Dynamic Research Inc.

Visual Scanning of Motorcycle Riders – A Preliminary Look

Terry Smith[1], Steve Garets[2], Jessica Cicchino[3]
Tia Tucker[1]

[1] Dynamic Research Inc., Torrance, CA
[2] Team Oregon, Corvallis, OR
[3] National Highway Traffic Safety Administration, Washington, DC

MSF Motorcycle Safety Symposium
Orlando, Florida, October 2013

BACKGROUND TO THE PROBLEM

Motorcycle Fatalities in the USA

	2007	2008	2009	2010	2011
Total killed on US roadways	41,259	37,423	33,883	32,999	32,367
Motorcyclists killed	5,174	5,312	4,469	4,518	4,612
% change of motorcyclists killed from previous year	+7.0	+2.7	-15.9	+1.1	+2.1
Motorcyclists injured	103,000	96,000	90,000	82,000	81,000
Motorcyclist fatalities as % of all fatalities	12.5	14.2	13.2	13.7	14.3

Source: NHTSA Fatality Analysis Reporting System (FARS)

BACKGROUND TO THE PROBLEM

Distribution of Fatal Motorcycle Accidents in USA

	2007	2008	2009	2010	2011
Single vehicle accidents	50% n=3107	53% n=2736	52% n=2259	49% n=2151	51% n=2163
Collision with another vehicle in transport	50% n=2047	47% n=2554	48% n=2203	51% n =2351	49% N=2449

Source: NHTSA Fatality Analysis Reporting System (FARS)

BACKGROUND TO THE PROBLEM

INITIAL HYPOTHESES

- Poor scanning contributes to both single vehicle and multiple vehicle crashes
- Scanning patterns differ between car drivers and motorcycle riders
- Scanning patterns differ between beginner and experienced riders
- Rider training can improve scanning patterns

METHODOLOGY – SYSTEM DEVELOPMENT

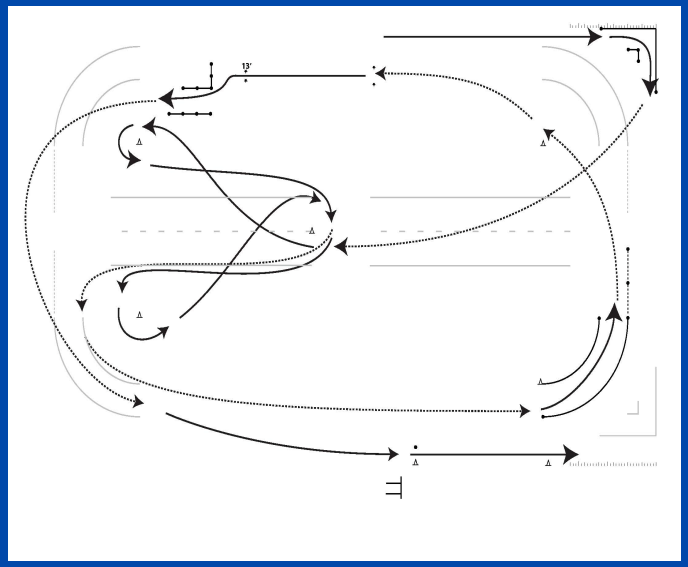
- Arrington Eye Tracker System
- Speedbox - GPS and speed measurement
- Inertial motion units on helmet and motorcycle
- All instrumentation mounted on rider's own motorcycle
- 31 riders recruited
  - Beginner Untrained – recent MC endorsement without any rider training
  - Beginner Trained – recent MC endorsement and signed up for Team Oregon BRT
  - Experienced – minimum of 5 years and 15,000 miles of riding experience

METHODOLOGY – EYE TRACKER TECHNOLOGY

METHODOLOGY – EYE TRACKER TECHNOLOGY

METHODOLOGY – DATA COLLECTION

- Both closed course and open road riding (9.4 miles)
- Helmet mounted two way communication with following rider
- 3 separate test sessions (one every 6 months)



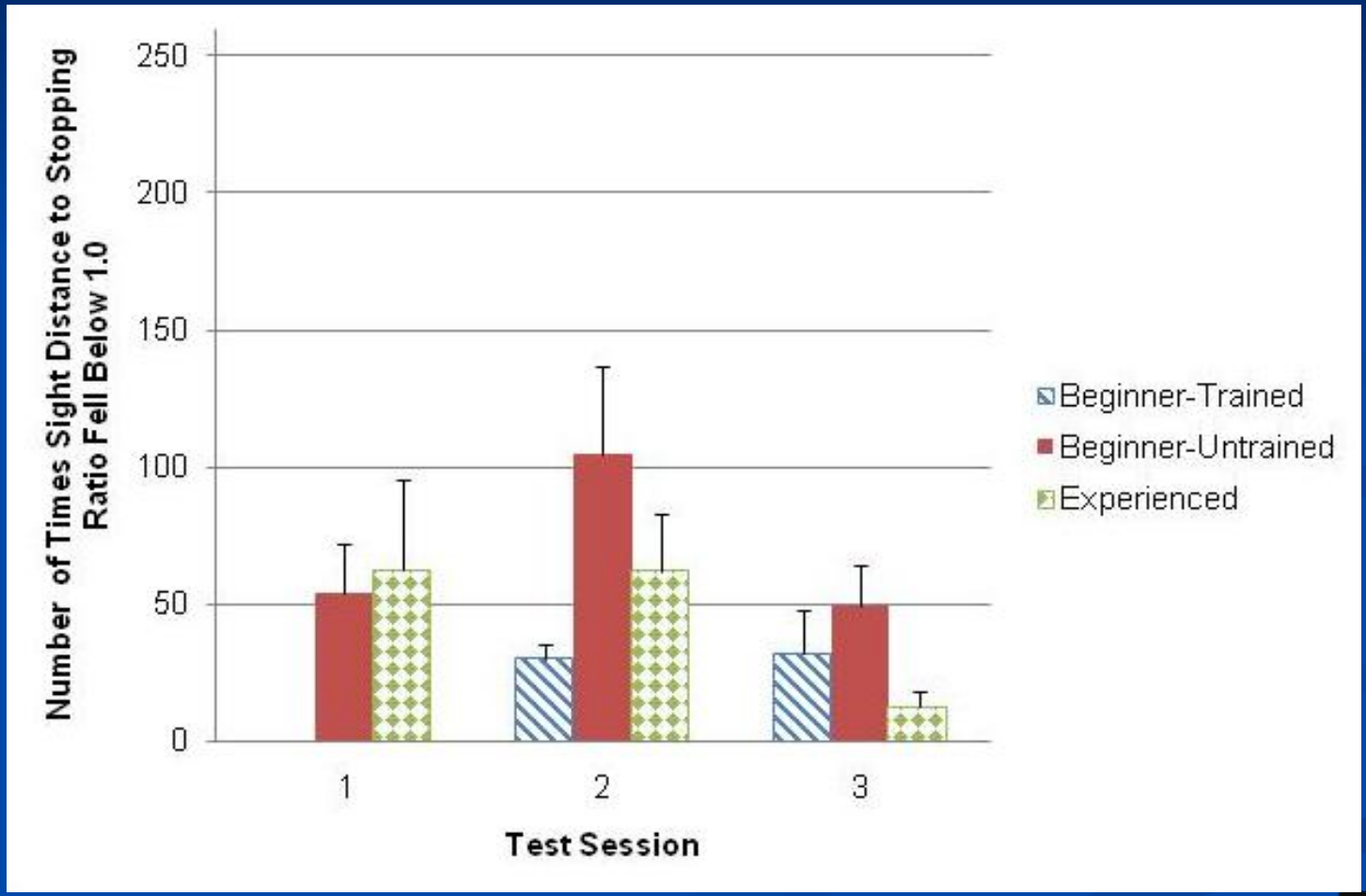
METHODOLOGY – DATA ANALYSIS

- Over 30 hours of eye tracker data collected
- Data was parsed into 63 distinct segments
- 3 segments were analyzed in detail
  - Closed course left hand curve
  - Open road left hand curve
  - Open road straightaway
- Analysis of the speed to sight distance ratio
  - (distance required to stop with .7g braking at instantaneous speed)
- Visual gaze 95% confidence ellipse calculation

METHODOLOGY – DATA ANALYSIS

Dynamic Research Inc.

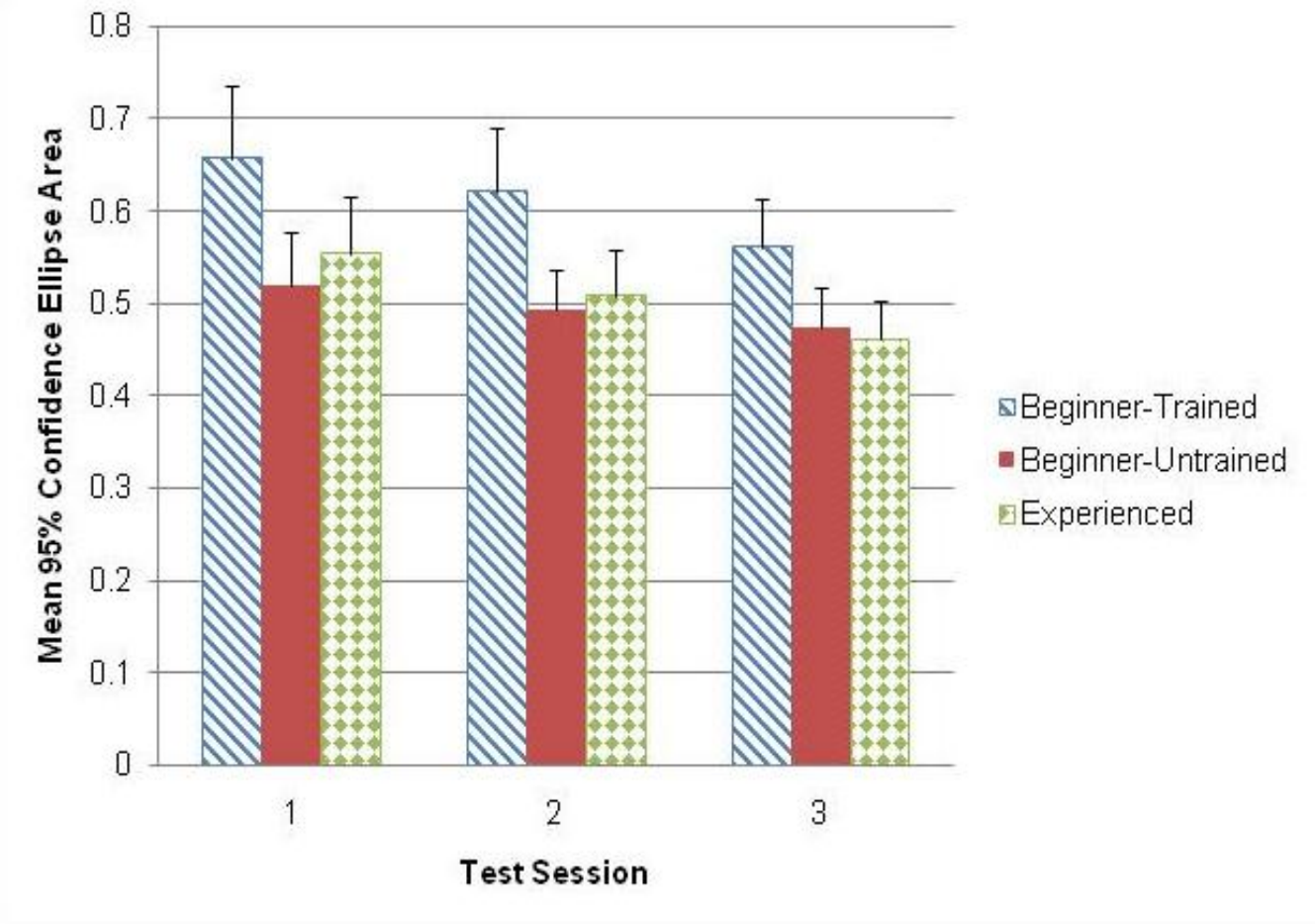
RESULTS



- Significant across test session (alpha = .05)
- Tukey Post-hoc significant difference between beginner untrained riders and beginner trained and exp. riders

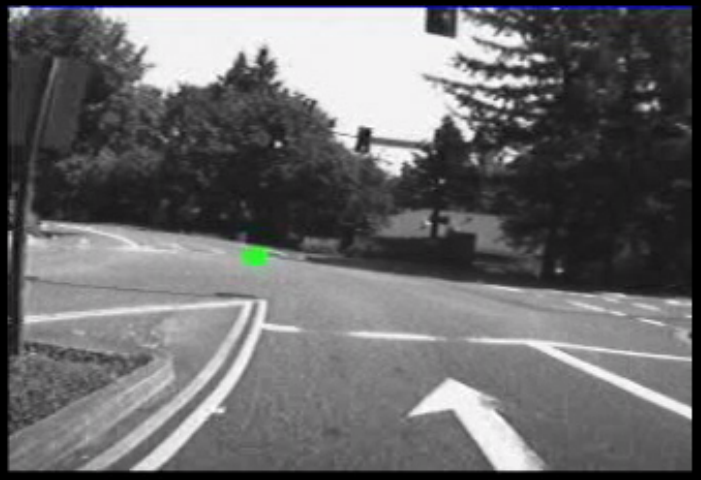
Dynamic Research Inc.

RESULTS



RESULTS

Team Oregon Open Road Ride



Beginner Untrained Rider

Experienced Rider

SUMMARY AND CONCLUSIONS

- No significant difference between beginner untrained and experience riders in terms of sight distance to stopping distance ratio during Session 1
- Significant difference between groups in terms of sight distance to stopping distance ratio (Sessions 2 and 3)
- Sight distance to stopping distance ratio dropped below 1.0 more often for beginner untrained riders
- Sight distance to stopping distance ratio dropped below 1.0 more often during Session 2 than Session 3

- Bottom line: Training improves sight distance to stopping distance ratio – but so does riding experience

SUMMARY AND CONCLUSIONS

- No significant difference between beginner untrained and experience riders in terms of gaze 95% confidence ellipse during Session 1
- Significant difference between groups in terms of gaze 95% confidence ellipse (Sessions 2 and 3)
- Gaze 95% confidence ellipse was significantly larger for beginner untrained riders as compared to experienced riders (Sessions 2 and 3)
- No significant difference between beginner trained riders and any other rider group (Sessions 2 and 3)

- Bottom line: Gaze area may not be a good indicator of visual strategies

SUMMARY AND CONCLUSIONS

- Beginner riders make more glances (total) and more glances to non-riding related targets
- Initial qualitative analysis suggests that beginner riders have no distinct scanning strategy
- As a rider gains more riding experience, their ability to focus upon riding related targets improves
- Collection and analysis of eye tracking information is critical to understanding visual targeting and hazard perception strategies for motorcycle riders

Dynamic Research Inc.

Thank You!