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Learning to Drive: From Hazard Perception to Hazard Handling

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Introduction

- **Research Rationale**
- **Hazard Perception**
  - Detection & Handling
- **Declarative Knowledge of Driving**
  - Driving Theory Test
- **Conclusions**

Background to Research

- **Limited knowledge about the benefits of pre-driving education**

- **Some evidence linking hazard perception skill to driver safety**
  - Experience-related differences have emerged
    - More experienced (safer) drivers respond more quickly to hazards than novice (less safe) drivers

Hazard Perception

- **What is a Hazard?**

  "any situation in which a collision or near collision with another road user or external object could occur unless you take some type of evasive action (e.g. braking, steering, etc.)"

- **What is Hazard Perception?**

  "the ability to quickly perceive and respond to a potentially dangerous driving event" (Crundall et al., 2003)

- **Contribution of Hazard Perception**
  - Only driver-specific skill found to correlate with crash involvement (Horswill & McKenna, 2004)
  - Although only in limited circumstances (Wells et al., 2008)

Evaluating Hazard Perception Skill

- **Majority of hazard perception tests consist of button press responses to hazards presented in filmed scenarios**

=/?

- **Response**

Discrete button press, analogous to simple reaction time

vs

Choice between several alternative actions

Selecting Hazardous Events

- **Little knowledge of which particular stimuli discriminate between novice & experienced drivers**
  - Or why?
- **Hazards selected based on characteristics of young driver accidents**
  - Events which naturally occur in the driving environment
    - Bends
    - Cars pulling out
    - Traffic Lights
    - Pedestrians

Driving Simulator Technology

- **Provides high fidelity, fully immersive environment for drivers**
- **Allows manipulation of hazards**
- **UCC's Simulator:**
  - Augmented STISIM 400W
  - Full Size Vehicle
  - Output
    - Speed
    - Pedal and steering wheel movement
    - Lateral Position

Contrasting Detection and Handling

- **Cognitive Account of Driving**
  - Separates process of hazard responding into:
    - Hazard detection
    - Threat appraisal
    - Action selection
    - Action implementation
- **Hazard Detection**
  - Discrete response to viewing hazardous events incorporated within continuous drive
- **Hazard Handling**
  - Changes in driving when confronting identical events in the same setting

Research Questions

1) **Are hazards detected in a fixed-speed, immersive driving environment**
   - Speed, lane positioning etc. controlled
   - Outcome variables
     - Response Rate (no. of responses)
     - Response Time
2) **Is there a discernable change in a hazard handling test which measures actual driving behaviour?**
   - Outcome variables
     - Response Rate
     - Behavioural Response Time

Design of Drive

- **Route length – 25km**
- **Five Speed Zones: 25kph, 40kph, 60kph, 70kph, 100kph**
- **Five hazard types**
  - Traffic Lights
  - Bends
  - Car Emerging
  - Merging Traffic
  - Pedestrians
- **Control events to check for false responding**

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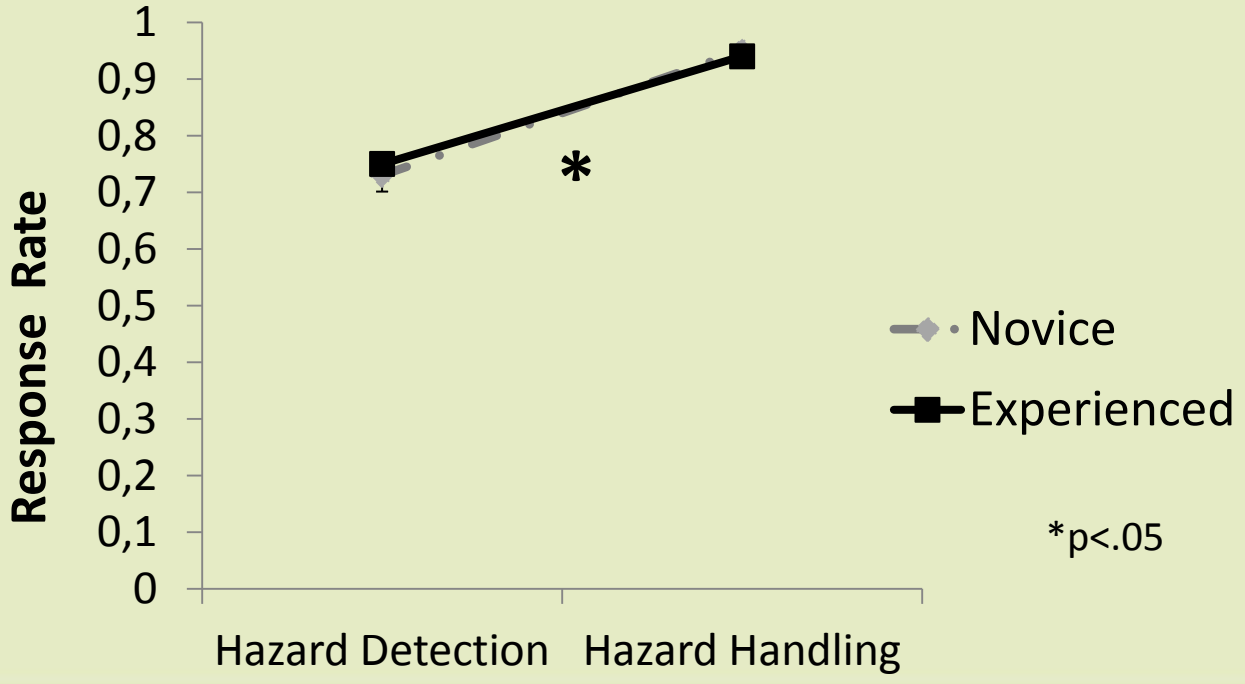
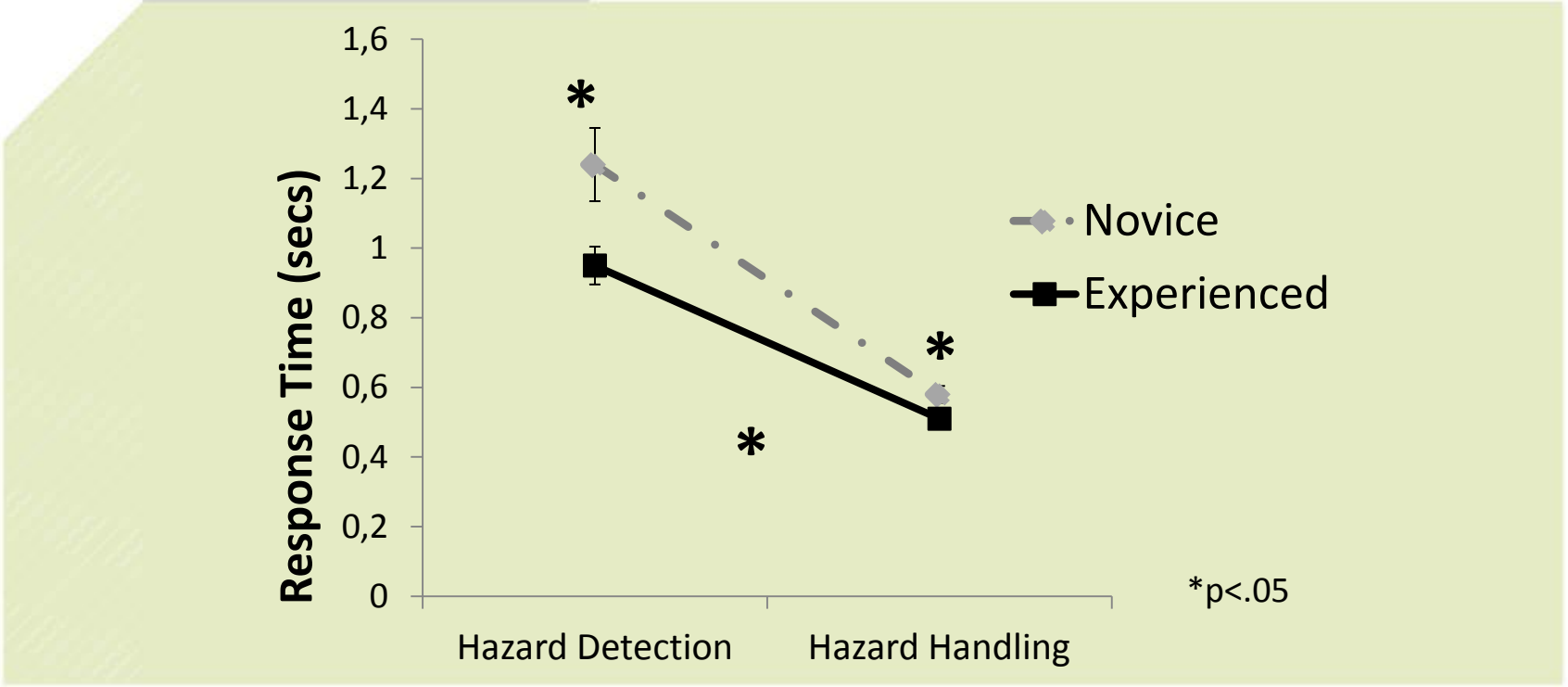
Participants

- **Novice Drivers (N=18; 8 male, 10 female)**
  - Age Range: 19.45 years to 23.35 years (M=20.68; SD=.98)
  - Driving Experience: 0-2 years (M=1.01; SD=.65)
- **Experienced Drivers (N=18; 9 male, 9 female)**
  - Age Range: 21.49 years to 36.84 years (M=24.25; SD=3.58)
  - Driving Experience: 5-17 years (M=6.86; SD=2.79)
- **Groups differed significantly in terms of age (t(34)=-4.09; p<.001)**

Comparing Response Rates across Tests



Comparing Response Times across Tests



Links to Theoretical Knowledge of Driving

- **Driving Theory Test:**
  - 40 questions on the topics such as the following:
    - The rules of the road
    - Risk perception
    - Hazard awareness
    - Good driving behaviour
  - Participants need to get 35 questions correct to pass
  - Maximum of 45 minutes to complete

Driving Theory Test Results

- **Significant effect of experience on the number of correct responses made ($t(32)=-3.54$; $p<0.001$, $|d|=1.20$)**
  - Novice drivers (M=80.38%, SE=2.23) making fewer correct responses than experienced drivers (M=88.72%; SE=1.06).

- **No significant experience differences in average response time to DTT items ($t(33)=0.72$; $p=0.48$, $|d|=0.24$)**

Novice Drivers: Driving Knowledge & Hazard Perception

	DTT Score	DTT RT	HD-RR	HD-RT	HH-RR
1. DTT Score	1				
2. DTT Mean RT	-0.20	1			
3. Hazard Detection Mean RR	**0.62***	0.17	1		
4. Hazard Detection Mean RT	-0.26	0.30	**-0.50***	1	
5. Hazard Handling Mean RR	0.04	-0.20	0.29	-0.43	1
6. Hazard Handling Mean RT	0.28	-0.37	-0.08	-0.34	0.09

Experienced Drivers: Driving Knowledge & Hazard Perception

	DTT Score	DTT RT	HD-RR	HD-RT	HH-RR
1. DTT Score	1				
2. DTT Mean RT	-0.05	1			
3. Hazard Detection Mean RR	0.12	0.25	1		
4. Hazard Detection Mean RT	-0.13	-0.14	0.10	1	
5. Hazard Handling Mean RR	0.08	0.13	**0.53***	-0.24	1
6. Hazard Handling Mean RT	0.07	0.09	0.14	-0.07	-0.20

Summary of Findings (1)

- **Simulated delivery of hazard perception tests can work equally as well as video-based recording**
  - Both Hazard Detection and Hazard Handling tests distinguish between novice and experienced drivers in immersive environments

- **This allows more manipulation of potential hazards**
  - Potential to design hazardous events around accident 'black-spots'

Summary of Findings (2)

- **Use of a simulator provides a more implicit test of hazard handling behaviour than traditional button-press response tests**

- **Evidence that for novice drivers hazard perception tests link more into their knowledge of driving theory than their ability to respond safely**
  - Driving behaviour not correlated to this knowledge

THANK YOU