PSYC305 Applied Cognition & Neuroscience

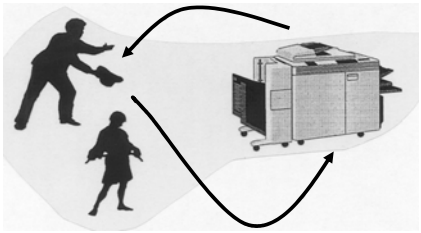
Lecture notes

Road Transport: Learning to Drive

Dr Robert Isler

Knowing the human characteristics and capabilities:

Machines, products, systems and environments can be made more user friendly: Human Factors/Ergonomics



People can be trained to improve the quality of their interactions with machines, products, systems and environments: Human performance

Some factors that influence Human Performance:

Individual Diff. e.g.,
Personality
Cognitive Styles
Physical Diff.

Physiolog.Factors e.g.,
Development
Motivation
Stress
Fatigue
Disabilities
Mental Disord.
Brain Injuries
Mental Disease

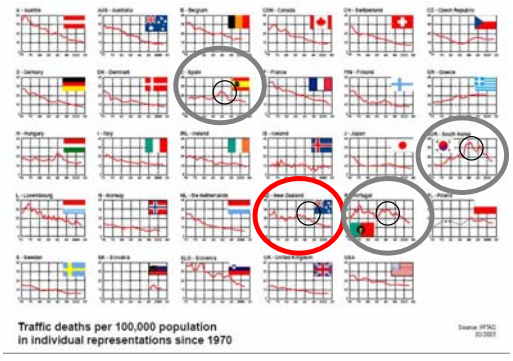
HUMAN PERFORMANCE

TRAINING improves **SKILLS**

Physical (Motor)

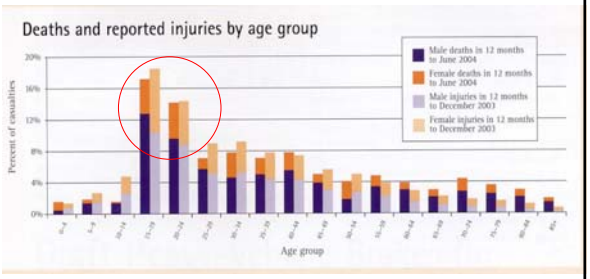
Intellectual (Cognitive) e.g.
- Perceptual
- Information Processing
- Decision making
- Language
- Creativity

Cognitive Neuroscience: The Science of Behaviour and Mental Processes

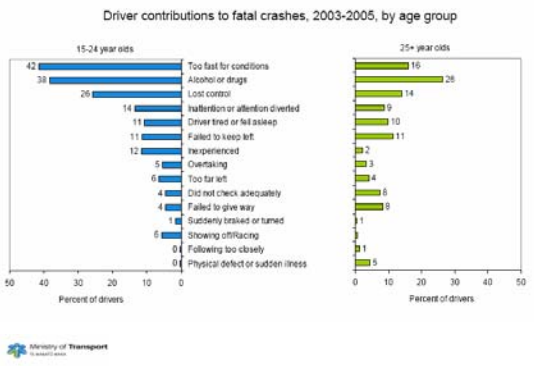


Traffic deaths per 100,000 population in individual representations since 1970

The Young Driver Problem



A world-wide problem



Extent of problem

1. Traffic crashes are the single greatest killer of 25 To 24 years old and the leading cause of permanent injury for that group.
2. In 2006, young drivers aged between 15 and 24 years represented 16 percent of all licenced drivers, but they were involved in 34.8% of the fatal traffic crashes, 38% of the serious injury crashes and 42.8% of the minor injury crashes. Of these crashes young drivers were at fault around 77% of the time.
3. The total social cost of crashes where 15-24 year old were at fault in 2006 was nearly $1 billion.

1985

DeKalb Study (1975)

An evaluated driver education programme "at best had only small, short term benefit and, at worst, it was not associated with reliable or significant decrease in crash involvement."

Pre 2000 evaluations

Conclusion:

Driver education/training is useless and can even increase the number of crashes in young drivers...

The lack of evidence for the benefits of road safety education/training may be ascribed to a lack of methodological soundness in previous evaluations and to the content of the courses.

Crick and McKenna (1991)

Lack of methodological soundness in previous evaluation studies

Most of the pre-2000 evaluations were not published in peer reviewed journals

They often used:

1) no control group
2) the hypothesis testing procedure inappropriately
3) crude outcome measures such as number of collisions/deaths

The young driver problem

Why are young drivers over-represented in crash statistics world-wide?

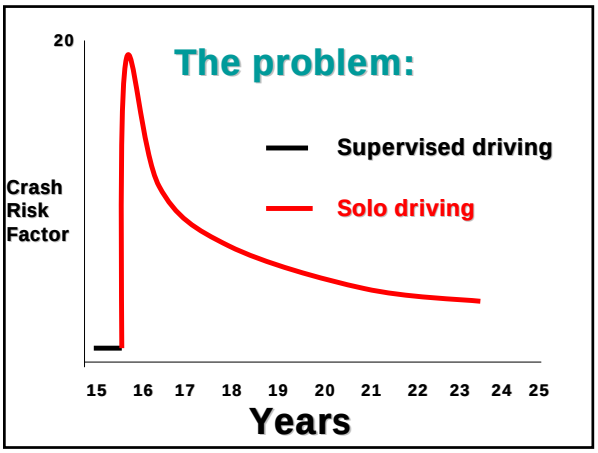
1. **Because they lack maturity: biology & lifestyle factors**
2. **Because they have a high exposure to dangerous traffic conditions**
3. **Because they lack experience: haven't learned enough**

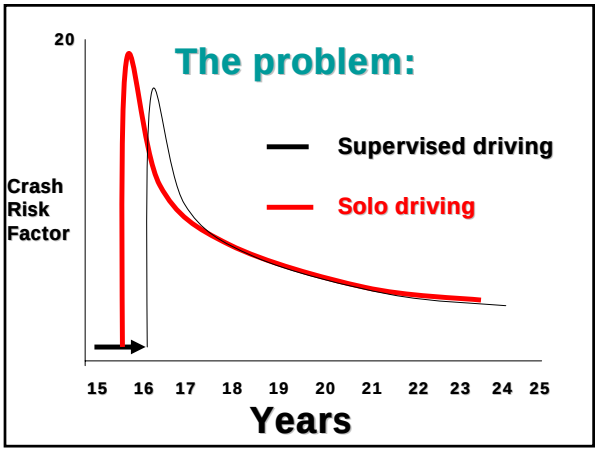
Scare them…

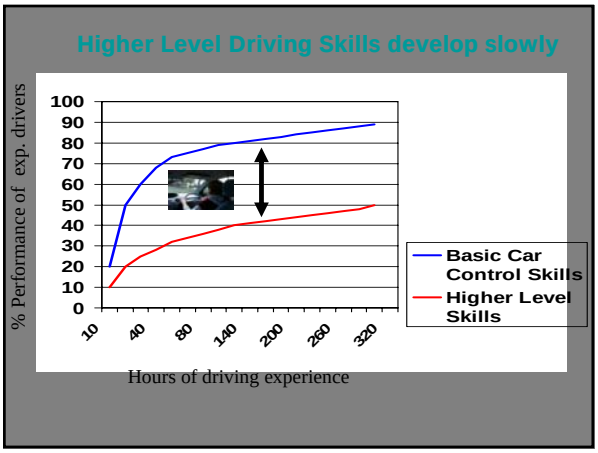
Restrict them further…

Enforce the traffic rules…

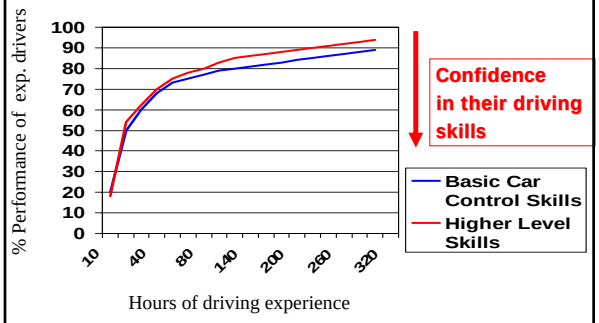
But all these counter-measures do nothing to improve the competence of young drivers on the road..







Put emphasis on teaching higher level skills!



Eye Tracking Research

Eye Scanning

Chapman, P., Underwood, G. and Roberts, K. (2002).

Novice drives (compared to more experienced drivers)

- **concentrate their search in a smaller area, closer to the front of the car**
- **have longer fixation times in hazardous situations**
- **have a smaller spread of search when driving on dual-carriage ways**

More effective Eye Scanning can be taught via video simulations

Hazard Detection

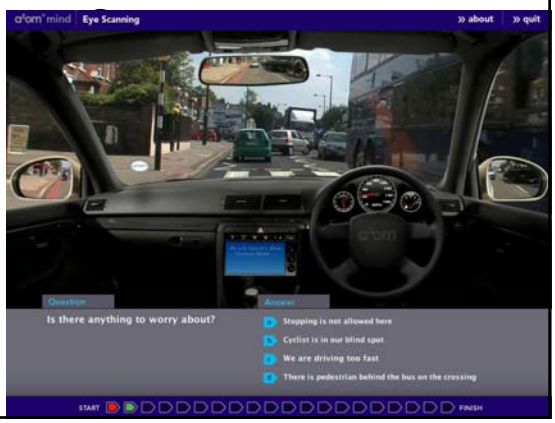
McKenna et al., (2006).
Does Anticipation Training Affect Drivers' Risk Taking?

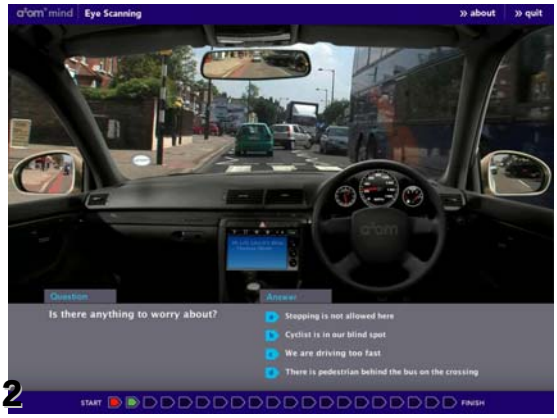
- **Hazard Anticipation skills in novice drivers could be significantly improved by training using video simulation techniques.**
- **They showed that novice drivers could be improved to the level of experienced drivers within 4 hr of training.**
- **Hazard Anticipation training reduced risk taking behaviour (speed choice, following distance and gap acceptance).**

Risk Management

Diagrams are difficult to understand!

Video-based real traffic scenarios on Cd-Drives





2

Eye scanning of a²om mind simulations

Eye scanning of a²om mind simulations

www.a²om.com

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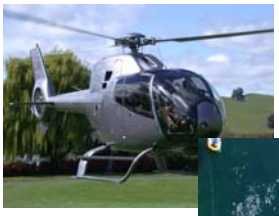
THE 'FRONTAL LOBE' PROJECT 2006

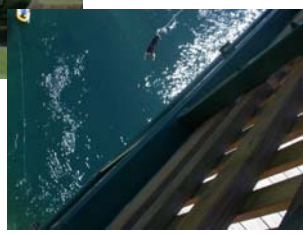
TARS

Driver Education Foundation

ROAD SAFETY TRUST

Support from the Taupo community





Prizes

Dealing with the media:

Katikati Advertiser
Tuesday 19/10/2006
Page: 3
Section: General News
Region: Bay of Plenty Katikati Circulation: 6,941
Type: Publication
Size: 411.84 square...
Published: ...

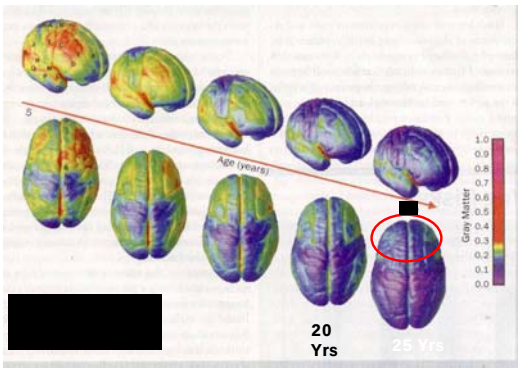
Driver training aims to curb risk-taking among under 25s

G ...

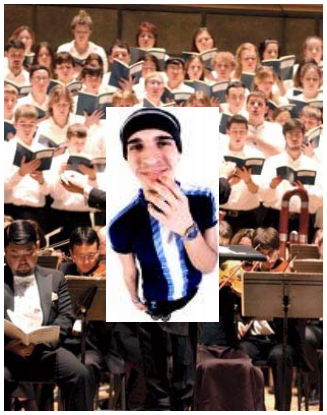
Farewell

Aims of the study

- 1. To determine if the level of frontal lobe brain functioning in young drivers is related to their driving performance.



Source: Dynamic mapping of human cortical development during childhood through early adulthood, by Nitin Gogtay et al., In PNAS, Vol 101, No.21; May 25, 2004.



The teenage brain: A work in progress

From the Time Magazine

Frontal Lobes:
Executive Functions
- **Working Memory**
- **Inhibition**
- **Planning ahead**
- **Impulse (self) control**
- **Risk Management**
- **Reasoning**
- **Self Monitoring**
- **Verbal self-regulation**
- **Emotion regulation**
- **Motivation**
- **Hazard Perception**
- **Eye Movements**

Working memory

- Memory for information kept for immediate processing e.g. remembering a phone number before you dial
- Cognitive load – new tasks use lots of working memory resources until they become automated
- Teenagers have higher cognitive load when driving compared to experienced drivers


Mystery of that fatal u-turn

Not only did teenage driver Graeme Bignell allow passengers on his restricted licence, but he had also smoked a cannabis joint a few hours before the crash.

Aims of the study

- 1. To determine if the level of frontal lobe functioning in young drivers is related to their driving performance.

1. PRE - ASSESSMENT

Extensive Psychometric testing included:
Frontal lobe executive function (D-KEFS), General Ability, Depressive and Anxiety tendencies

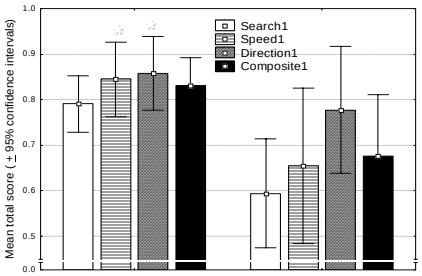
Driving skills assessment

Visual Search - Speed choice - Directional control

Baseline

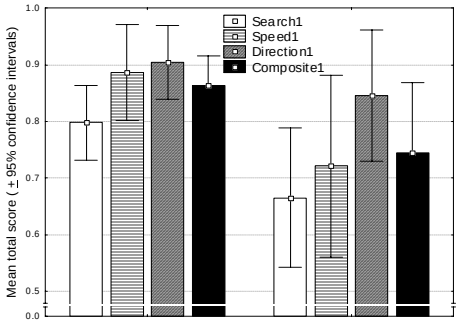
Professional driver assessors

Effect of working memory on driving performance



High working memory **Low working memory**

Effect of Anxiety on Driving Performance

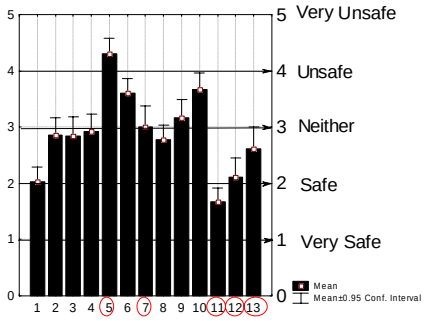


High Anxiety **Low Anxiety**

1. PRE - ASSESSMENT

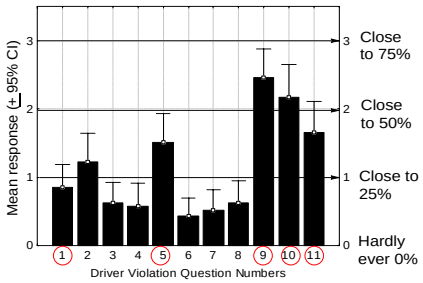
Questionnaires included
Confidence in driving skills, driver behaviour/attitude, personality, self reported risk taking behaviour

How safe would you feel driving:



5. after drinking 7. towing a trailer? 10. when being tailgated 11. at 100 km/hr 12. at 110km/hr 13. at 120km/hr

How often will you?



1. Drive close to car in front to get driver to move faster
5. Disregard speed limits early in the morning or late at night
9. Exceed the 100 km/h 10. Drive fast 11. Exceed 50km/h speed limit

Aims of the study

- 2. To determine the effects of 'higher level' and 'vehicle control' skills training on displayed and self reported driving behaviour, self rated confidence level and driving skills.

2. Training

Red: **Higher level skills**
Blue: **Vehicle control skills (traditional)**
Yellow: **Control**

Red Group: Higher Level Driving Skills Training (low risk)

Road commentary

Self assessment

Group work

Video based hazard perception training

Civic reception

Prizes

Blue Group: Car Control Skills Training (high risk)

Steering

Manoeuvering

Braking

Parking

Yellow Group: Control – off sightseeing (very low risk)

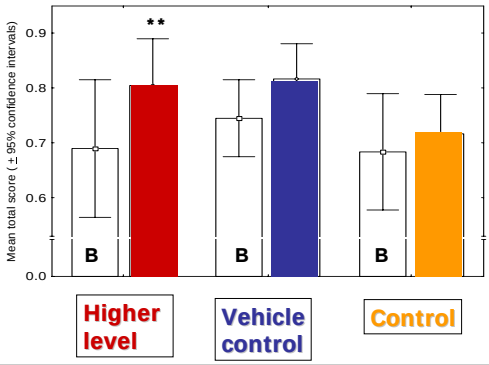
Driving skills assessment

Visual Search - Speed choice - Directional control

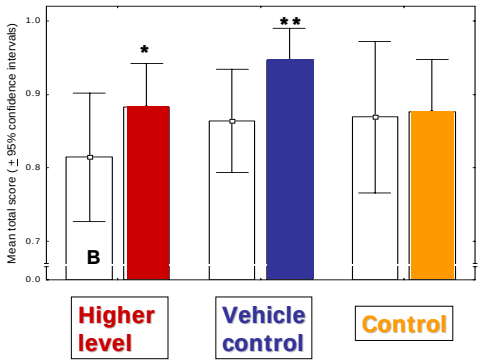
post-training

Professional driver assessors

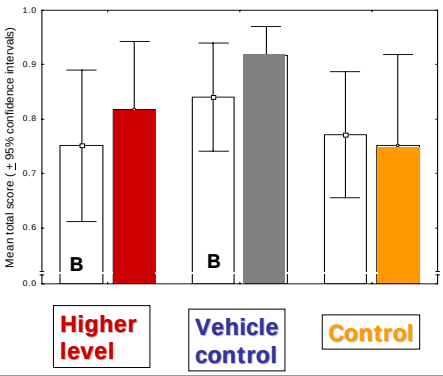
Effect of training on 'visual searching'



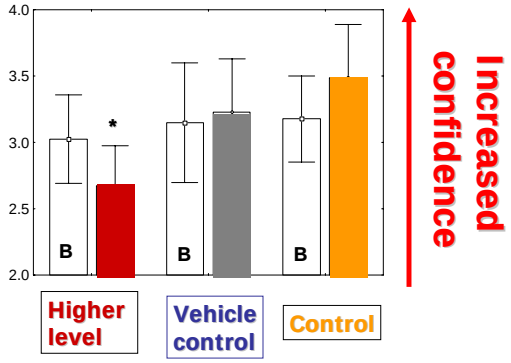
Effect of training on 'directional control'



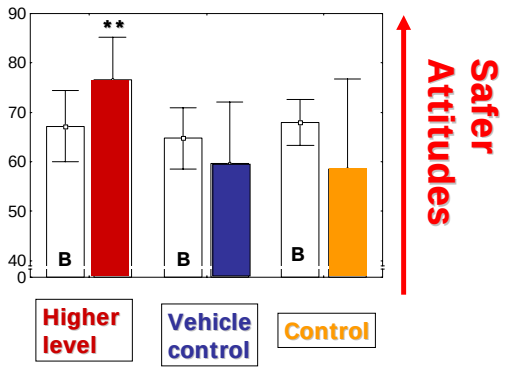
Effect of training on 'speed choice'



Confidence when driving in different circumstances



Attitudes to risky driving



3. Post-training driving evaluation

Fortnightly diaries:
36 frontal lobe participants versus 36 controls

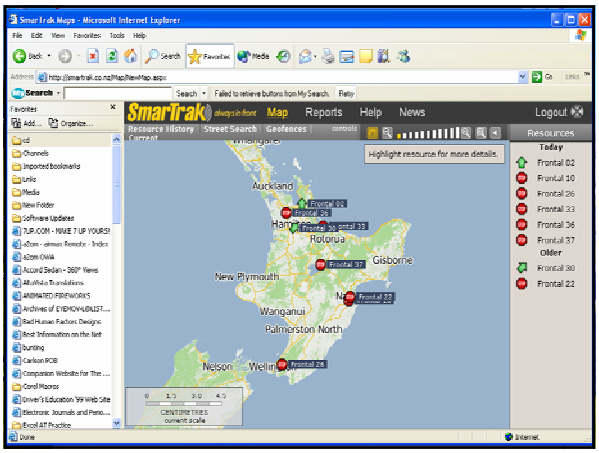
- **Number of near hits, failures and successes, errors, lapses, traffic fines, and possibly crashes**
- **Frequency of speeding, unsafe following distance, cell phone while driving, text messaging etc.**

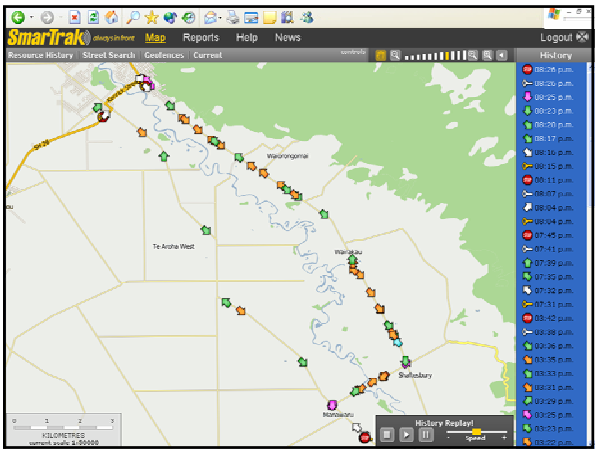
Most often reported: Speeding and use of cell phones

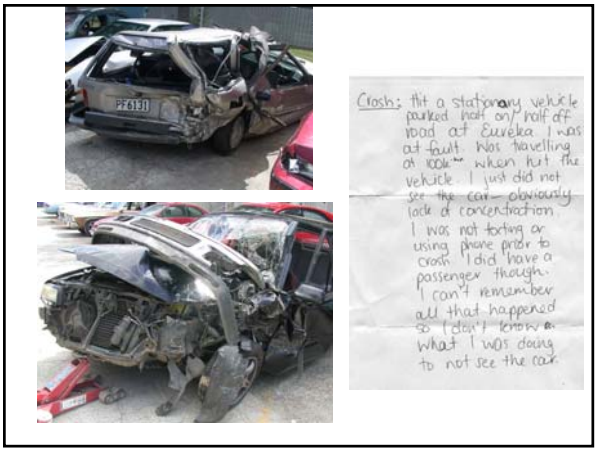
3. Post-training driving evaluation

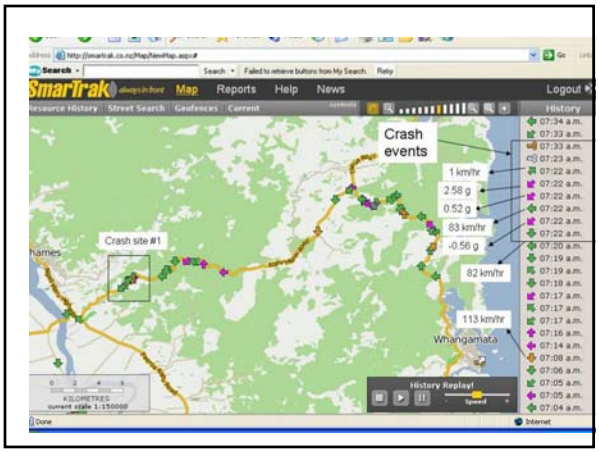
Piloting a GPS based telemetric data tracking system to evaluate post training real driving behaviour of young drivers

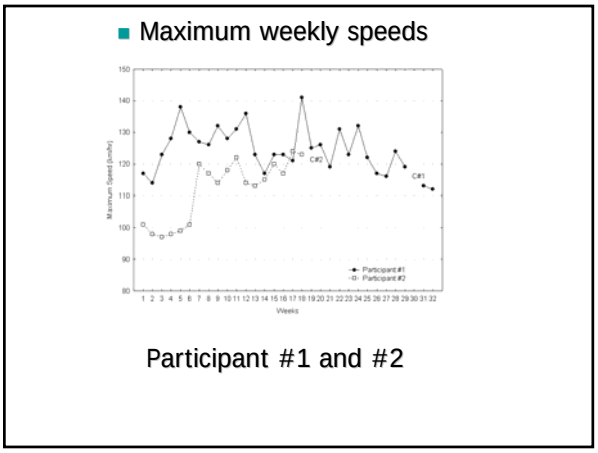
- **Speeding**
- **Average speed**
- **G force**
- **Distance travelled**


SmarTrak
Map
Reports
Help
News
Logout
Auckland
Rotorua
Gisborne
New Plymouth
Wanganui
Palmerston North
Nelson


SmarTrak
Map
Reports
Help
News
Logout
History
History Replay!


Crash: Hit a stationary vehicle parked inat on/ half off road at Eureka. I was at fault. Was travelling at 100km when hit the vehicle. I just did not see the car – obviously lack of concentration. I was not texting or using phone prior to crash. I did have a passenger though. I can't remember all that happened so I don't know what I was doing to not see the car.


SmarTrak
Map
Reports
Help
News
Logout
Crash events
1 km/hr
2.58 g
0.52 g
83 km/hr
-0.56 g
Crash site #1
82 km/hr
113 km/hr
Whangamata
History Replay!

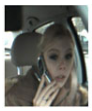

Maximum weekly speeds
Participant #1 and #2

What next:

Frontal lobe project - second serving

60 participants 60 controls - 120 data trackers to evaluate post training effects

Install video based black boxes



(Currently used by DriveCam (www.drivecam.com

Human History becomes more and more a race between education and catastrophe

HG Wells, 1920

Thank you!