Risk Homeostasis Theory in Traffic Safety

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October 31, 2008

Outline

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- Measures of Traffic Safety
- Arguments against the theory
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Definitions

- To take a risk – to expose oneself to potential loss
- Target risk – the level of risk a person chooses to accept in order to maximize the expected benefit from an activity
- Homeostasis – a regulating process that keeps the outcome close to the target by compensating for disturbing external influences

Risk Homeostasis Theory

- People accept a certain level of subjectively estimated risk to their safety in exchange for the benefits they hope to receive from their activity

Experienced risk – acceptable risk = 0

Risk Homeostasis Theory

Behavioral adaptation

- Increase in lane width associated with higher driving speeds
  - *For every 30 cm of additional lane width speed increased by 3.2 km/h (New South Wales, Australia)*
  - *For every 30 cm of reduction in lane width speed decreased by ~1.7 km/h (Ontario)*

Risk Homeostasis Theory

Behavioral adaptation

- Roads with paved shoulders are associated with speeds at least 10% higher as compared to unpaved (Texas)
- Drivers move at higher speed at night on roads with clearly painted edge markings

Risk Homeostasis Theory

Each adjustment action carries an objective probability of risk of accident

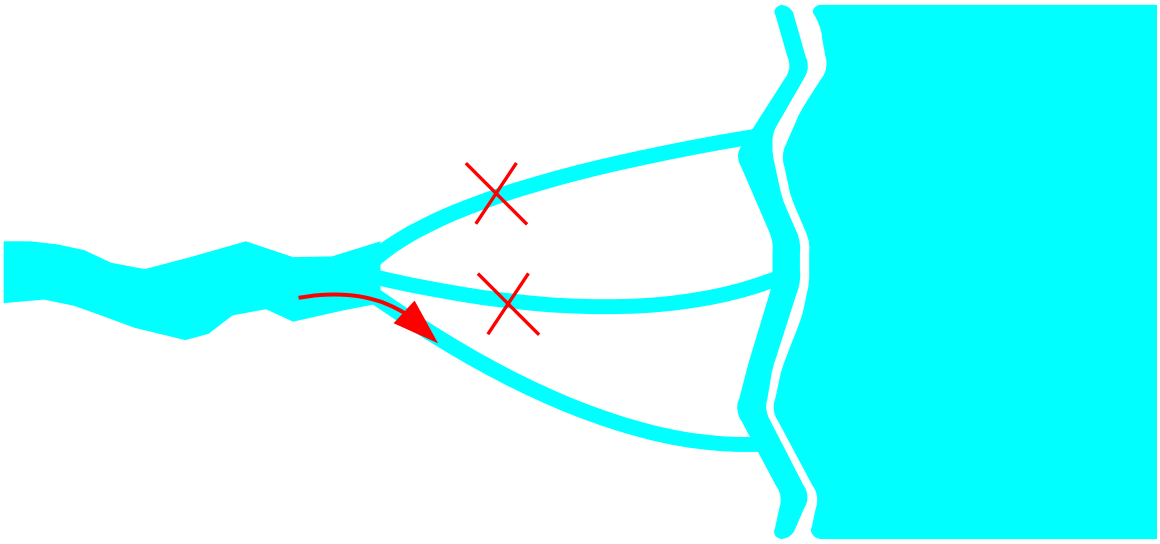
$$\frac{\Sigma \text{ adjustment actions} \times \text{number of population}}{\text{period of time}}$$

…determines rate of accidents in the population

Risk Homeostasis Theory

- Rates and personal experience of danger influence the acceptable level of risk.
- In the long run, human-made mishap rate depends on the amount of risk people are willing to accept
- A “closed loop” is formed.

Risk Homeostasis Theory



Risk Homeostasis Theory

Many safety campaigns and policies simply move accidents around rather than reducing them.

Reason – promotions fail to motivate people to reduce the level of risk they are willing to accept.

Risk Homeostasis Theory

People become accustomed to some acceptable level of risk.

level of risk after safety improvements ↓

↑ other risks

Risk Homeostasis Theory

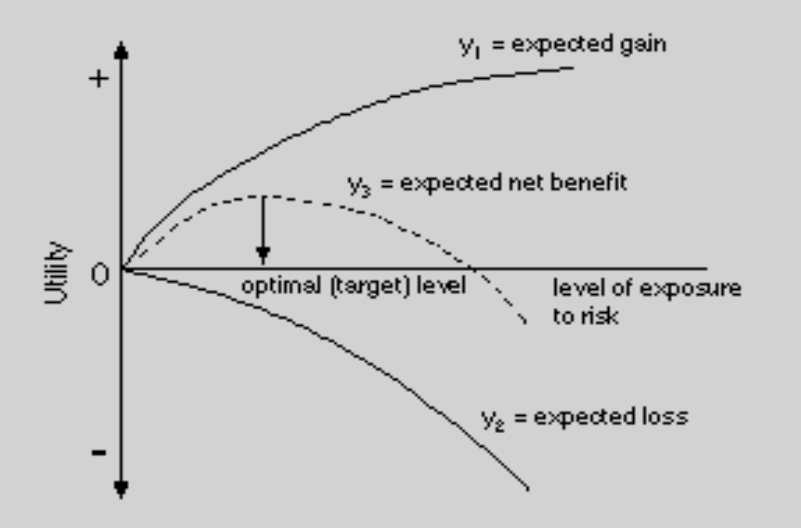
Examples:

- German study: installing anti-lock brakes failed to lower the accident rate in a fleet of taxis. Drivers drove faster and more recklessly due to a perceived lower accident risk.

- American study: air-bag equipped cars tend to be driven more aggressively. That offsets the effect of the air bag and increases the risk of others.

Risk Homeostasis Theory

- Risk-taking behavior



Measures of Traffic Safety

Gerald J.S. Wilde:

Safety improvement per distance has following effect:

- increase in speed,
- increase in distance traveled per passenger,
- no effect upon the annual traffic accident rate per capita.

Accident rate per capita depends upon the level of risk people are willing to accept in return for the benefits

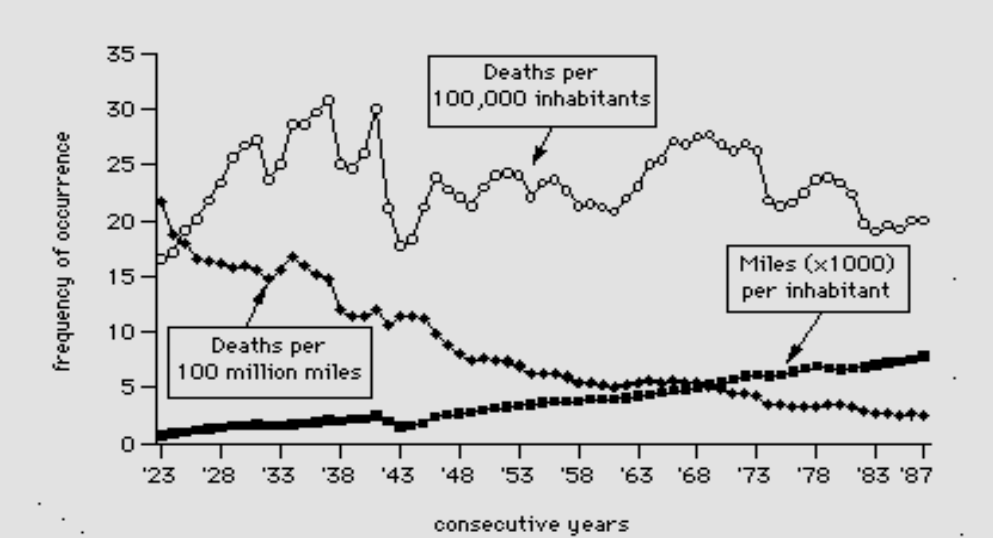
Measures of Traffic Safety

Relationships between three variables:

- The accident rate per mile driven (acc/mi),
- The vehicle miles per capita (mi/cap),
- The accidents rate per capita (acc/cap).

(acc/mi) x (mi/cap) = acc/cap

Measures of Traffic Safety



Traffic death rates in the U.S., 1923 - 1987

Arguments against Risk Homeostasis Theory

- Data supporting the theory use fatality rates rather than accident rates
- Accident rates per mile driven might be reduced after some safety improvements

Arguments against Risk Homeostasis Theory

Example:

Intersection before and after traffic lights are installed

- Observer counts number of accidents per hour
- Observer counts number of cars to get the accident rate per mile driven

accidents / mi ≠ accidents / hr

Arguments against Risk Homeostasis Theory

People do not completely compensate for additional safety, leaving a net gain in safety.

- If net gain in safety exists argument is correct;
- If little change appears risk homeostasis theory is valid;
- If net loss in safety appears the theory is valid, people over estimate the additional safety.

Conclusions

- People “consume” the additional safety forced upon them in other risky behavior.
- Substantial improvements in traffic safety can be achieved by lowering target risk levels.
- Risk Homeostasis Theory raises questions about the utility of engineering measures to reduce risk.

Something to think about…

Are we more likely to take risks if we feel protected?

Do safety belts, anti-lock brakes and safety devices on the road lead to more risky driving?

Thank you

Questions?