# 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

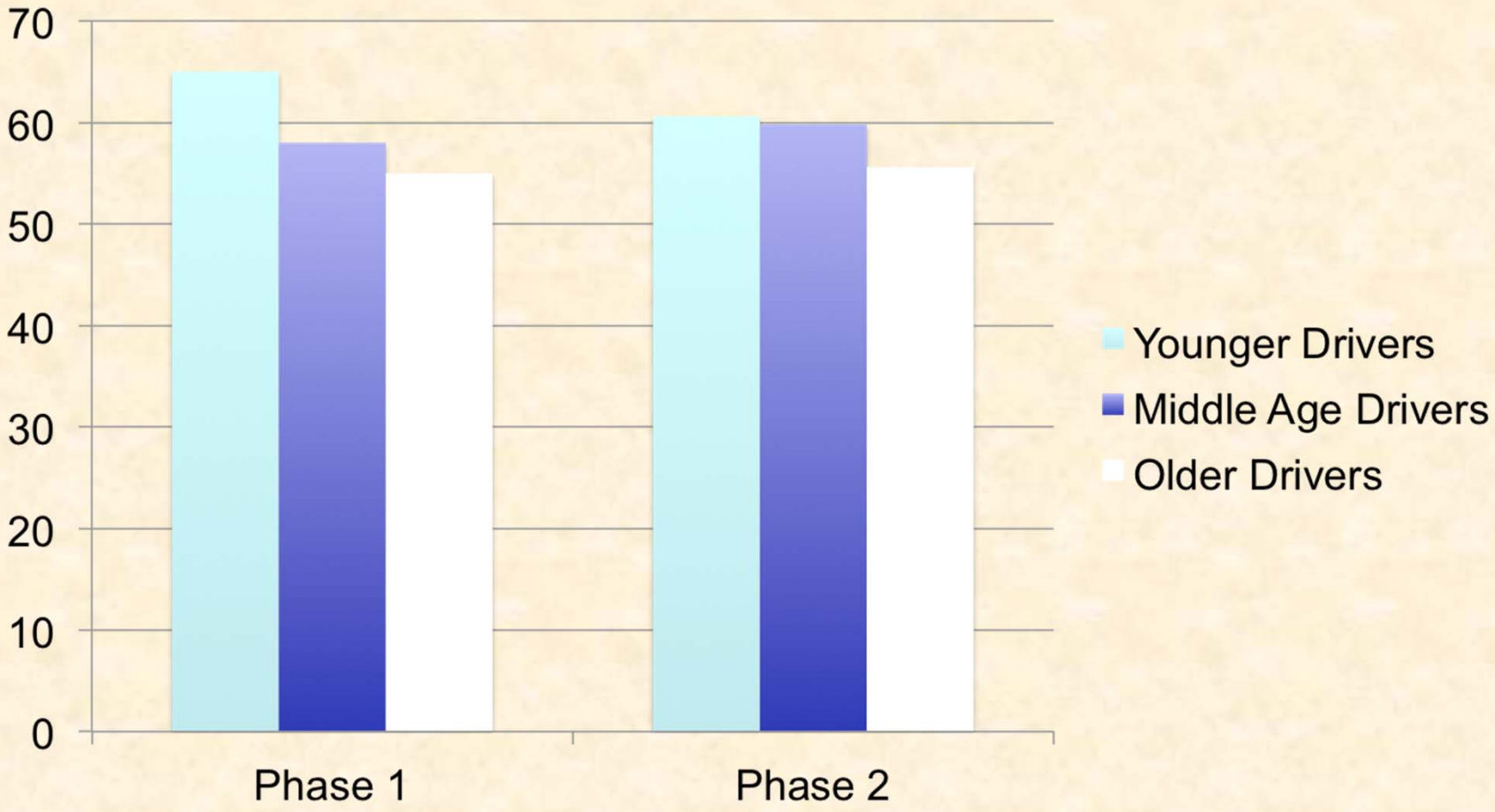
# Amber Alert:  Phase 1

# 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



# 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!

kharder@umn.edu