Motorcycle Ergonomics & Rider Human Factors

Dr Alex Stedmon
CPsychol FRSA FIEHF
Reader in Human Factors

Human Systems Integration Group
Faculty of Engineering & Computing
Coventry University
alex.stedmon@coventry.ac.uk

Open Road Simulation Ltd
Nottingham, UK
alex@openroadsim.com
Motorcycling is a risky activity

- Motorcyclists represent 4% of licensed vehicles on UK roads
  - but they account for 21% of all UK road fatalities
  - in the order of 51 times more likely to be killed or seriously injured than car drivers

  (Dept of Transport, 2009)

- Most common motorcycle accidents
  - right of way violations or ‘SMIDSYs’
  - loss of control on bends (usually only the motorcyclist involved)
  - overtaking and filtering

  (Brown, 2002; Clarke et al 2004)

- How can Ergonomics and Human Factors support rider needs?
  - What is Motorcycle Ergonomics?
  - What is Rider Human Factors?
One size does not fit all
Ergonomics and Human Factors

- Motorcycle Design and Rider Behaviour
  - user-centred perspective (the rider)
  - human-machine interaction

- Rider cognition
  - processes become more automatic with experience = more spare capacity

- Attention
  - split between task and environment (hazards, navigation, etc)
  - potential to miss vital information

- Decision-making
  - distraction effects, confirmation bias
  - focusing on the wrong primary issues?
Motorcycling as an interactive system

- adapted from McInally (2003)
Transport as an interactive system
Systems issues

• The performance of one agent in the system can affect others in the same system

• Training, expertise and confidence
  – differences between novice, experienced and advanced trained riders

• Rider fatigue and alertness
  – traffic conditions, filtering, junctions, traffic lights, bends
  – risk taking behaviour (thrills vs danger)

• Situational factors
  – road surface – we’re always looking at it
  – we don’t have sun visors or windscreen wipers!
  – weather – tyre warm-up, tyre contact
  – thermal comfort – physical and cognitive issues
MotorcycleSim

- Coventry and Southampton Universities working together
  - developed from STISIM-Drive driving simulation software
  - full size interactive motorcycle
  - rider interaction using real controls
  - reconfigurable riding scenarios

- Physical & functional fidelity
  - looks like the real system
  - behaves like the real system

- Principles associated with accidents
  - braking on bends!
  - swerving on straight roads!
Left hand bend hazard
Left hand bend hazard
Left hand bend hazard

Advanced riders

Safer profile – notice the hazard earlier, less correction and compensate before the hazard
Left hand bend hazard

Novice and Experienced riders

Dangerous profile – notice the hazard later and over-compensate past the hazard
Speed through bends

The graph shows the average speed in miles per hour (mph) for different experience levels. The x-axis represents different sections or trials, numbered 1 to 7. The y-axis represents the average speed. The graph compares novice (solid black line), experienced (dotted gray line), and IAM (triangle) performance. The error bars indicate variability in the data.
Speed through bends

Classic & most efficient profile ‘slow in – fast out’
(50mph > 48mph > 56mph)

Risk perception and behaviour enhanced through experience and training
Speed through bends

Inefficient profile - slowing too much through the bend (49mph > 45mph > 50mph)

Risk perception over-developed through negative experiences?
Speed through bends

Dangerous profile – speeding up too soon in the bend
(46mph > 48mph > 54mph)
Risk perception not fully developed
• Advanced systems
  – 3D audio
  – speech input

• Integrated rider aids
  – rider information
  – communication systems
  – entertainment systems

• Geo-spatial information for riders
  – couriers, paramedics, police
  – accident detection (e.g. SafeRider)
Solutions Looking Problems?

- Designing solutions that users need and want
  - understanding different road user requirements
  - understanding issues of automation

- Formal user-requirements elicitation
  - iterative and participatory processes
  - diverse methodologies and diverse populations
  - expert and end user interviews and focus groups
  - define current practices, capabilities and issues
  - define future requirements
  - manage expectations
  - deliver solutions that are fit for purpose
Thank you