Traffic Sign Detection and Identification

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Propose
Assess the conspicuity of traffic signs:
• Detection conspicuity angle
• Identification conspicuity angle

Introduction
• Decisions about the placement of traffic signs, and of measures to ensure conspicuity are left to “engineering judgment”
• Little guidance available to support those judgments
• No standard method of measuring conspicuity

Method
• Measure conspicuity in the lab and in the field using critical conspicuity angle
• Critical conspicuity angle is the greatest distance an observer can look away from an object and still detect its presence, or alternatively for signs, its message

Detection Stimuli
• Four backgrounds
  • Three Targets

Detection Laboratory Procedure
• Observers sit in driving simulator cab
• Stimuli projected on screen
• Trial:
  • Fixation cross 1 s
  • Background scene with or without target 0.1 s
  • Grey field until observer responds yes (target present) or no
• Method of limits
  • Target present on half of trials
  • Angle increased 3 degrees following 4 correct responses, decrease 3 degrees following 4 trials with 1 or more errors

Detection Field Procedure
• Observers points at sign from distance of 85 ft
• Gradually shifts gaze (and point) to left until sign presence no longer detectable
• Angle of gaze change recorded
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**Detection Results**
- **Laboratory:**
  - Observers sit in driving simulator cab
  - Stimuli projected on screen
  - Trial:
    - Fixation cross projected for 1 s
    - Background scene with target projected for 0.15 s
    - Grey field until observer identifies message
  - Offset of fixation cross from target varied from trial to trial:
    - -9, -6, 0, 3, 6, 9, 12, and 15 degrees, where negative offsets are to right of sign, positive offset to left

**Identification Procedure (lab only)**
- Observers sit in driving simulator cab
- Stimuli projected on screen
- Trial:
  - Fixation cross projected for 1 s
  - Background scene with target projected for 0.15 s
  - Grey field until observer identifies message
- Offset of fixation cross from target varied from trial to trial:
  - -9, -6, 0, 3, 6, 9, 12, and 15 degrees, where negative offsets are to right of sign, positive offset to left

**Conclusions**
- Surround (background) is important to traffic sign detection
- Speed Limit Sign detection is degraded when background is light colored or cluttered
- Method of limits is useful for determining detection conspicuity angle
- Traffic signs can be read without direct fixation
  - Speed limits > 80% accuracy with 9 degree offset
  - Warning signs text readable at 80% accuracy with 3 degree offset
- Background surround is not a major factor in reading signs—just detecting them
- Further research is needed to develop guidance for
  - Identifying when conspicuity enhancement is needed
  - Which conspicuity enhancements are most effective for given environments
  - Developing/refining traffic sign conspicuity enhancements

**Identification Stimuli**
- Six backgrounds
- Five speed limit targets (25 to 45 mph)
- Five text based warnings

**Identification Results**
- Speed Limits
- Warnings

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