

# Innovations in driver assessment:

## **Tests of visual performance**

**Michael White**

**SA Department of Transport, Energy & Infrastructure**

**13 September 2006**

# Overview

- The Austroads model for older-driver licence re-assessment
- Three computer-based tests of visual perception:
  - Useful Field of View (UFOV)
  - Proficiency of Peripheral Visual Processing (ProPerViz)
  - DriverScan

# The Austroads model for older- driver licence re-assessment

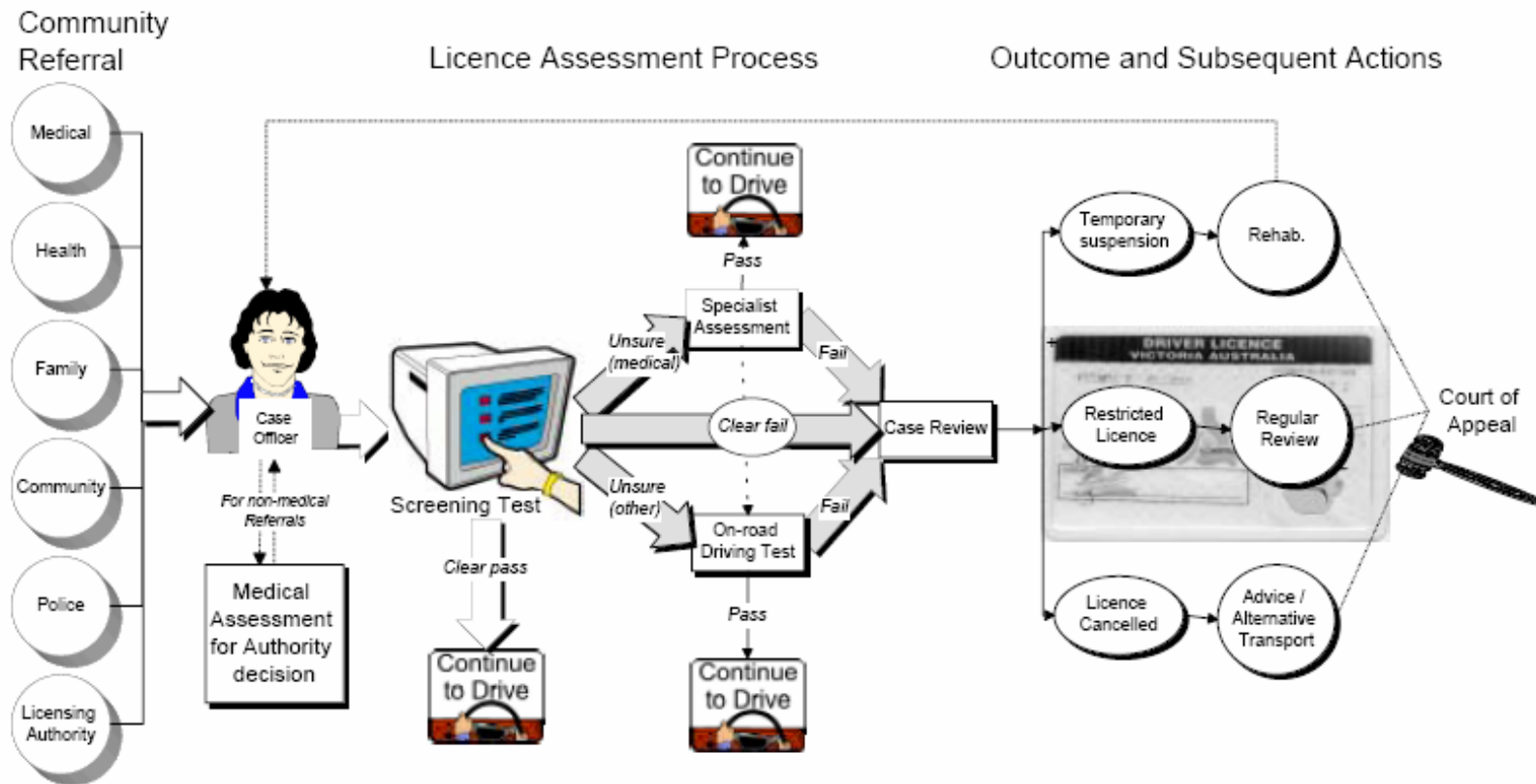


Figure 5 — Outline of the Model Licensing Re-assessment Procedure for Austroads

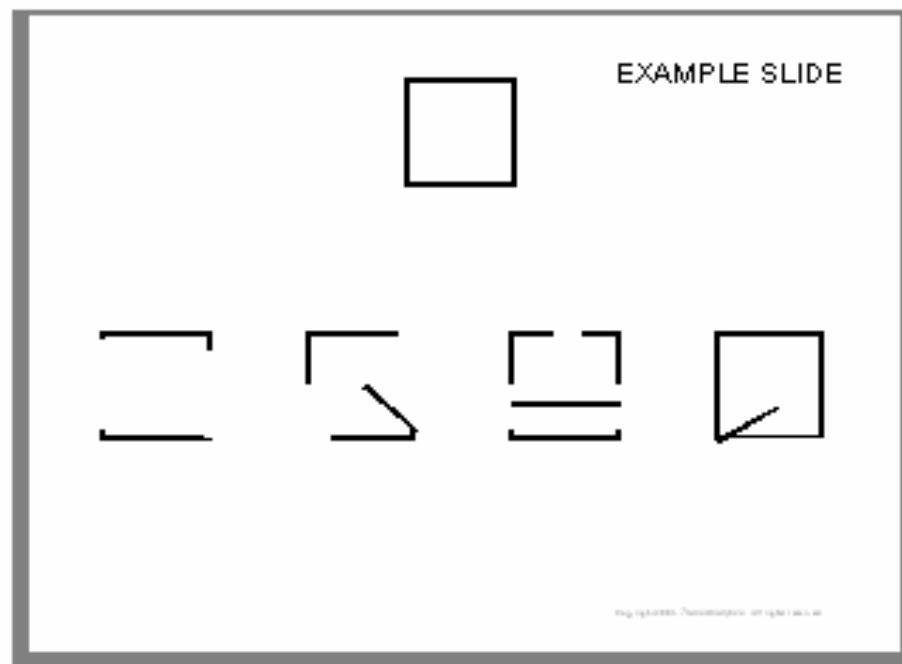
# The Austroads model for older-driver licence re-assessment

- Does not involve blanket screening
- Instead, involves ‘community referral’
- Involves a case officer
- Has three levels of assessment:
  1. Health Screen for Drivers (HSD)
  2. Computer-based screening (CALTEST)
  3. On road driving test

# Health Screen for Drivers (HSD)

1. Motor-Free Visual Perception Task (MVPT)
2. Self-reported medical problems/difficulties
3. Self-reported family/friends rating of driving performance
4. Months backwards test
5. Practitioner's rating of slowness
6. Practitioner's rating of confusion

# Motor-free Visual Perception Test (MVPT)



# Second stage screening battery (‘CALTEST’)

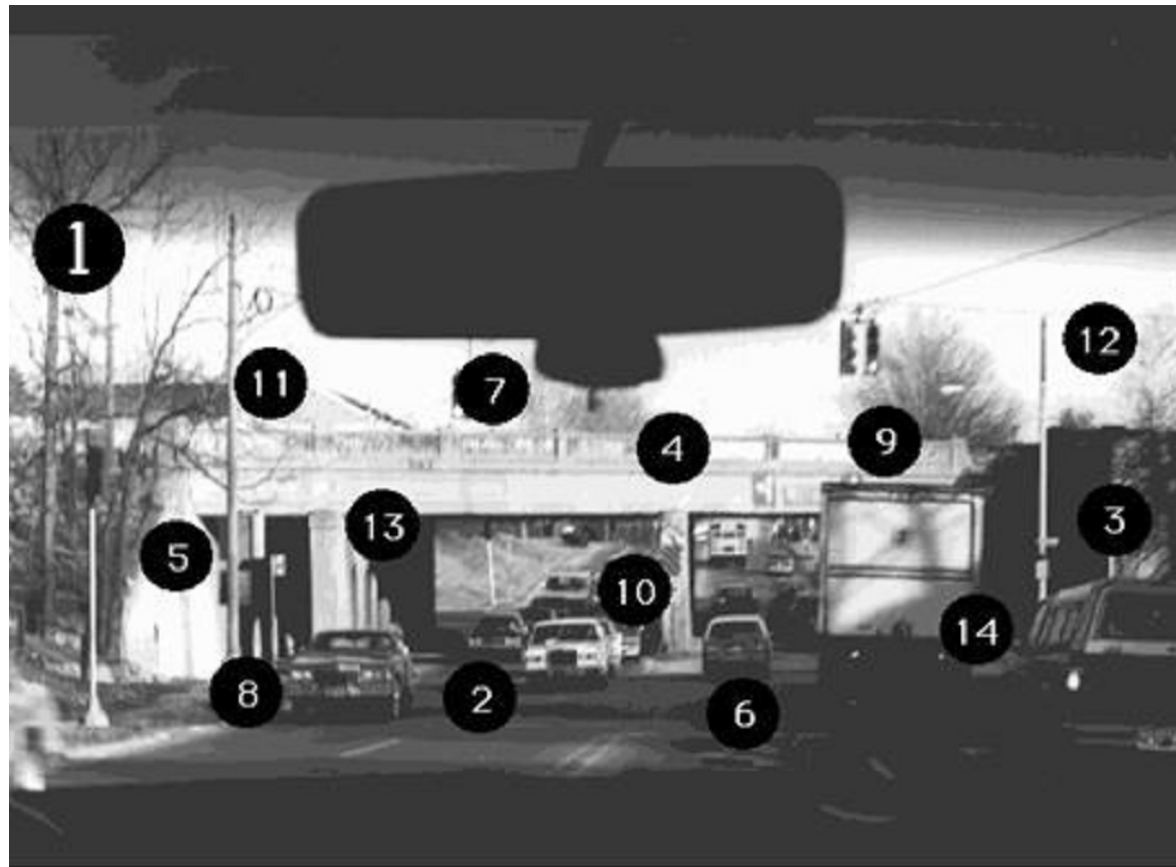
1. VicRoads Hazard Perception Test
2. Auto Trails II
3. Useful Field of View (UFOV)

# VicRoads Hazard Perception Test

“Touch the screen when you would begin to slow down”



# Auto Trails II



# The Useful Field of View test (UFOV)

# The UFOV Rationale

- Your *simple* field of view is the width of the region in front of you where you can see something very obvious, such as a flash of light
- Your *useful* field of view is the width of the region in front of you where you can direct your attention in a more complex visual task
- The size of a person's *useful* field of view, which shrinks with age, is an important factor in safe driving

# The UFOV Rationale

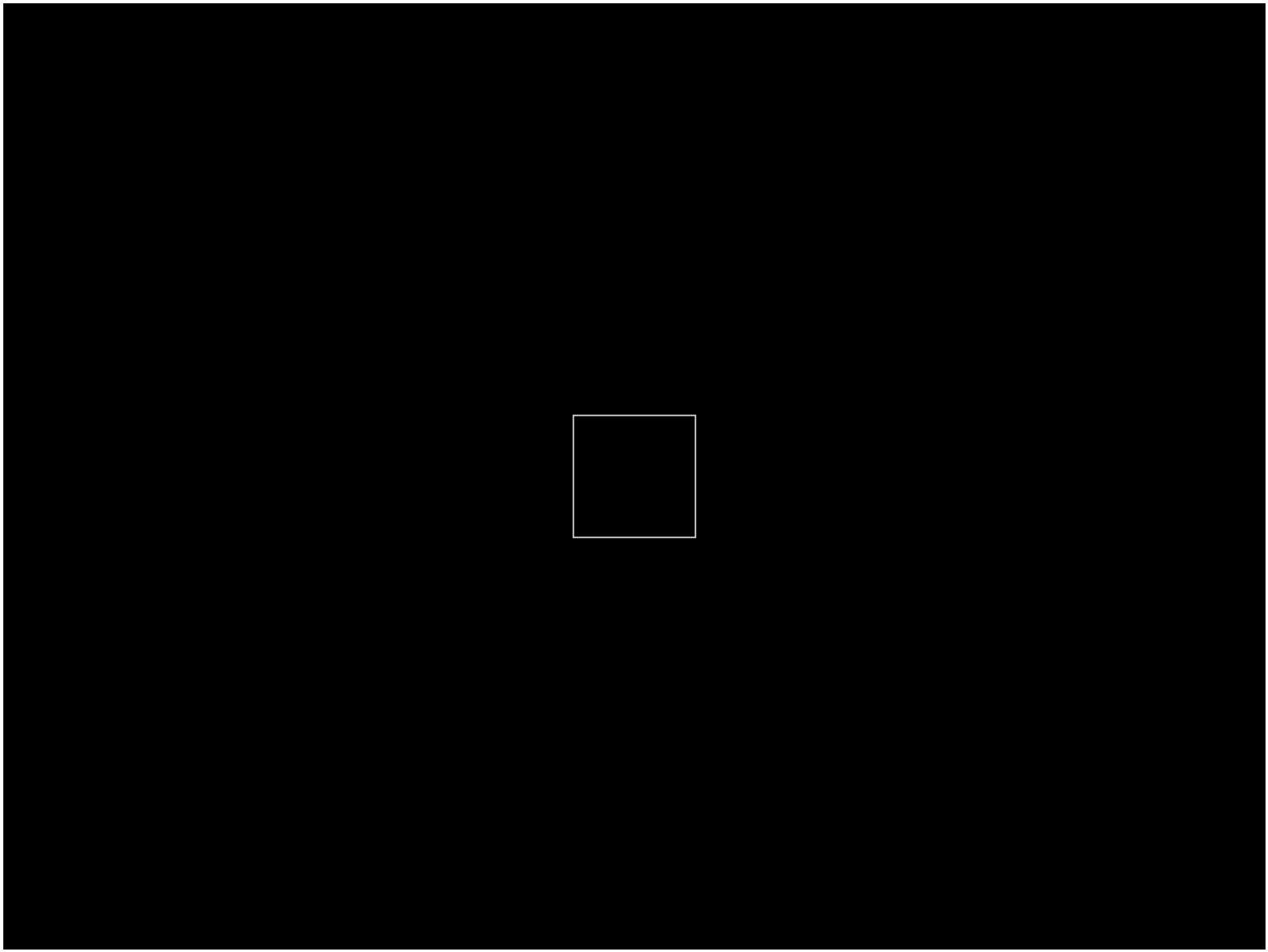
- The size of the useful field of view should be measured under conditions of:
  - Divided attention (when attempting to do two things at once)
  - Selective attention (when attempting not to be distracted by irrelevant information)

# The UFOV test

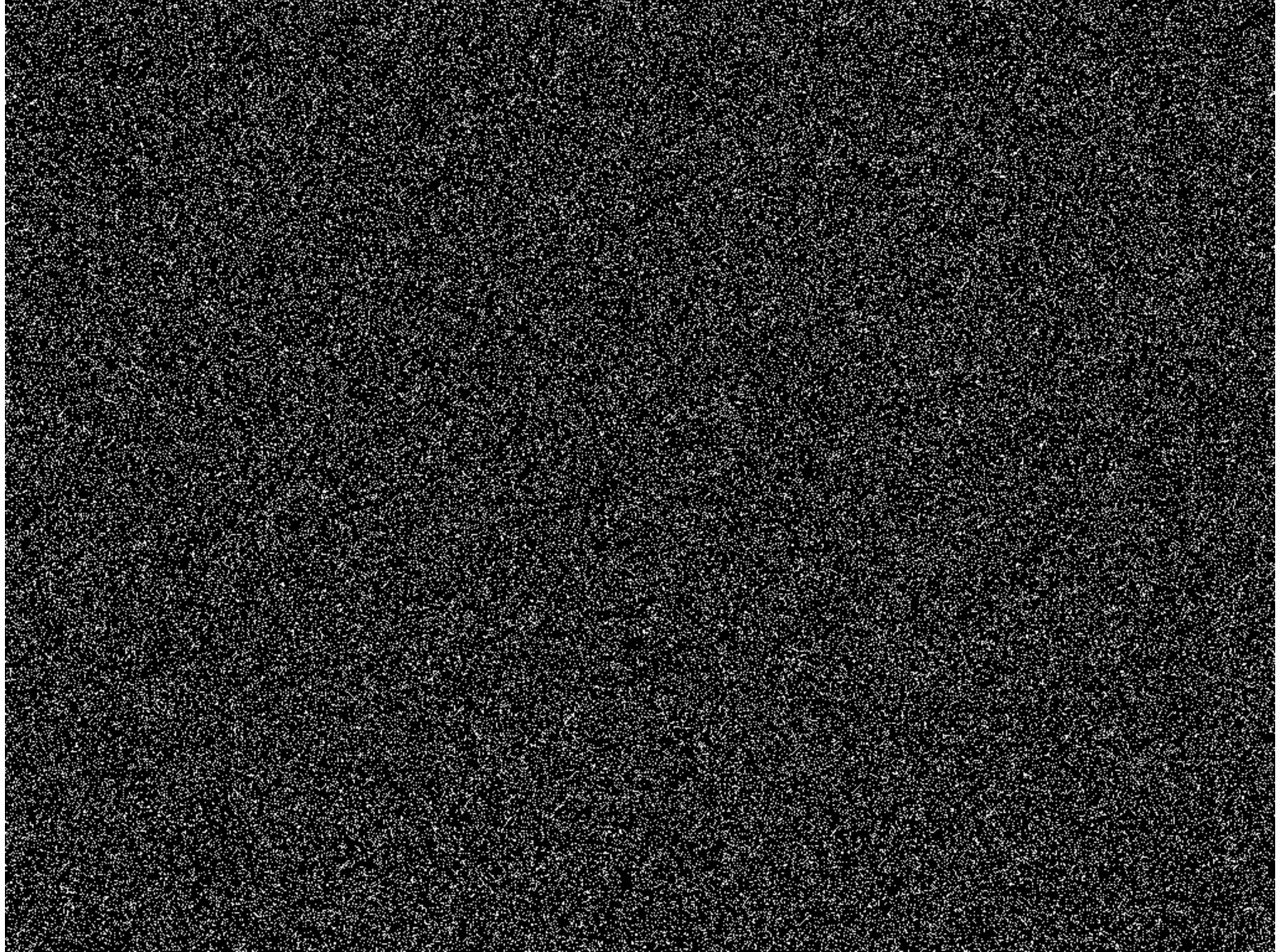
- Three subtests of increasing complexity:
  1. Processing Speed
  2. Divided Attention
  3. Selective Attention
- (The most recent version of the UFOV has a fourth subtest)

# UFOV Test 1: Processing Speed

- Fixation box
- Car or Truck in central box
- Noise Mask
- Response: Identification of Car or Truck





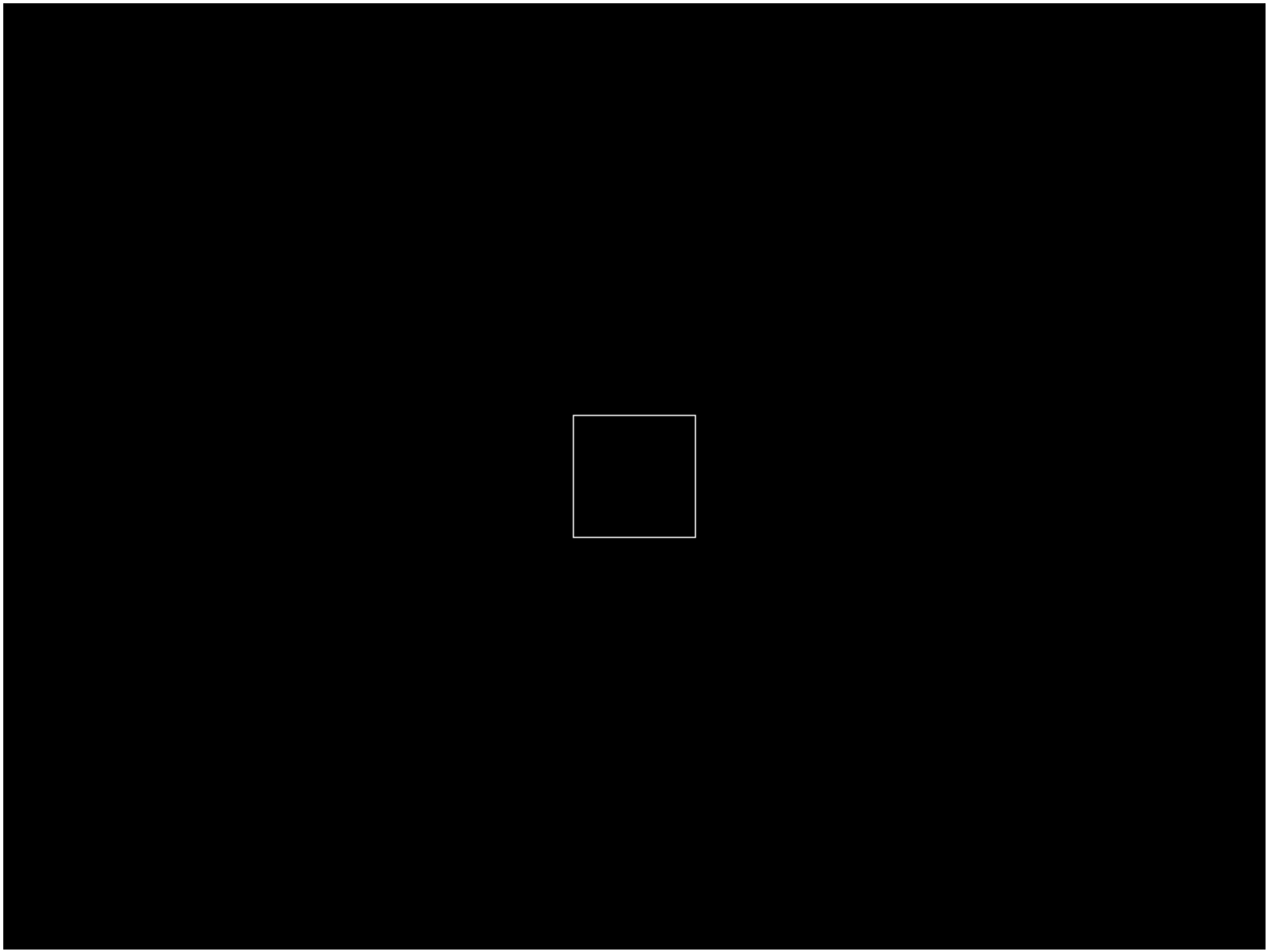


Which object was inside the white box?

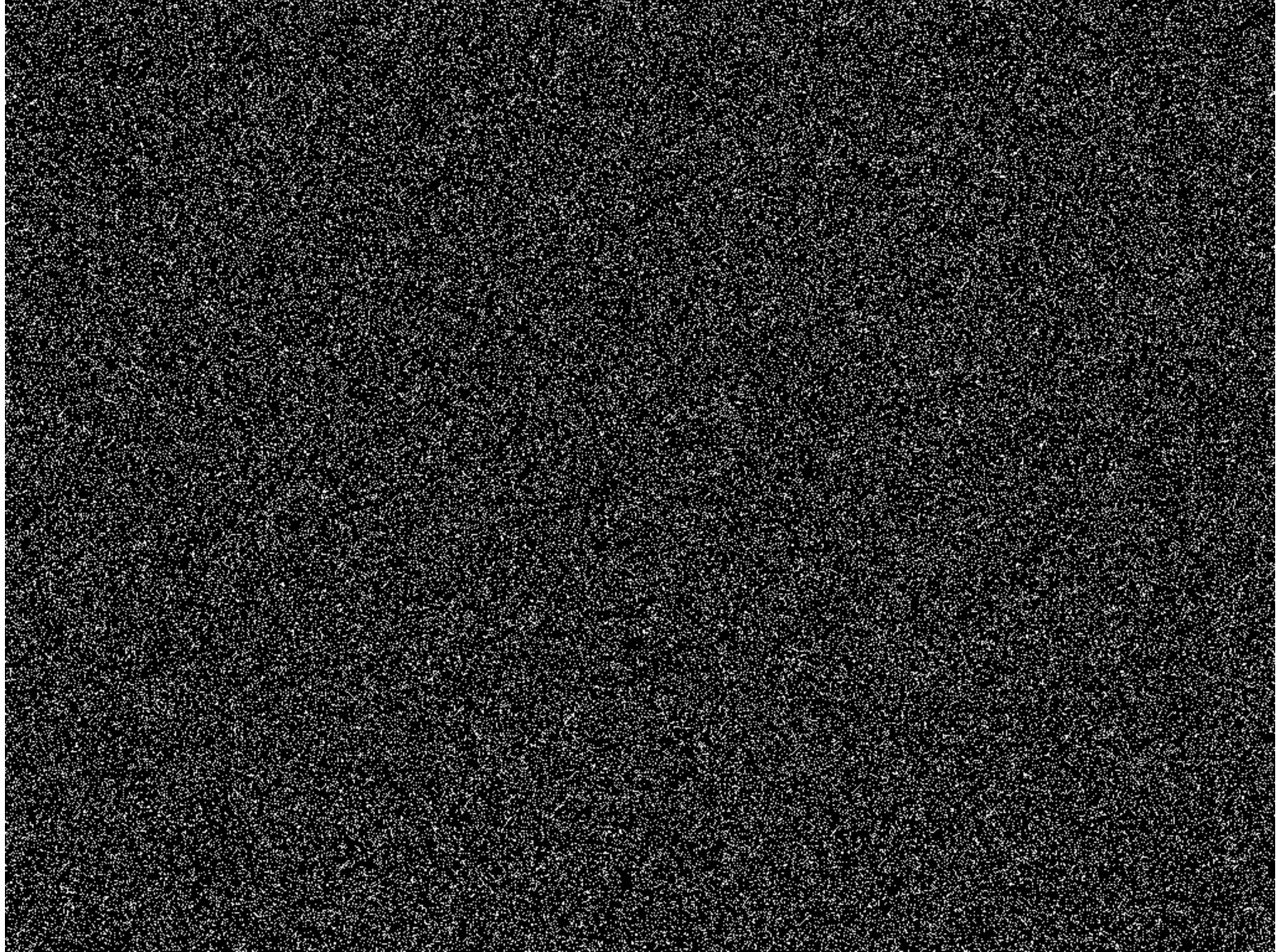


# UFOV Test 2: Divided Attention

1. Fixation box
2. Car or Truck in central box **AND**  
Car/Truck at a peripheral location
3. Noise Mask
4. Response 1: *Identification* of central Car  
or Truck
5. Response 2: *Location* of peripheral  
Car/Truck



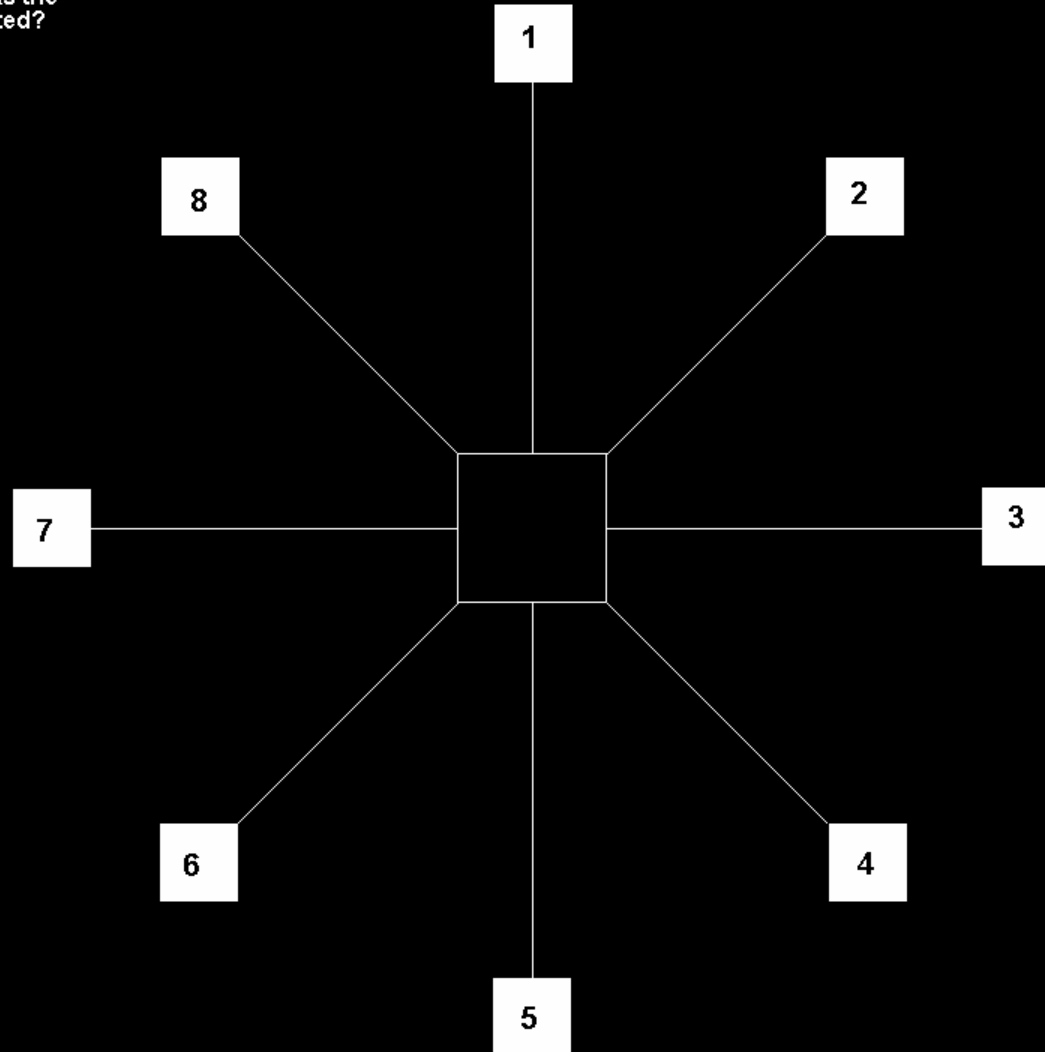




Which object was inside the white box?

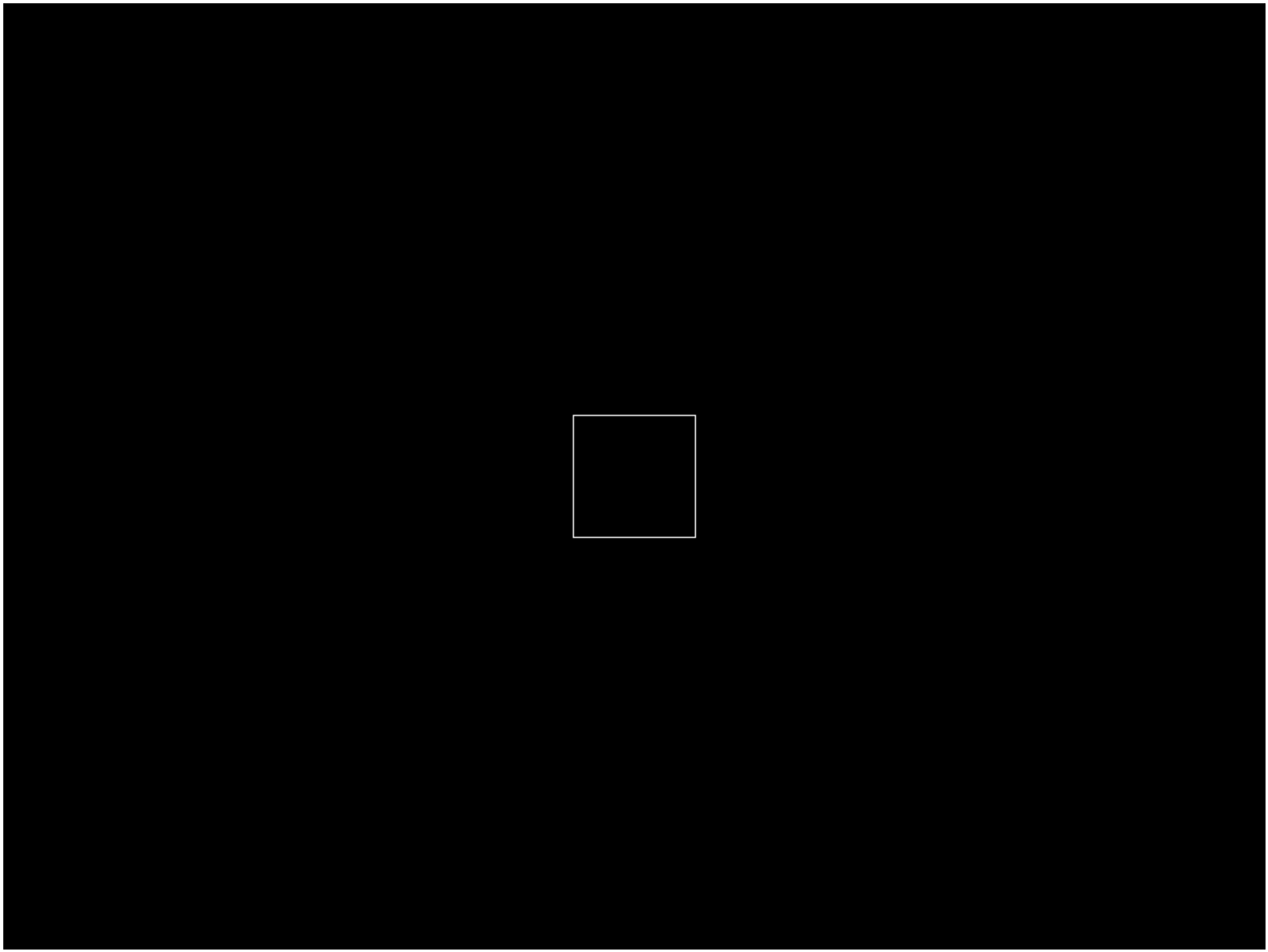


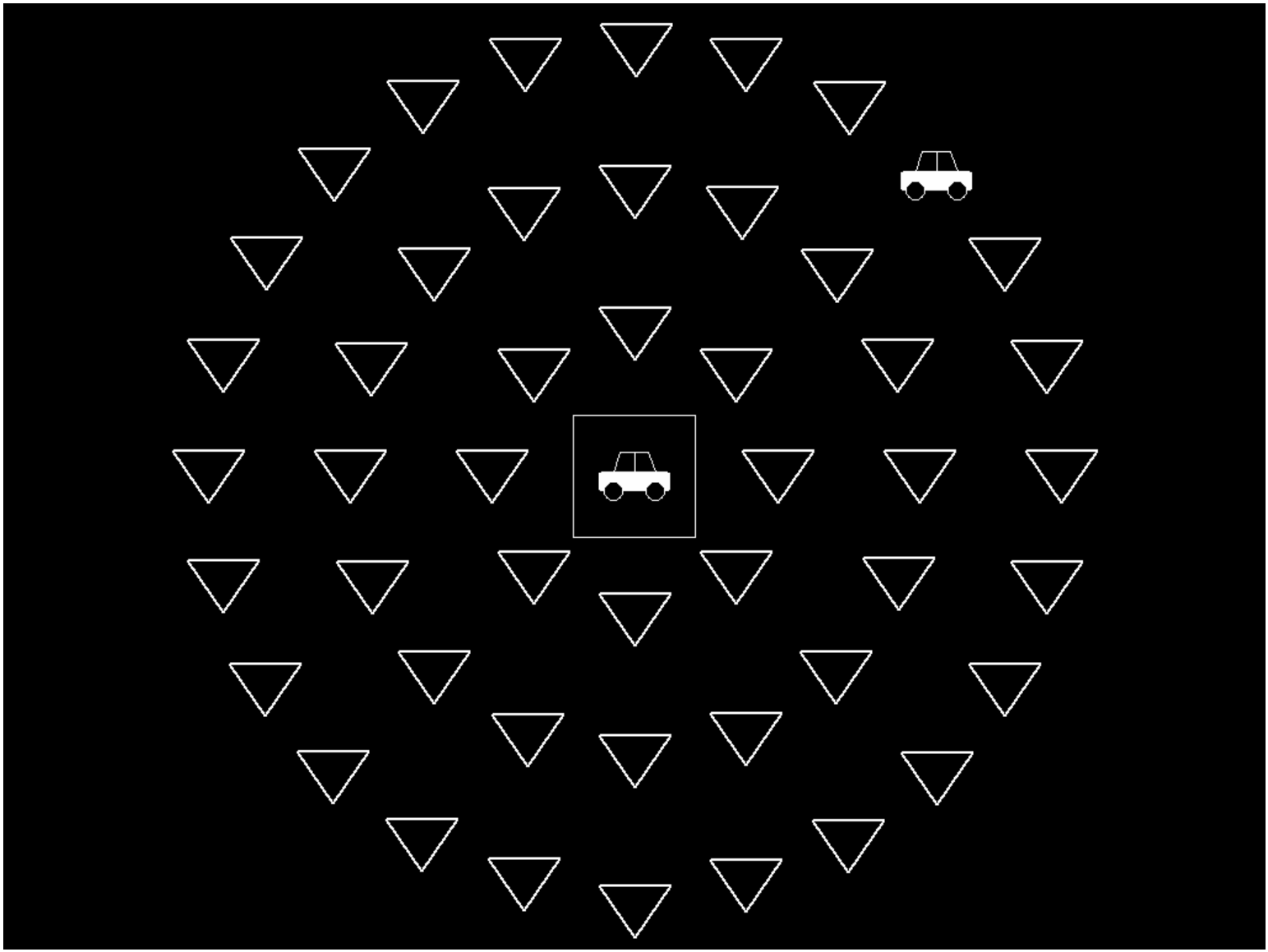
On which spoke was the outside object located?

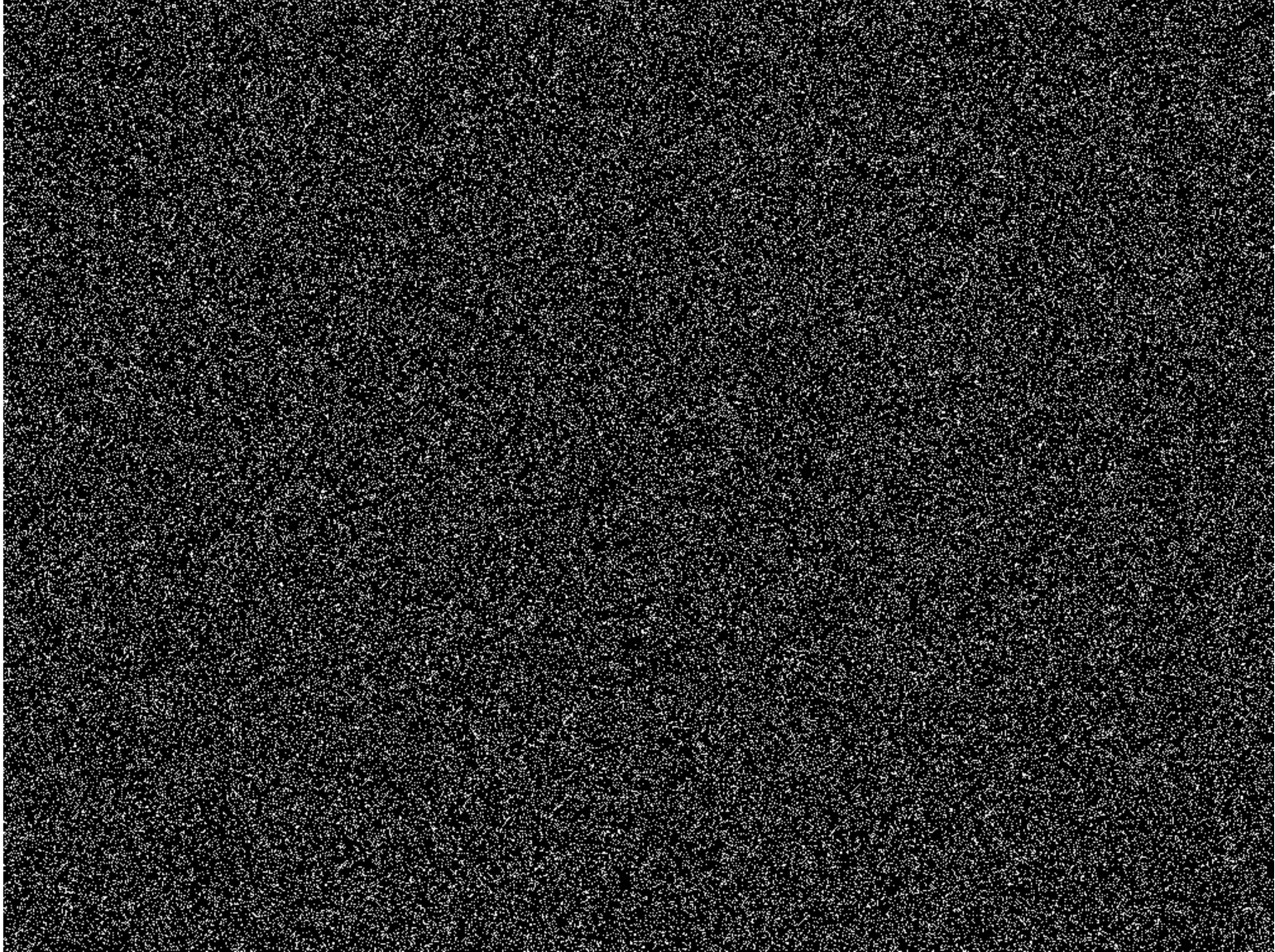


## UFOV Test 3: Selective Attention

1. Fixation box
2. Car or Truck in central box **AND**  
Car/Truck at a peripheral location **AND**  
distracting peripheral triangles
3. Noise Mask
4. Response 1: *Identification* of central Car  
or Truck
5. Response 2: *Location* of peripheral  
Car/Truck



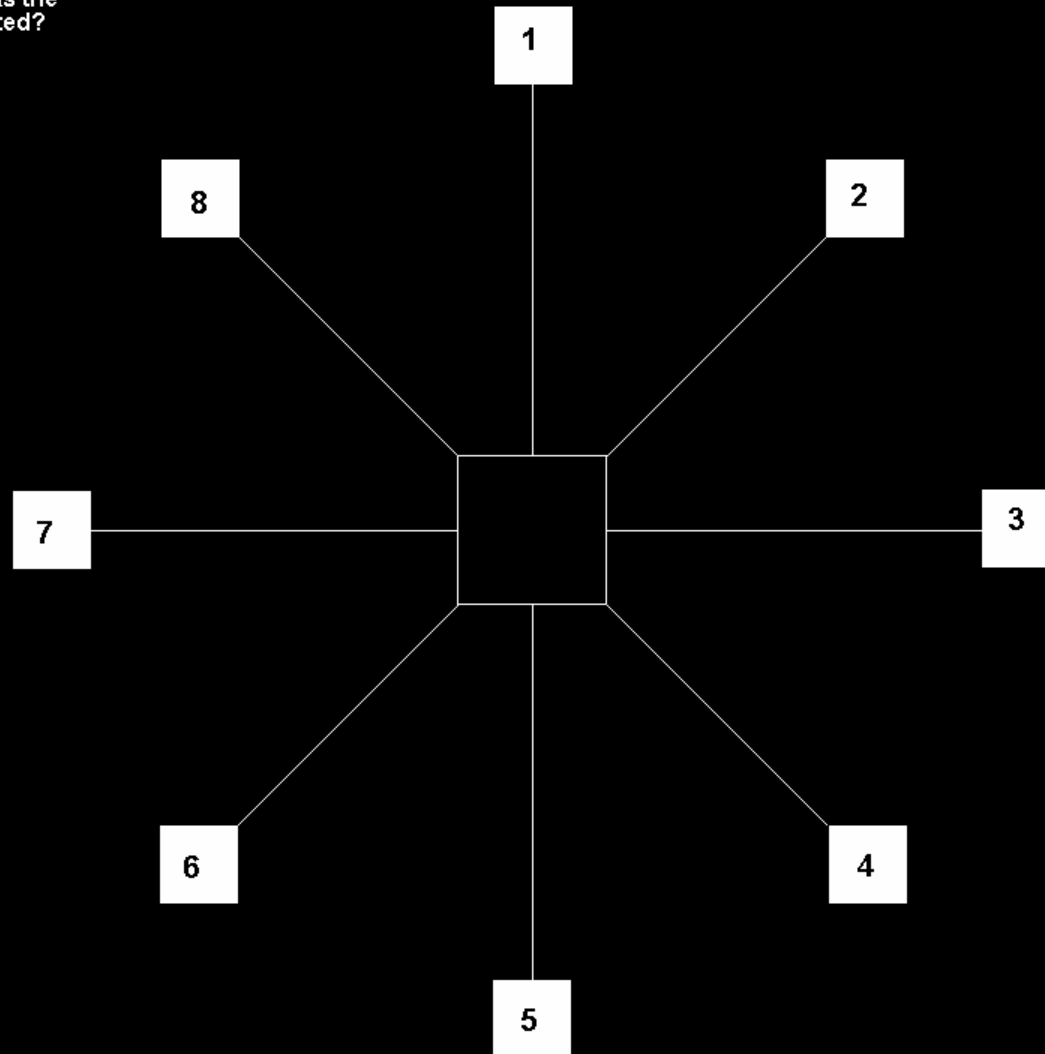




Which object was inside the white box?



On which spoke was the outside object located?



# Application of UFOV

- The UFOV predicts driver impairment and crashes
- The UFOV is being recommended by Austroads for inclusion in an Australian Fitness to Drive test battery

# Critique of the UFOV

- The UFOV rationale has shifted over time:
  1. Useful field of view
  2. Divided and selective attention
  3. Processing speed

# Critique of the UFOV

- The concept of 'tunnel vision' or a 'restricted useful field of view' is *incorrect*, as the age-related deterioration is not eccentricity-dependent, but is simply worse overall
- A single overall score is often used. But it is inappropriate to combine scores from subtests for very different abilities

# Critique of the UFOV

- While the UFOV has some face validity (detecting cars in the periphery of the visual field) ...
- It is unclear *what* is really being measured: very little basic vision research has been conducted

The Proficiency of Peripheral  
Visual Processing test  
(ProPerViz)

# The ProPerVis Rationale

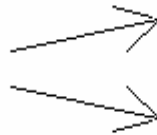
- The proficiency of a computer monitor can be described in terms of:
  1. Temporal resolution (screen refresh rate; e.g, 60 Hz)
  2. Spatial resolution (e.g., 1280 x 1024 pixels)
- The proficiency of the human peripheral visual system can be described in the same two terms :
  1. Temporal resolution: Critical stimulus onset asynchrony (CSOA)
  2. Spatial resolution: Crowding

# The ProPerVis test

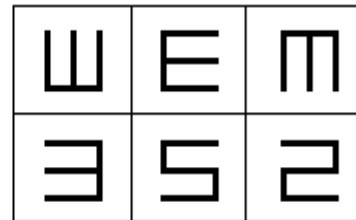
- Two independent subtests
  1. Temporal resolution: Critical stimulus onset asynchrony (CSOA)
  2. Spatial resolution: Crowding

Both tests use the same target and  
masking shapes

FOUR-SQUARE PARENT  
FIGURE



SIX TARGET FIGURES



# Background: Visual crowding in peripheral vision

•

Y

• X Y X

# The mystery of crowding

- When the target is unflanked (Y), the retina of the eye can see it
- So, the resolving power of the eye is sufficient to detect the target
- So, when the target is flanked (X Y X), the *eye* can presumably still 'see' it ...
- But the *brain* can't!

# ProPerViz Test 1: Crowding

1. Fixation point
2. Flanked target (using 'four square' flanks)
  - Presented for 125 ms
  - In one of 5 positions on the horizontal meridian (5.0 and 2.5 degrees left, fixation, 2.5 and 5.0 degrees right)
  - (No subsequent pattern mask)
3. Response panel



田 5 田 .

**SELECT TARGET**

W	E	M
3	5	2

# ProPerViz Test 2: Critical stimulus onset asynchrony

1. Fixation point
2. Simple (un-flanked) target
  - Presented for one of 10 different exposure durations (from 20 to 350 ms)
  - In one of 3 positions on the horizontal meridian (2.5 degrees left, fixation, 2.5 degrees right)
3. Pattern mask
4. Response panel



S .



**SELECT TARGET**

W	E	M
3	5	2

# Application of the ProPerVis

- The ProPerVis explains all of the variance in the UFOV (Burns et al., 2005)
- It is therefore possible that the UFOV measures little more than spatial and temporal resolution for patterns
- The ProPerVis could be used in place of the UFOV in Fitness to Drive test batteries for older drivers

# Recommendation

- For older drivers, the validity of the UFOV, and ProPerViz be tested against (1) on-road driving performance and (2) at-fault crashes

# Contact Details

Email: [white.michael3@saugov.sa.gov.au](mailto:white.michael3@saugov.sa.gov.au)

Phone: (08) 8204 8817

The End