



# Pedestrian and Cyclist Safety National Conference

9 June 2006, Transport Accident Commission, Melbourne

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# Behavioural Factors and Issues Relating to Vulnerable Road Users: Pedestrians

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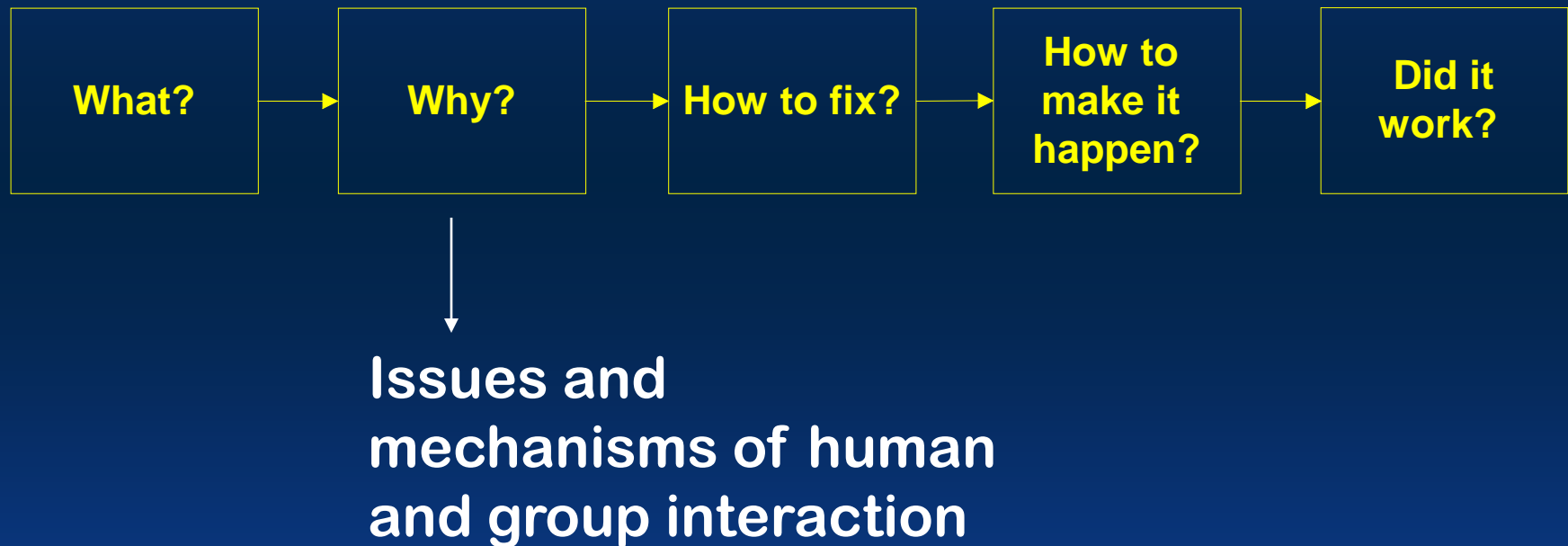


# Overview

- Issues of human performance, behaviour and psychology
- Human information processing
- The perspective of the driver
- The perspective of the pedestrian
- Social interaction between vulnerable road user and driver; group behaviour; culture and attitudes

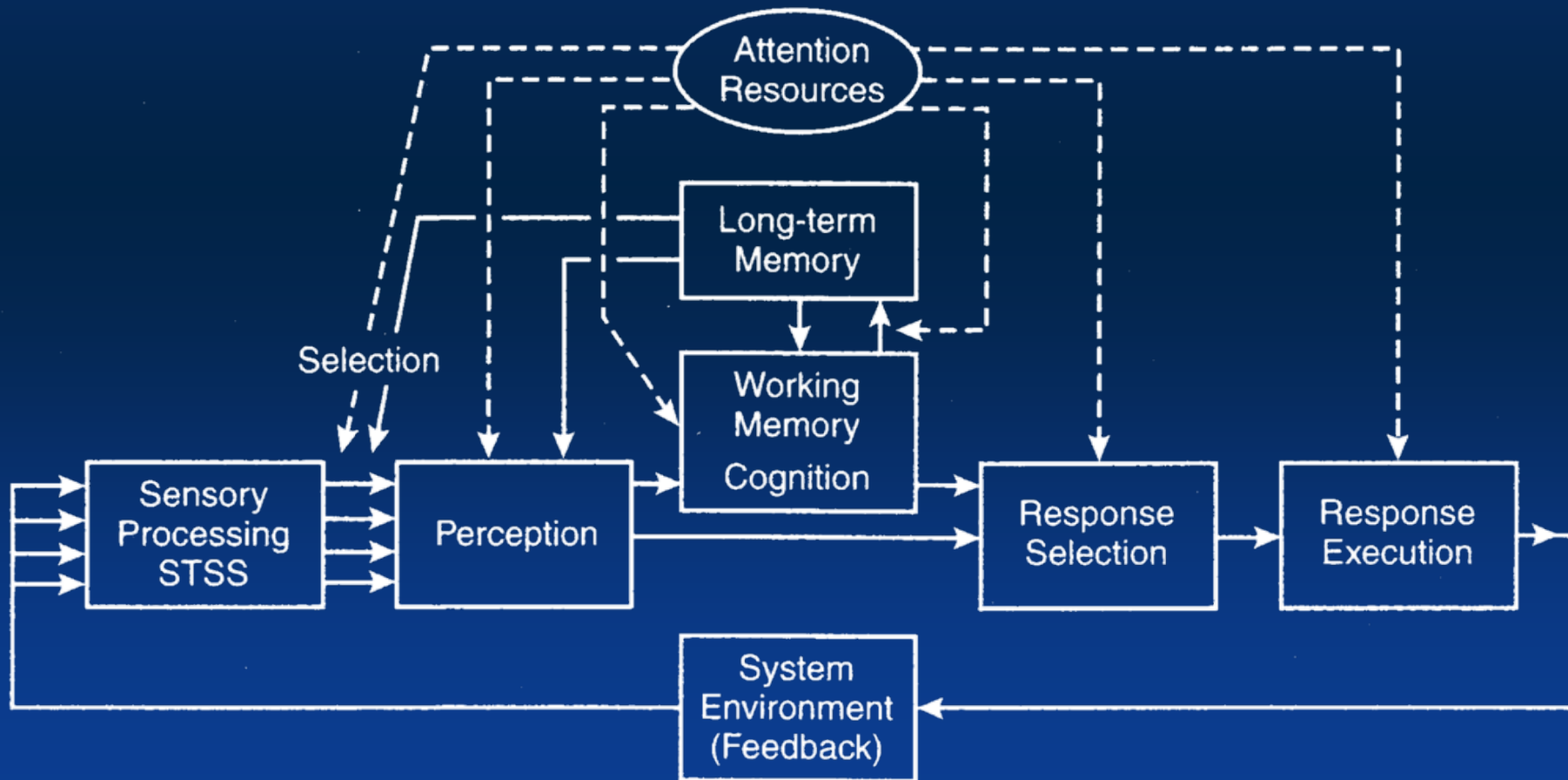


# Injury Prevention Chain





# Human Information Processing Stages





## **Ped/driver both must do:**

- **Select a proper course of movement**
- **Visually search for the presence of each other**
- **Detect each other and their relative locations**
- **Evaluate, Decide and Execute response**



<b>Causal Factors</b>	<b>Percent of Factors</b>
<b>Ped Course</b>	<b>30.6</b>
<b>Ped Search</b>	<b>29.4</b>
<b>Ped Detection</b>	<b>6.0</b>
<b>Ped Evaluation, Decision, Action</b>	<b>4.9</b>
<b>Driver Course</b>	<b>4.6</b>
<b>Driver Search</b>	<b>12.9</b>
<b>Driver Detection</b>	<b>7.4</b>
<b>Driver, Evaluation, Decision, Action</b>	<b>4.2</b>
	<b>100</b>

(adapted from Snyder and Knoblauch, 1971)



# Sensation & Perception - Driver

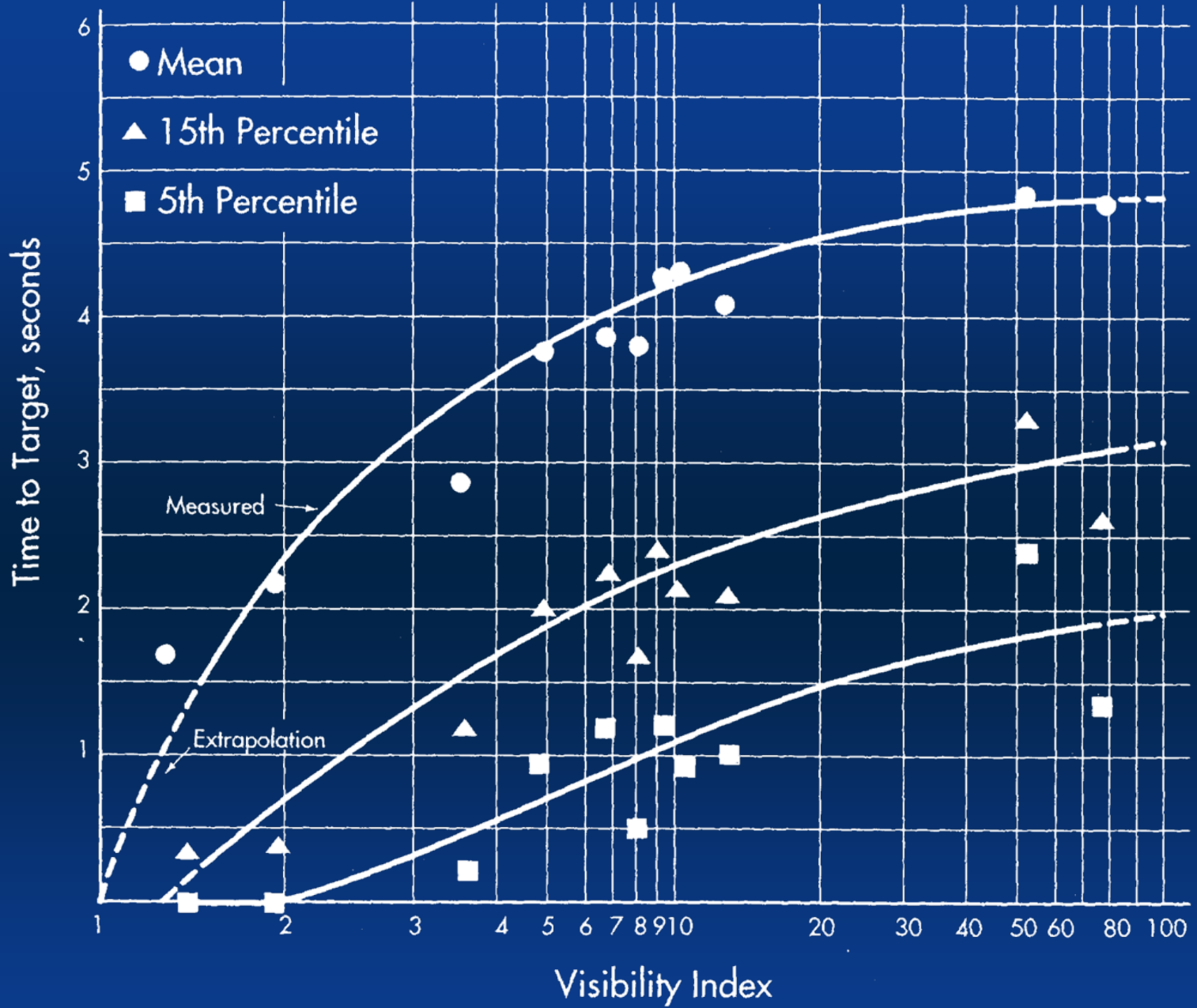
- Factors potentially contributing to events:
- Visual contrast
- Method of illumination
  - at night
    - negative silhouette
    - positive silhouette
    - in-between zone
    - glare effects
    - driver limitations (Leibowitz)
- Visual interference effects
  - “A” pillar, windscreen effects





# Sensation & Perception - Driver

- Visual search
  - preview
- Driver control
- Speed perception
  - perceptual countermeasures
- Visual periphery, perceptual narrowing
- Risk perception
  - potential for training
- Expectancy effects



# Avoidance Time-to-target and Target Visibility



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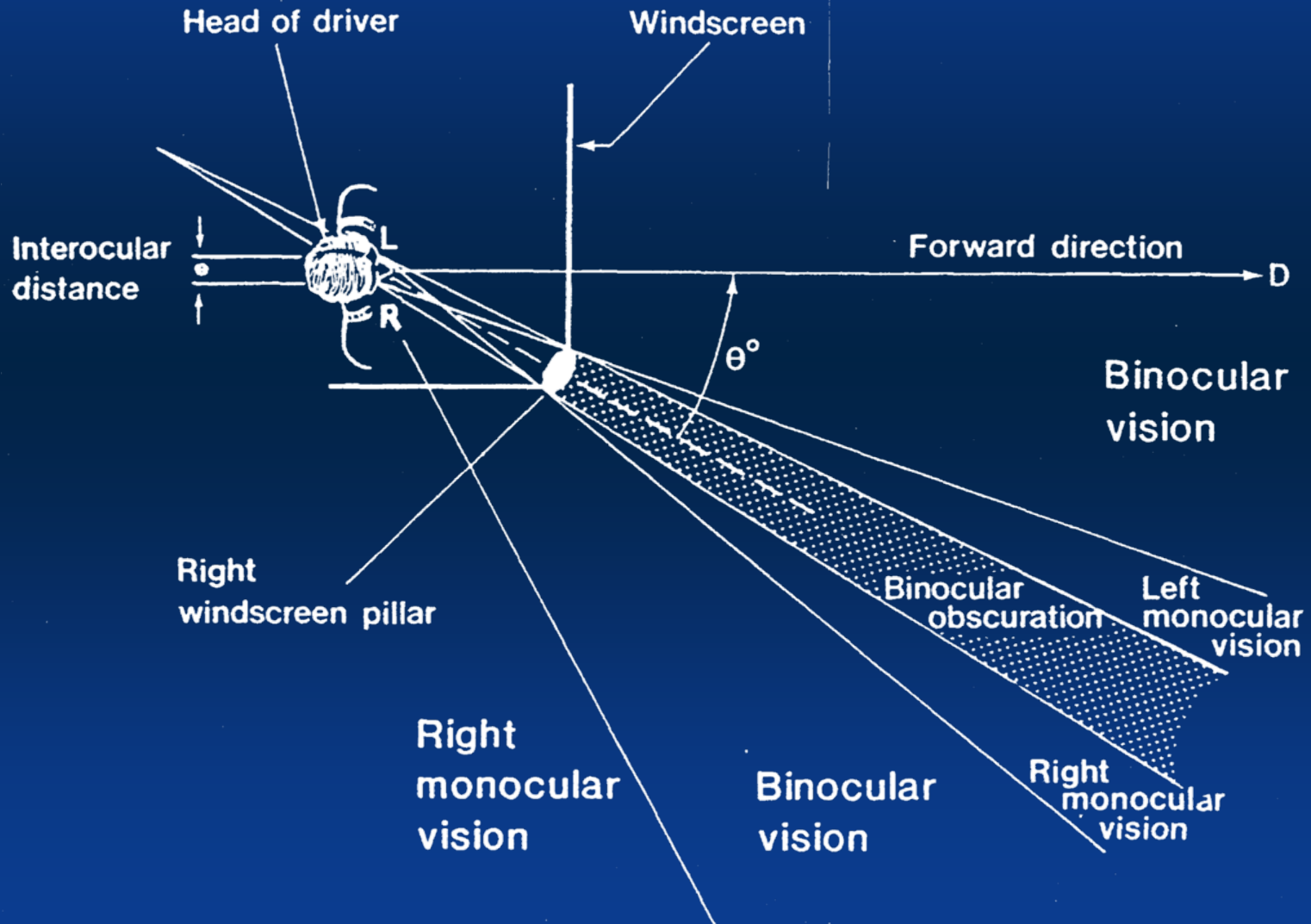
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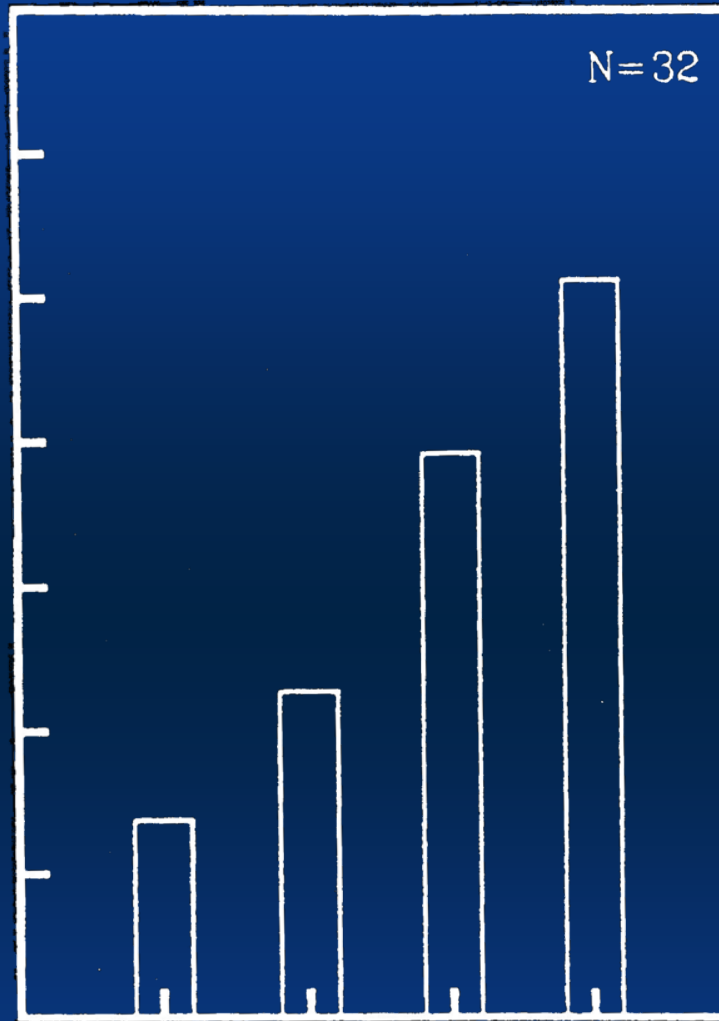


# Driver 'A' Pillar Obscuration



greater  
post  
effect

DIFFERENCE SCORES  
(No Post - post correct detections)



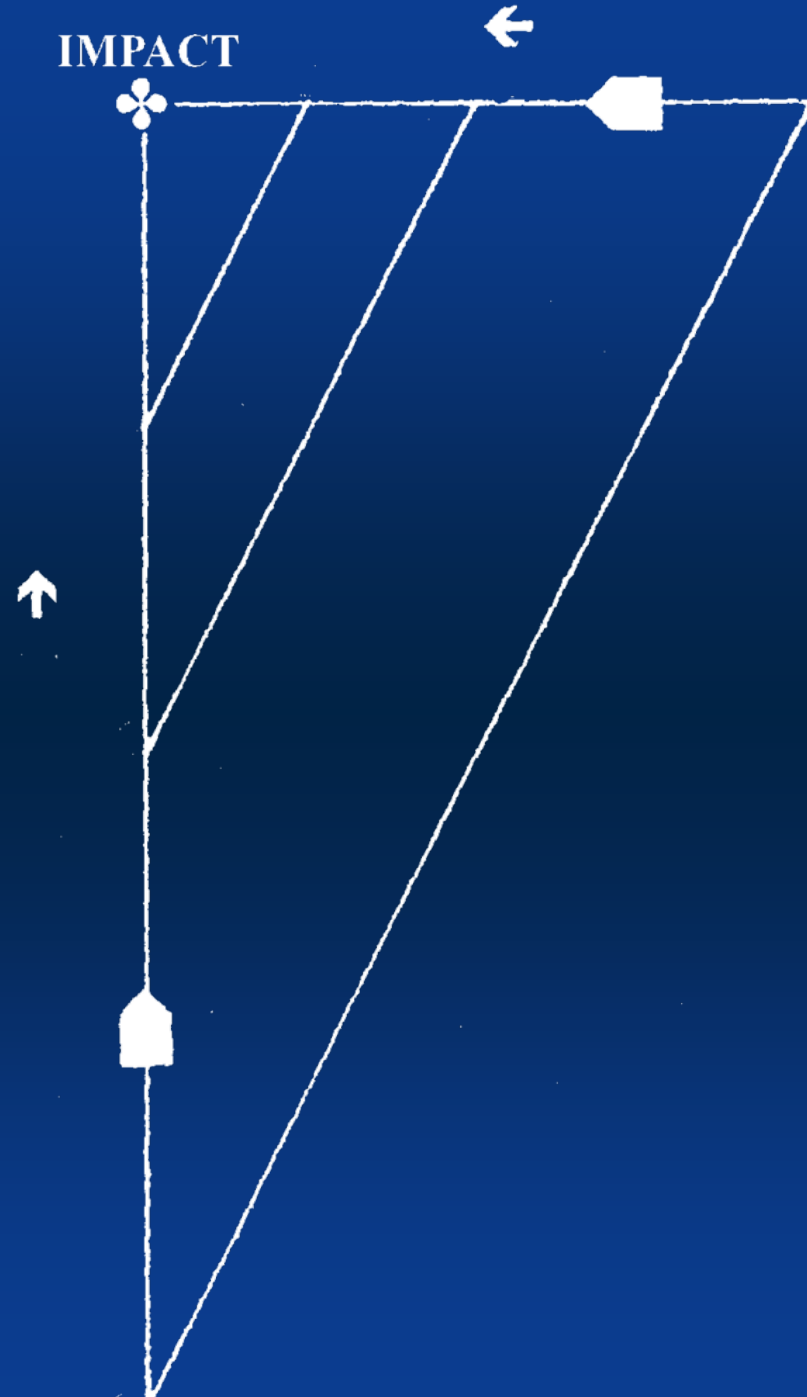
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POST WIDTH (cm)

**Driver 'A' Pillar Degrading Effects**

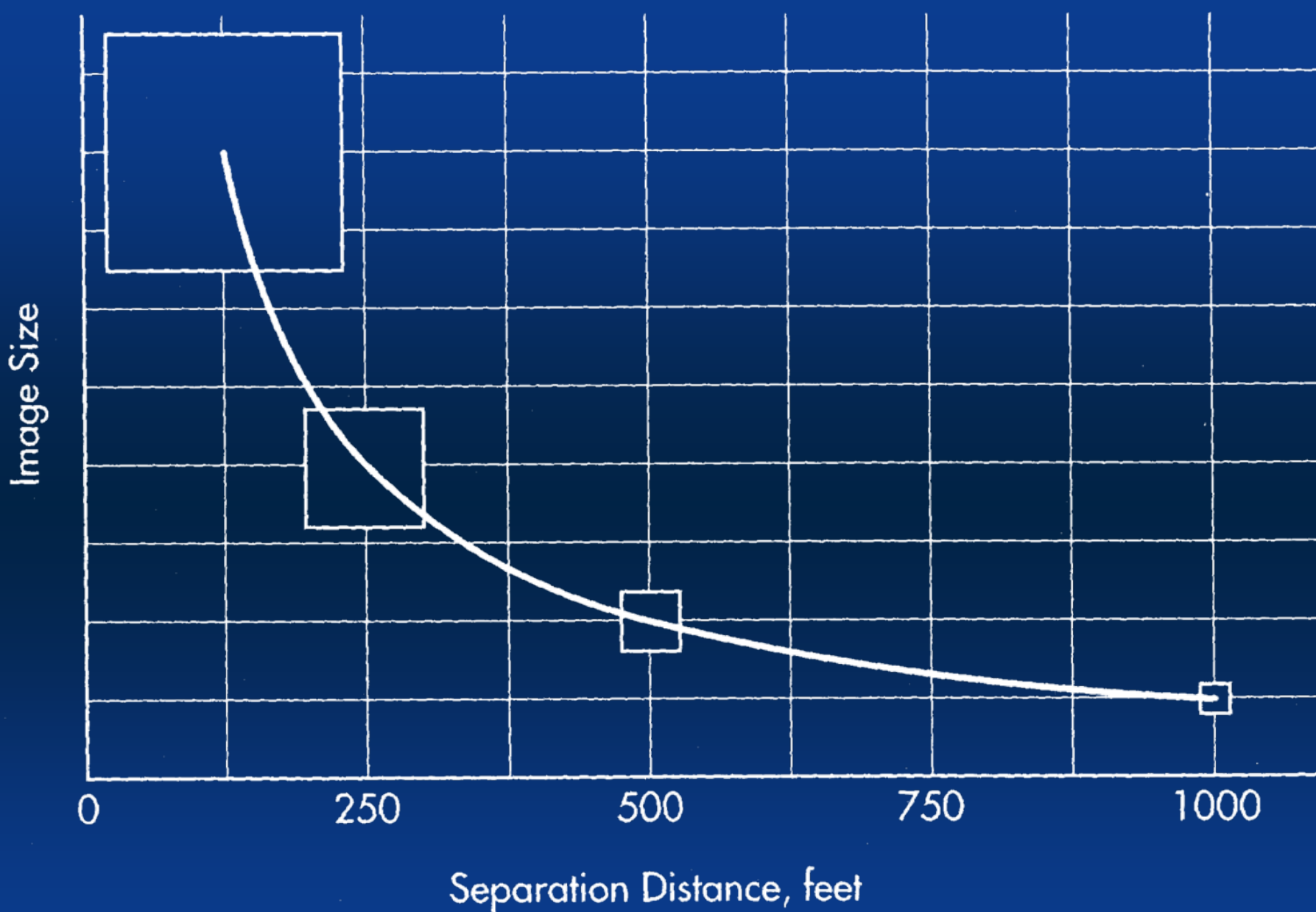


IMPACT



# The Collision Course





**Cues from 'looming' are late**



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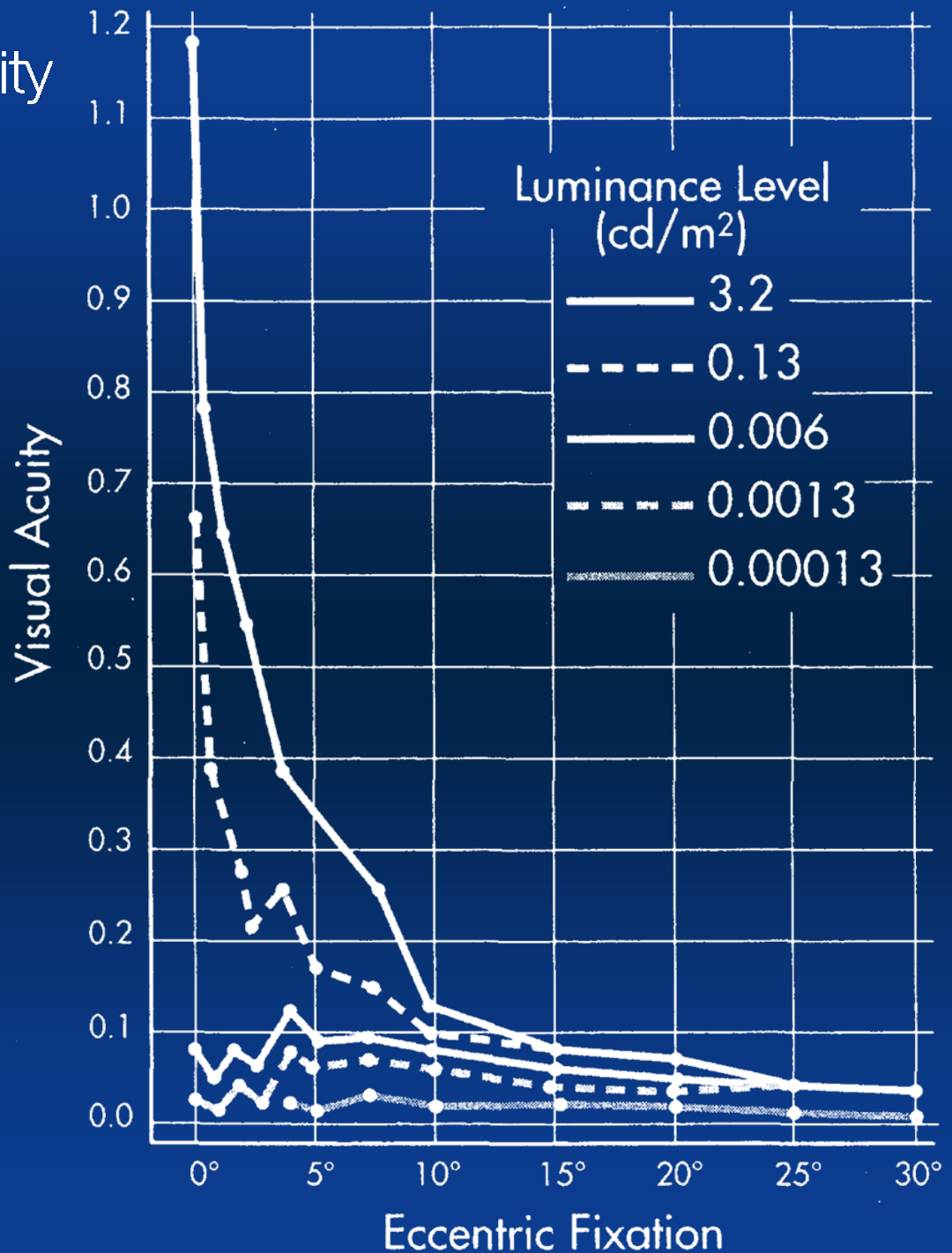
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# Approximate area covered by the fovea





# Visual Acuity in Peripheral Vision







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## Decision, Resources, Action Execution - Driver

- What response?
- Time to respond:
  - braking
  - lateral displacement
- Decision criterion (SDT)
- Sequential responding delays
  - psychological refractory period
- Expectancy effects
- Attention-sharing and resource effects
  - distribution
  - multiple task effects
    - potential for training
      - younger and older
- Situational awareness (e.g. ped crossing time)



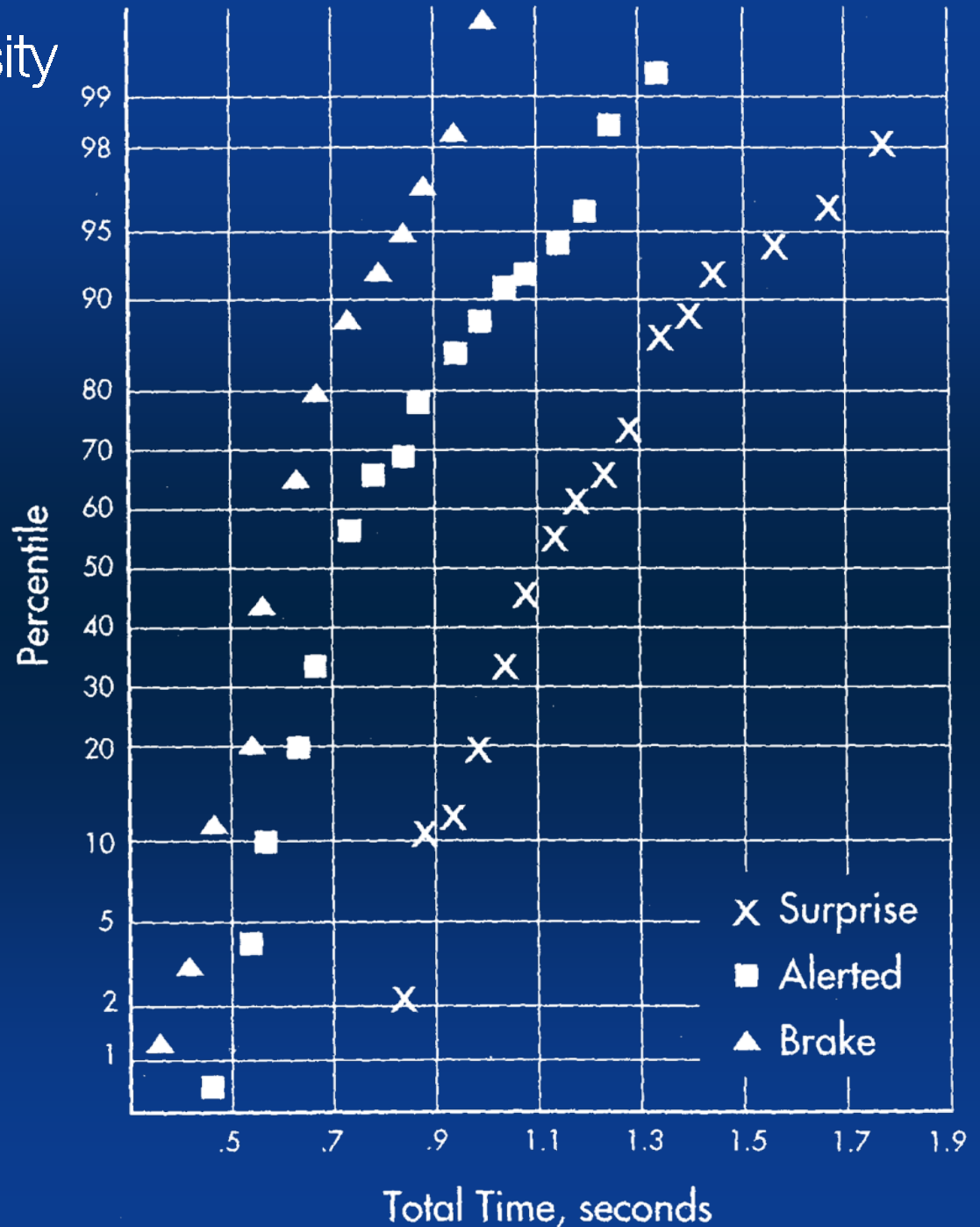
# Unaltered Driver Reactions

## 85<sup>th</sup> percentile reaction time values

C.R.B. 'Roadworks Ahead' sign	3.0s
Protruding vehicle with tyre change	1.5s
Lit vehicle under repair at night	1.5s
Parked Police vehicle	2.8s
Amphometer : Beaconsfield	3.4s
Amphometer : Dandenong North	3.6s
Amphometer : Gisborne	3.6s
Amphometer : Tynong	2.54s
Railway crossing : night (general population)	1.50s
Railway crossing : night (rally drivers)	1.50s
Railway crossing : day	2.53s
Car following	1.26s

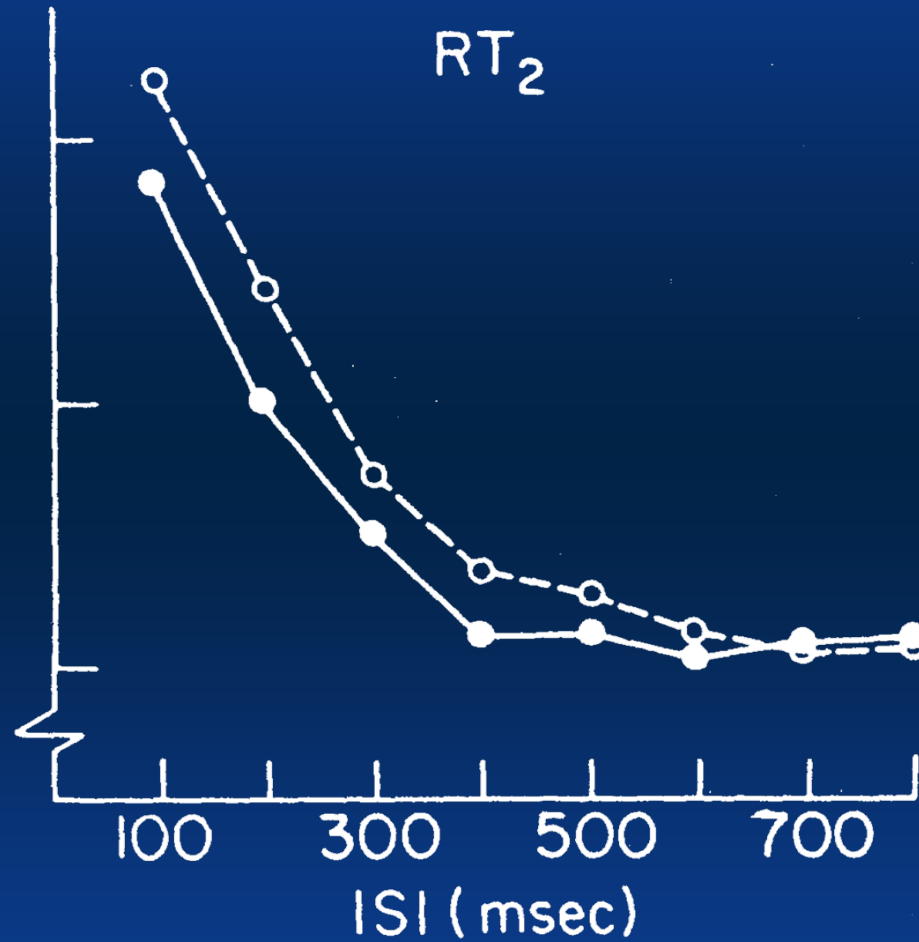


# Driver Reaction Times with Changing Expectancy





—●— Fixed  
- -○- - Varied

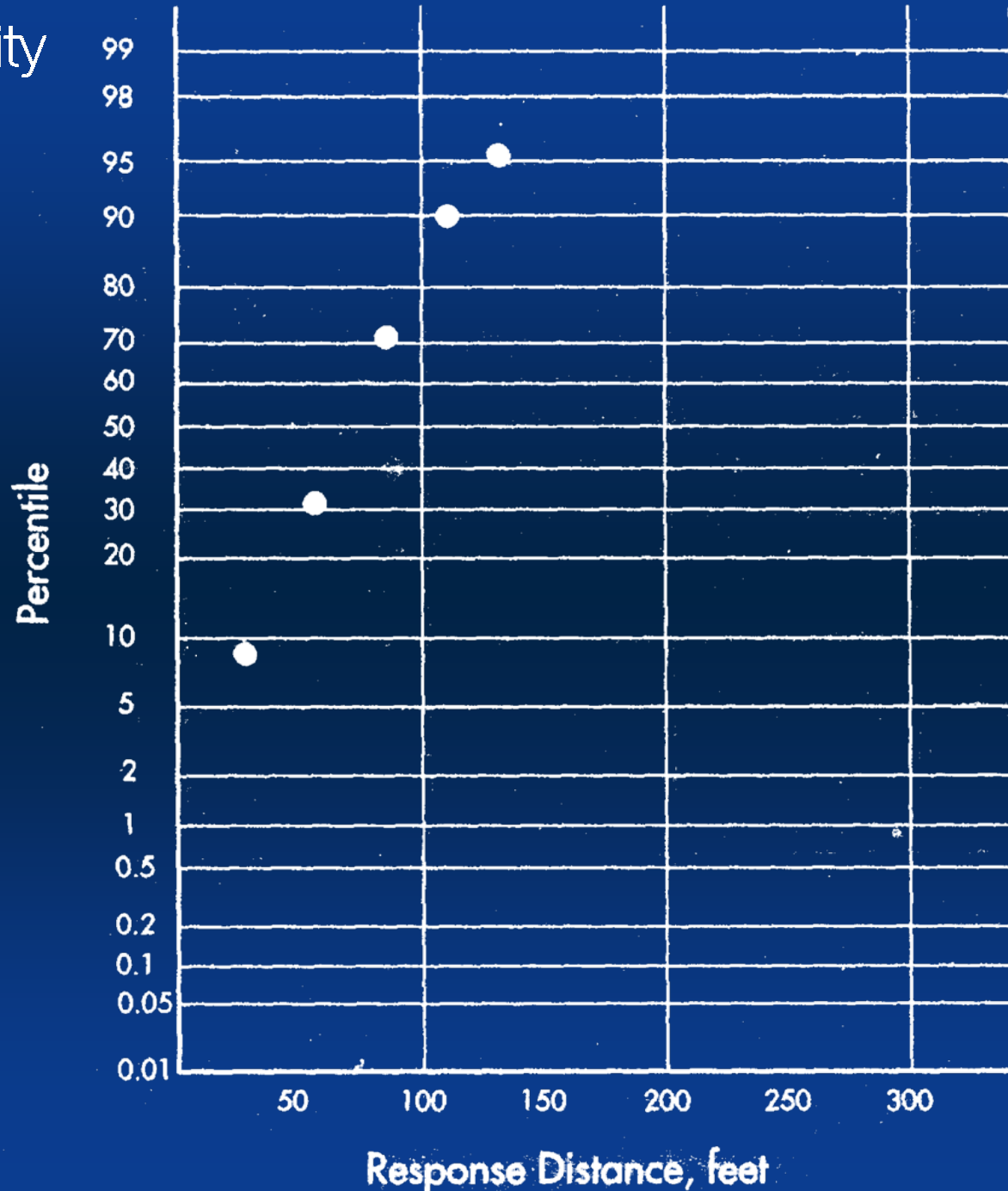


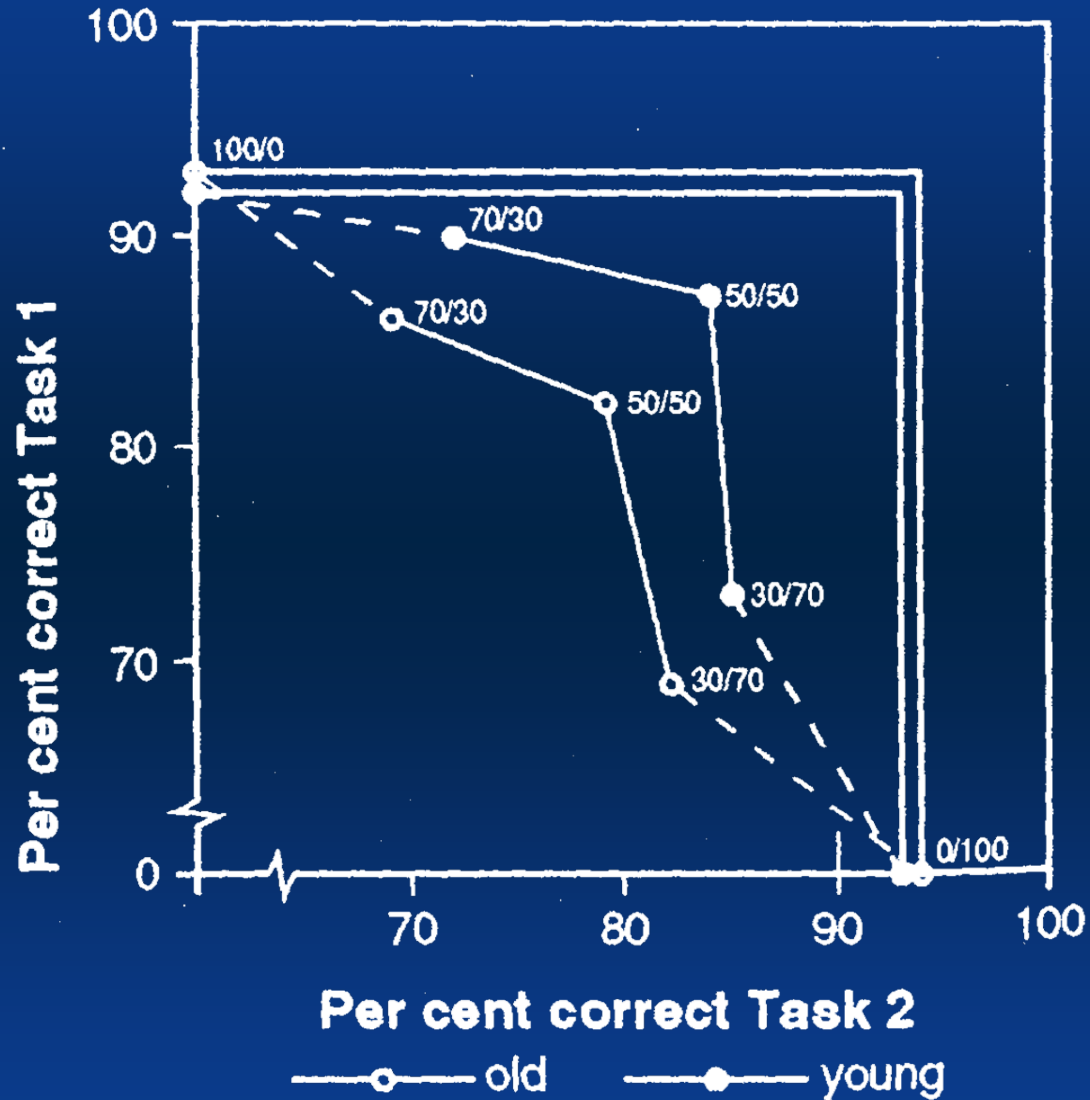
# Delays in Sequential Responding





**Unexpected  
pedestrians  
may only be  
seen at  
short  
distances**





# Attention-sharing in young and old



# Sensation & Perception - Pedestrian

- Visual search
  - wide field of search
  - different group search behaviour
- Time to cross judgements
- Risk perception
- Assumptions of priority
- Trade-offs
  - convenience vs risk
- Speed estimation of vehicles
  - size illusion
  - distance illusion



# Pedestrian Visual Search Behaviour at Signalised Intersections

	Search	Don't Search
<b>Older Females</b>		
Green signal	39%	61%
Red signal	60%	40%
<b>Older Males</b>		
Green signal	46%	54%
Red signal	52%	48%

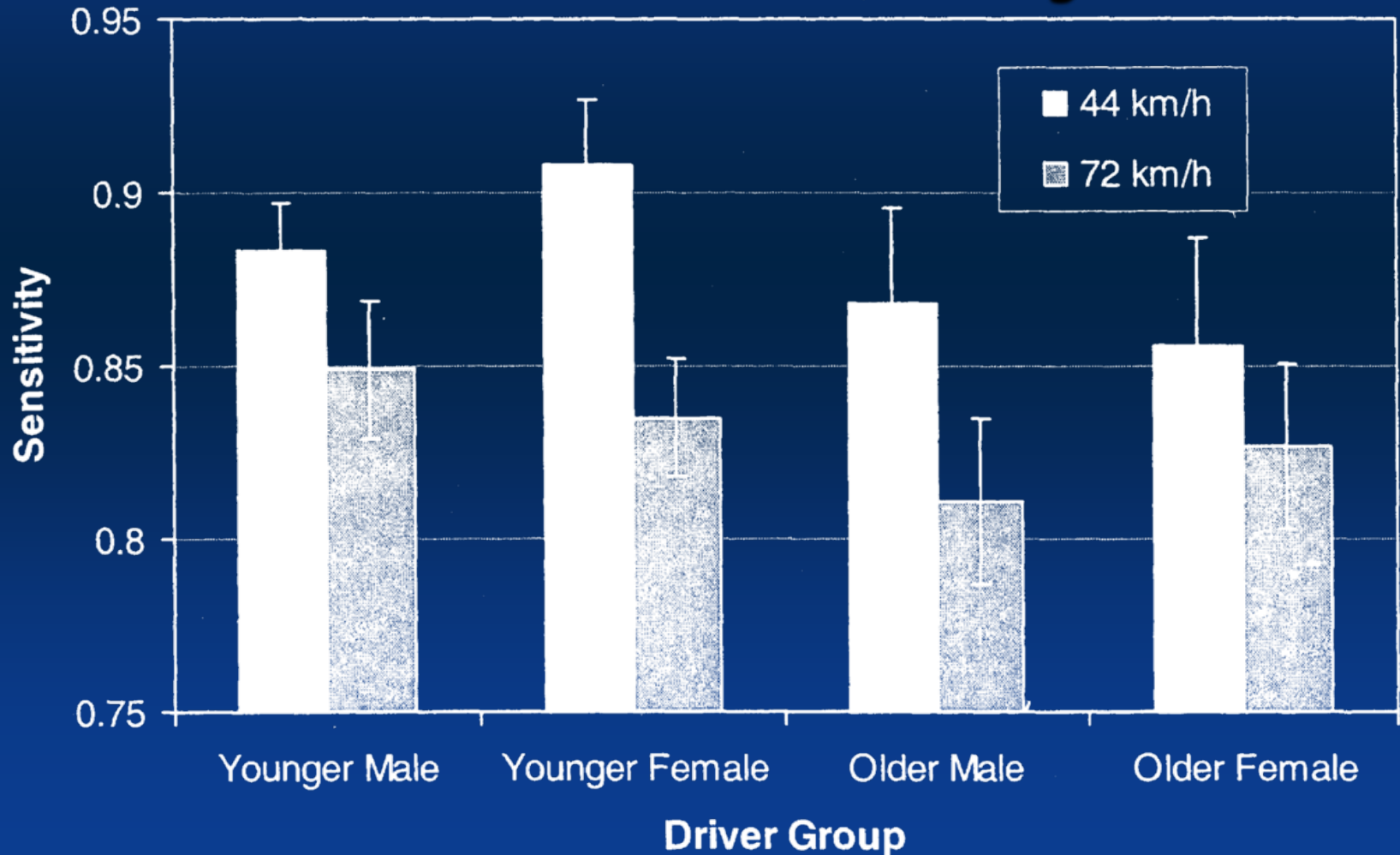


# Decision, Resources, Action Execution - Pedestrian

- Time-sharing
- Time of vehicle arrival estimates (sensitivity and bias)
- Expectancy effects – how detectable is pedestrian to the driver?
- Risk-taking:
  - Convenience vs risk
  - subjective expected utility
  - general and social effects
- Situational awareness
  - dart-out accidents
  - roadway understanding

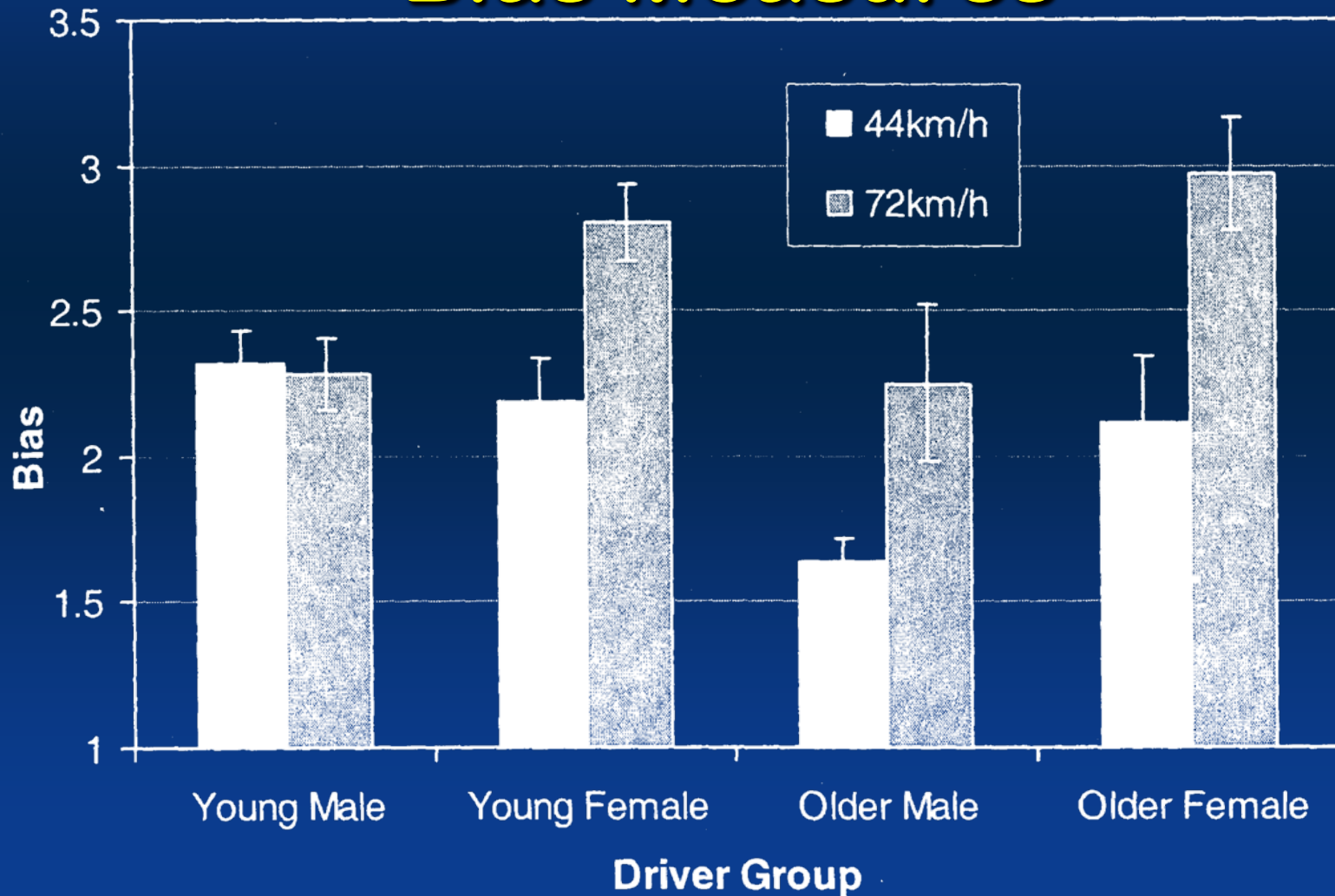


# Arrival Time Judgements – Mean Sensitivity





# Arrival Time Judgements – Bias Measures







# Social Interaction, Conformity and Social Groups

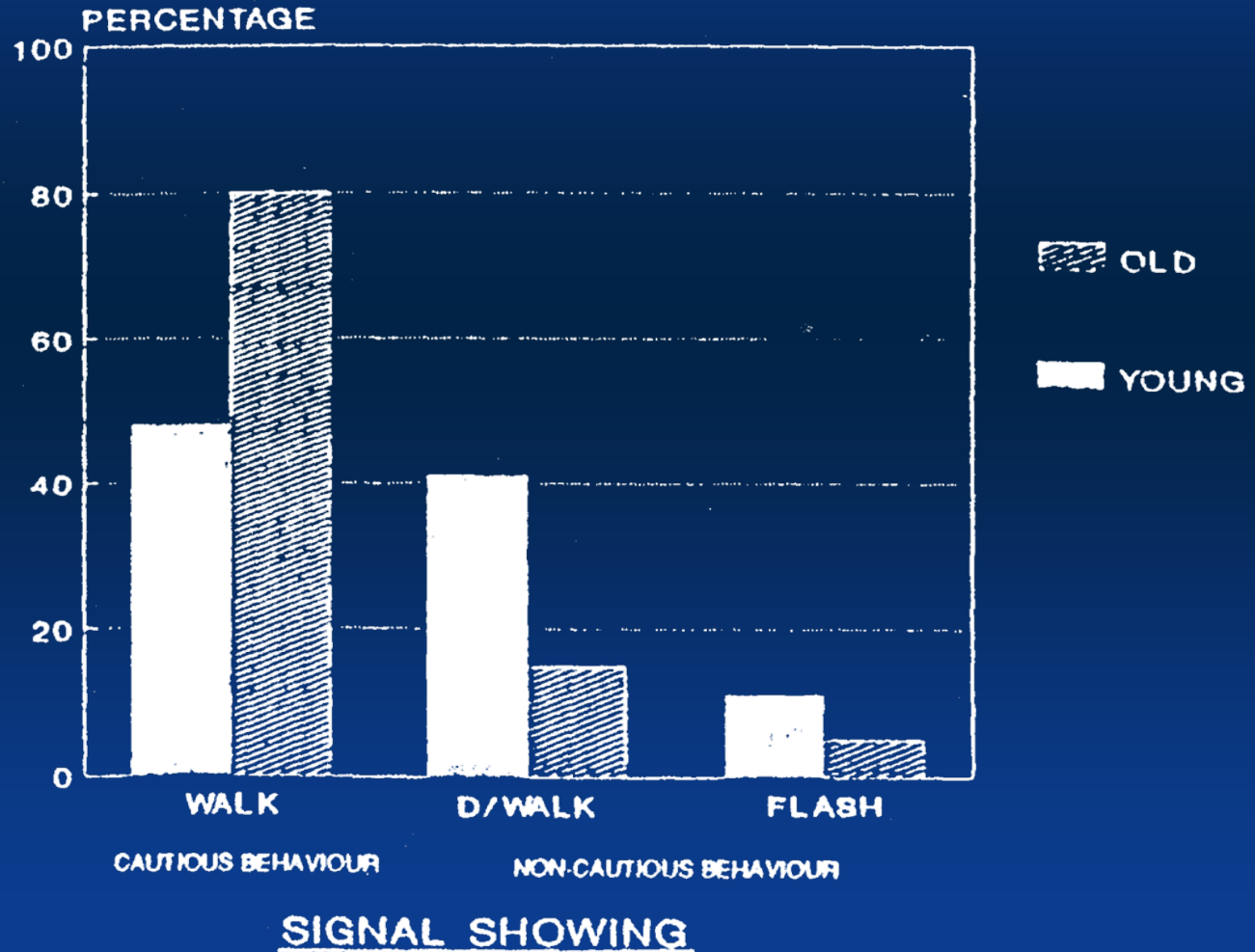


- Type of pedestrian influences driver behaviour
- Assumptions of pedestrian of his visibility distance
- Individual, small, large group effects
- Leader-follower behaviour
- Ambiguity of priority





# Caution Shown by Young and Old Pedestrians



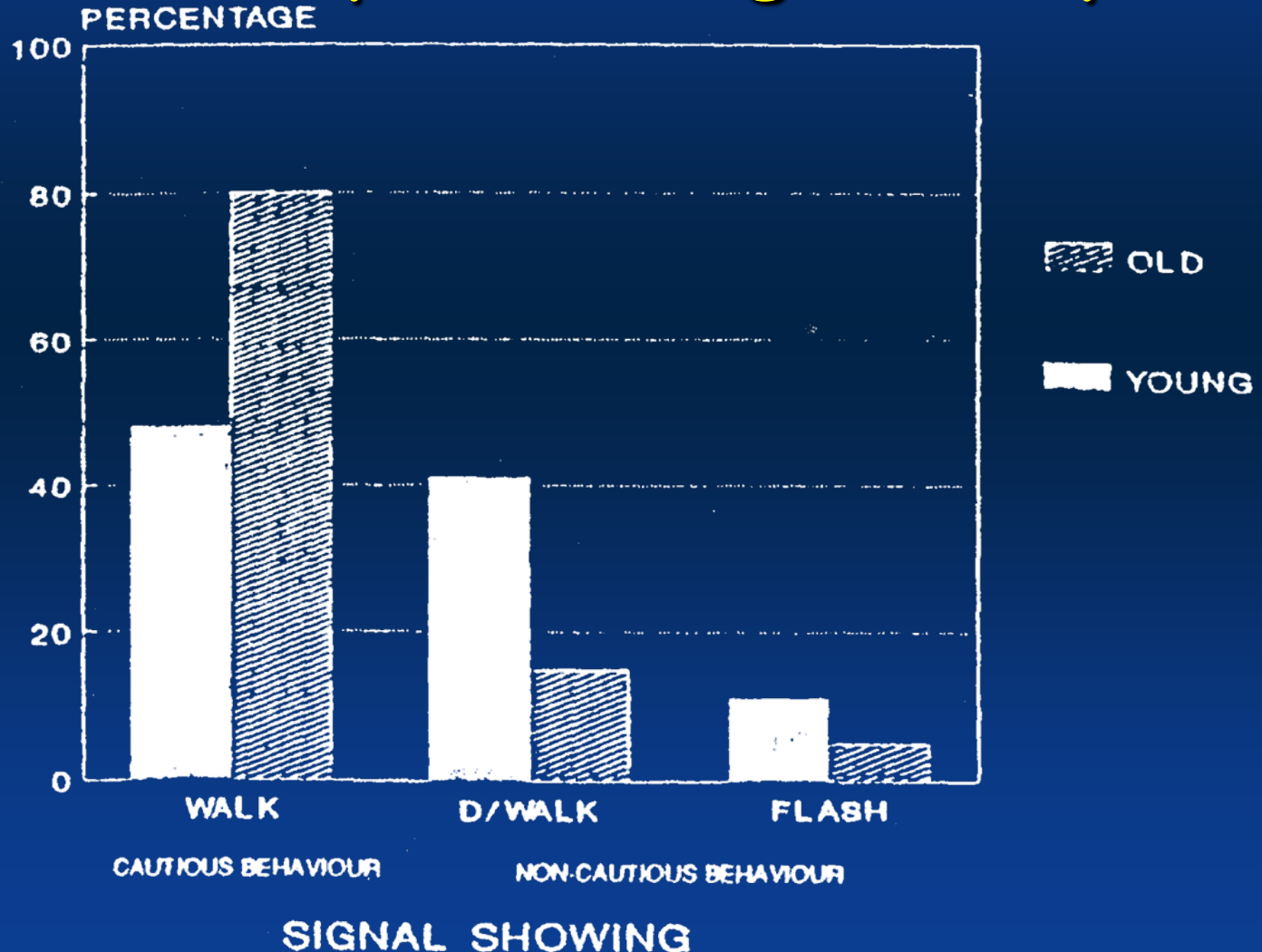


# Pedestrian Rule Compliance

	<b>Groups</b>	<b>Unaccompanied</b>
<b>Legally</b>	<b>80%</b>	<b>61%</b>
<b>Illegally</b>	<b>20%</b>	<b>39%</b>

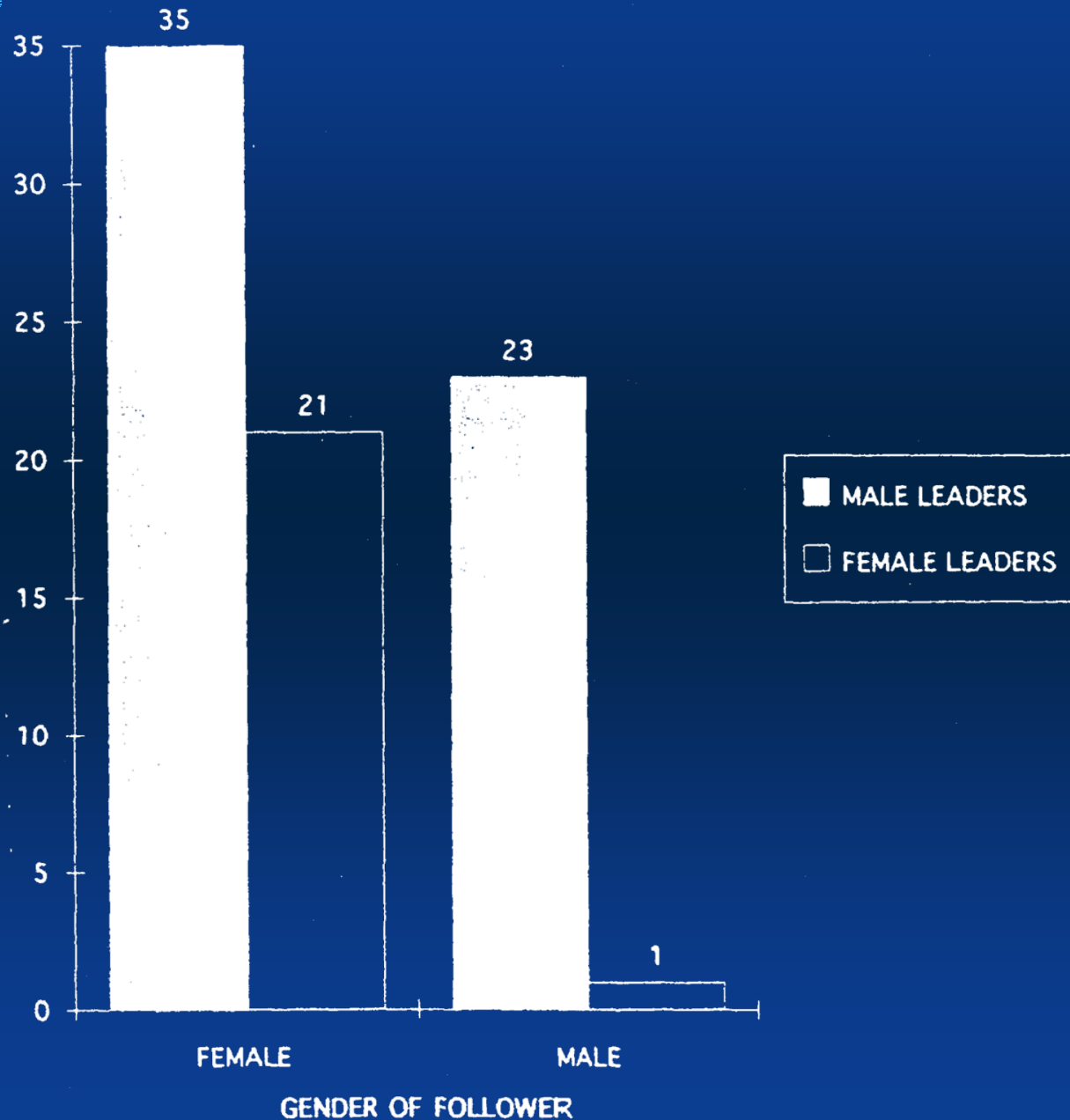


# Caution Shown by Lone Pedestrians, Small Groups and Larger Groups





# Gender and Pedestrian Leader / Follower Behaviour in Illegal Crossings





# Final Comments

- **Humans make errors**
- **Many threats to accurate visual processing and timely responding**
- **Need to reduce processing load by treatment measures and reduced vehicle speed**
- **Public education may be able to contribute**



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