Comparison of in-depth accident analysis data from three European countries using the Driving Reliability and Error Analysis Method

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Topics

- Introduction
  - DREAM method
  - Case study: Single motorcycle crashes outside urban area, no intersection
    - British, French and Finnish data

- Results

- Conclusions
  - Advantages and limitations of DREAM
  - Could DREAM be used routinely in the Nordic countries?
Methodology - DREAM

- An accident model

- Genotypes
  - Blunt end failure
  - Latent failure conditions

- Phenotypes
  - Sharp end failure
  - Phenotypes
RISK ACCUMULATION MODEL
IN INVESTIGATION TEAM INVESTIGATIONS

Background road factors
- Road user
  - motives
  - state, skill
  - risk-taking
  - health
  - etc
- Vehicle
  - features
  - faults
  - load
  - aggressiveness
  - etc
- Road and environment
  - condition of the road
  - features
  - guidance
  - etc
- System
  - laws
  - enforcement
  - road norms
  - training
  - etc

Safety suggestions

Immediate risks in the situation
- Road user's mistakes
- Faults in the vehicle
- Road failure

Recommendations for improvement

Key event

Countermeasures

Risks of injury
- Crash impact
Methodology - DREAM

- A classification scheme
  - Phenotypes: the observable effects
  - Genotypes: the factors that may have contributed to phenotypes

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Vehicle</th>
<th>Traffic environment</th>
<th>Organisation</th>
<th>A: Phenotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C: Interpretation</td>
<td>H: permanent HMI problems</td>
<td>K: Obstruction of view due to</td>
<td>O: Maintenance</td>
<td>Speed</td>
</tr>
<tr>
<td>D: Planning</td>
<td>I: Vehicle equipment failure</td>
<td>L: State of road</td>
<td>P: Vehicle design</td>
<td>Distance</td>
</tr>
<tr>
<td>E: Temporary personal factors</td>
<td>F: Permanent personal factors</td>
<td>M: Communication</td>
<td>Q: Road design</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Linking rules

## PHENOTYPES (A)

<table>
<thead>
<tr>
<th>ANTECEDENTS (CAUSES)</th>
<th>CONSEQUENTS (EFFECTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL Genotypes</strong></td>
<td><strong>Definition of GENERAL Phenotypes</strong></td>
</tr>
<tr>
<td>Misjudgement of time gaps (C1)</td>
<td>Timing (A1) The timing for initiating an action.</td>
</tr>
<tr>
<td>Misjudgement of situation (C2)</td>
<td></td>
</tr>
<tr>
<td>Fear (E1)</td>
<td></td>
</tr>
<tr>
<td>Fatigue (E3)</td>
<td></td>
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<tr>
<td>Under the influence of substances (E4)</td>
<td></td>
</tr>
<tr>
<td>Sudden functional impairment (E6)</td>
<td></td>
</tr>
<tr>
<td>Temporary access limitation (G4)</td>
<td></td>
</tr>
<tr>
<td>Equipment failure (I1)</td>
<td></td>
</tr>
<tr>
<td>Strong side wind (J2)</td>
<td></td>
</tr>
</tbody>
</table>
Methodology - DREAM

A DREAM chart for each rider involved in a crash

Phenotype:
Insufficient force (A5.2) - the rider failed to counter-steer strongly enough

Genotype:
Misjudgement of situation (C2)

Genotype:
Overestimation of skills (F5)

Genotype:
Inadequate transmission from road environment (M2)

Genotype:
Inadequate information design (Q1)

Genotype:
Inadequate training (N4)

Genotype:
Inadequate road design (Q2)

Genotype:
Permanenet obstruction to view (K2) - trees

Genotype:
Inadequate road geometry (L5) - a hill obstructed view to the curve

Genotype:
Insufficient skills/knowledge (F6)

Genotype:
Late observation (B2)

Genotype:
Misjudgement of situation (C2)
Sometimes all you can say is

Genotype:
Sudden functional impairment (E6)

Phenotype:
No action (A 1.3)
2BESAFE project

STATE OF THE ART

MACRO ANALYSIS LEVEL

National databases issues
UK, Greece, Finland, Italy, France

Scenario 1  Scenario 2  Scenario 3  Scenario …

MICRO ANALYSIS LEVEL

In-depth databases
UK, Finland, France

Scenario 1  Scenario 2  Scenario 3  Scenario …

M 1  M 2  M 3  M 4

M 1, 2, 3, 4 = Model 1, 2, 3, 4
UK data collection sites: 25 crashes

VSRC in Nottinghamshire

TRL in Thames Valley Region
French data: MAIDS & RIDER projects, 10 crashes
Finnish data collection: 16 crashes
Commonalities in the three countries

- Riding fast rather than safely, excitement seeking
- Overestimation of own skills
Country-specific factors

- Finland
  - High engine power
  - Riders compete / show off to one another
    - Riding in groups as a risk factor!
    - Inadequate information design

- France
  - Poor condition of the roads

- UK
  - Late observations by the riders
Differences in practice: Finnish DREAM chart

Genotype:
- Inadequate road design (Q2) - road lights should have been brighter - this link not included in DREAM manual

Genotype:
- Reduced visibility (J1) - darkness + road lights not bright enough + road lights situated on the opposite side

Genotype:
- Late observation (B2) - the rider perceived extremely late that the car was turning into his trajectory

Genotype:
- Excitement seeking (E5)
- Prioritization error (D1)

Genotype:
- Misjudgement of situation (C2) - riding drunk, without lights, without a helmet and other riding gear on a moped

Genotype:
- Under the influence of substances (E4) - Alcohol (E4.1) - BAC estimated at time of accident at 0.5

Genotype:
- Expectation of certain behaviors (F2) - the rider did not expect the driver to turn into his trajectory when he

Genotype:
- Overestimation of skills (F5) - the rider had a motorcycle riding licence which may have made him think he

Genotype:
- Equipment failure (11) - lights not working, moped tampered with to produce more power

Phenotype:
- Accident number 3
  - Driver or rider? Rider
  - No action (A1.3) - the rider apparently rode directly in front of the car

Do not forget the links between phenotype and genotypes and between genotypes and genotypes
Differences in practice: French DREAM chart

- Accident Number: Driver or Rider?

For more information, please refer to the Nordic Traffic Safety Academy meeting 2015.
Differences between countries

- Different ways of using the method
- Different input data (differences between the in-depth investigation methods)
- Question arises: which differences are real, which ones arise through different ways of using the method?
How to use the method?

- Personal opinion: using only DREAM genotype codes leaves essential information out
  - Good to complement the charts with more descriptive information
Conclusions: advantages of DREAM

- Well-suited for identifying sharp-end factors
- DREAM is a visual method
  - Easy to see things at a glance
- Good tool for turning incommensurable information commensurable
  - Between countries
  - Within countries
Conclusions: limitations of DREAM

- Blunt-end factors & injury risk factors receive less attention
- Aggregating results tedious & error-prone
  - Automatize DREAM!
- DREAM is a visual method
  - Add matrix representation: easier storage
- Factors not adapted to riders
- Differences in using the method
  - Amenable by better training of users
In-depth investigations in the Nordic countries

- Every fatal road accident investigated in:
  - Finland, Sweden, Iceland
  - Denmark, Norway?

- Similar methods, similar data:
  - Driver, vehicle, infrastructure
  - Similar objective: Uncover causal factors, prevent similar accidents
Discussion

- Is a harmonization of the Nordic methodologies for in-depth studies beneficial?
- If yes should an appendix based on DREAM be included in the in-depth databases?
- How does an optimal reporting system look like?
- Should also severe injury accidents be investigated in-depth?
Thank you for your attention

www.ltu.se/forskning publications
www.2besafe.eu
- Routine since 1997 and is regulated in the government’s instruction to the Transport administration
- Detailed investigation into each fatal road accident with the main objective to identify what caused the fatal injuries concerning...
What data is collected?

- Road data based on: Site inspection, Transport administration systems, Police, Rescue services etc.

- Vehicle data based on: Vehicle inspection, Police, car and vehicle register, manufactures description etc.

- Road user based on: Police report, autopsy report, driving license register etc.
## Methodology – Accident data for 9 scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>PTW accident configuration</th>
<th>Number of in-depth accidents analysed per country</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Finland</td>
<td>France</td>
</tr>
<tr>
<td>1</td>
<td>Moped / Passenger car accident – Inside urban area – No intersection</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Moped / Passenger car accident – Inside urban area – Intersection</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>Single motorcycle accident – Outside urban area – No intersection</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Single motorcycle accident – Inside urban area – No intersection</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>Single motorcycle accident – Inside urban area – Intersection</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>Motorcycle / Passenger car accident – Outside urban area – No intersection</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Motorcycle / Passenger car accident – Inside urban area – No intersection</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>Motorcycle / Passenger car accident – Inside urban area – Intersection</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>9</td>
<td>Motorcycle / Passenger car accident – Outside urban area – Intersection</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>33</td>
<td>201</td>
</tr>
</tbody>
</table>

- A lack of in-depth accident data for several scenarios
Driving Reliability and Error Analysis Method

- To classify and store information about factors contributing to accidents
  

- DREAM is an adaptation of CREAM (Cognitive Reliability and Error Analysis Method)
  
Results from Phan et al (2010)

- Moped / passenger car, inside urban area, no intersection
  - Inattention
  - Late observation
  - Reduced visibility

- Moped / passenger car, inside urban area, at intersection
  - PTW with a right of way status: expect a certain behaviour from the passenger car driver
  - PTW without a right of way status: late observation, inattention, priority error, reduced visibility

- Lack of riding experience for the moped users
Introduction

4 accident analysis models

- Description of the DriverVehicleEnvironment system
- Description of the evolution of the DVE system
- Determination of the Human Functional Failure (HFF)
- Driving Reliability and Error Analysis Method DREAM
France

Ministry of Transport

- BEA
- BEAmer
- BEAD
- INRETS (1985)
- STRMTG (1979)

Ministry of Research

CEESAR (1996)
United Kingdom

No routine in-depth investigation of road accidents

Separately funded projects

VSRC (1982)

BASC

TRL
### Pros and cons of the different systems

<table>
<thead>
<tr>
<th>Country</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| Finland | • Comprehensive  
         • Breadth of information  
         • Cost-effective | • Routine  
                       • Shallowness of information |
| France  | • Depth of information (?): MA of INRETS focuses on specific accident types | • Non-comprehensive  
                                 • Expensive (BEA-TT)  
                                 • Complicated administration  
                                 • Focused on the Paris area |
| UK      | • Depth of information  
         • VSRC: well-planned projects producing specific information  
         • BASC advanced knowledge of biomechanics | • Non-comprehensive  
                                 • Narrowsness of information |