

Just Culture in Testing?

Lessons to Learn from the Volkswagen Case

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Introduction

Consequences of Cheating in Tests

Three-Dimensional Risk Assessment

Case Study: Volkswagen

Can „Just Culture“ Reduce Risks?

Conclusion

Automotive Engineer



What my friends think I do



What my mother thinks I do



What society thinks I do



What my boss thinks I do



What I think I do



What I actually do

Introduction

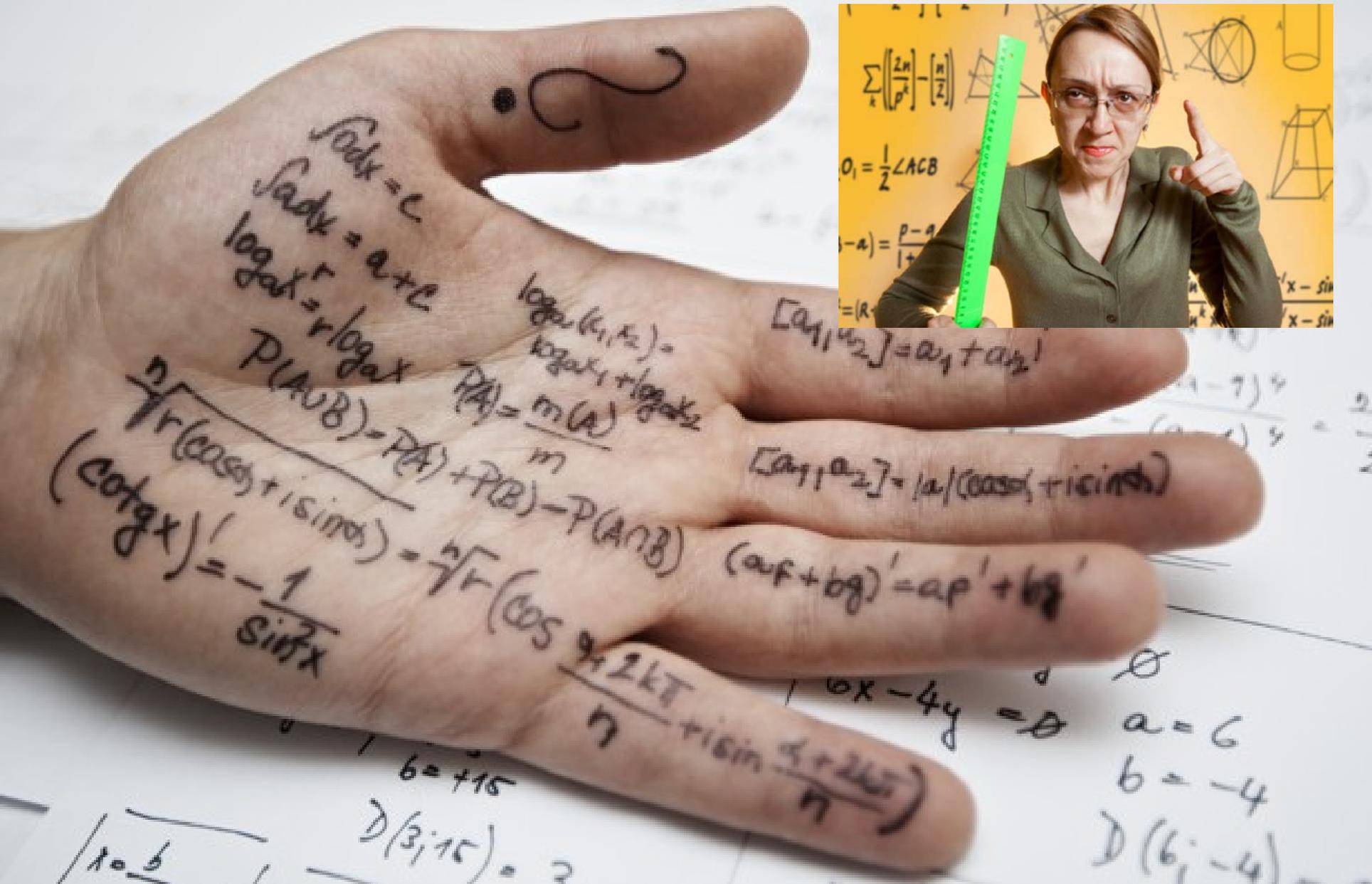
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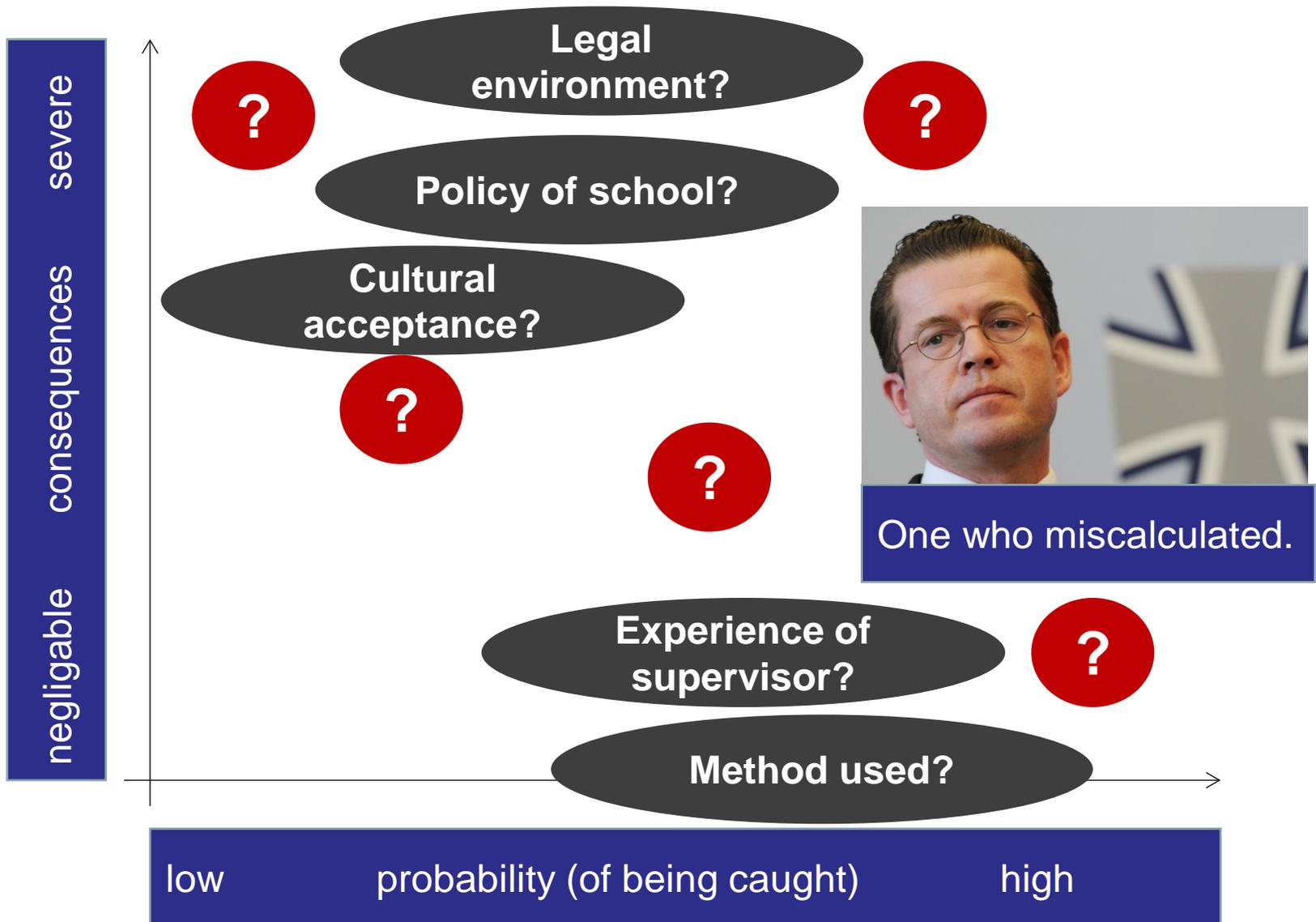
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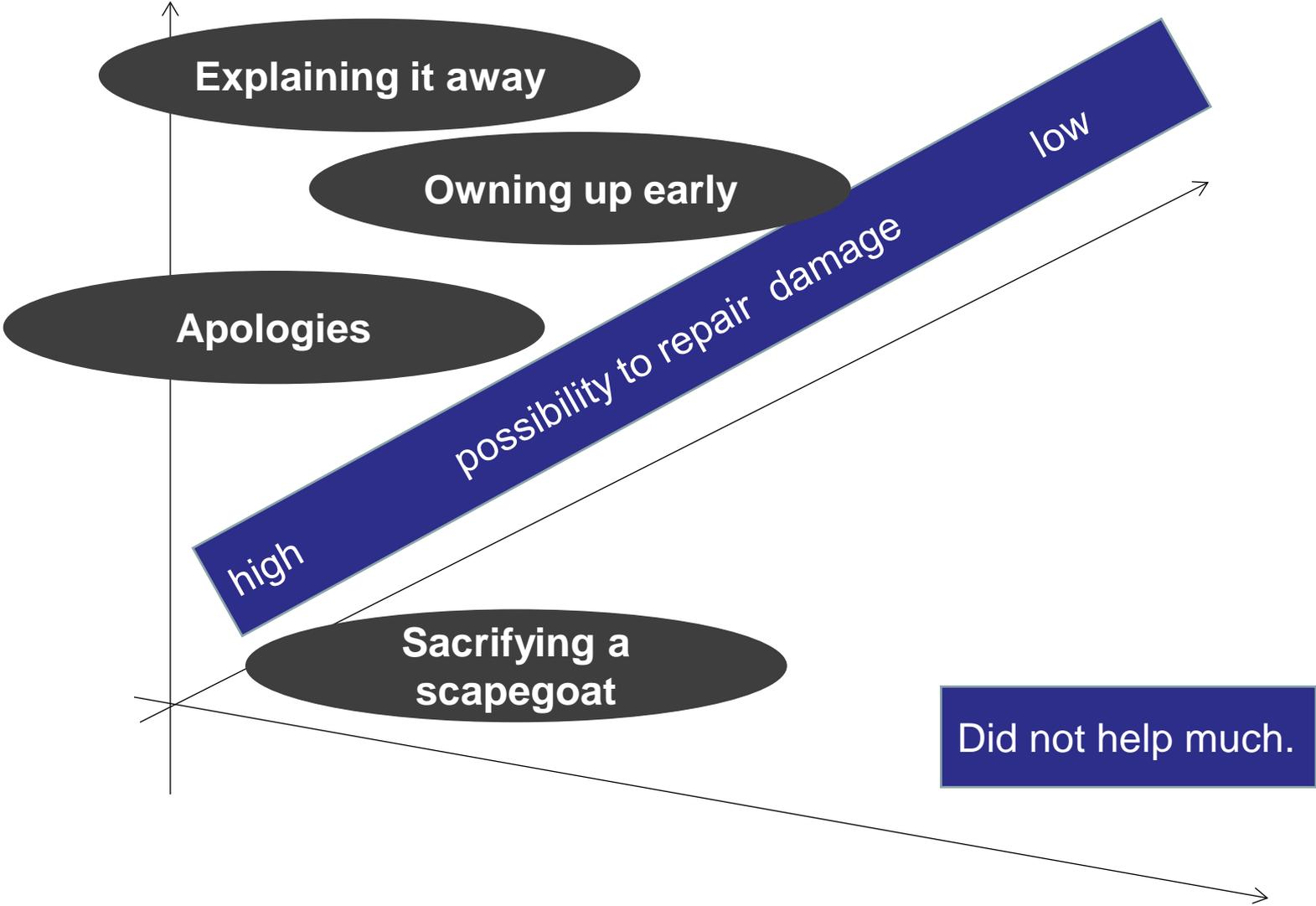
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The Risk of Cheating



A Third Dimension in Risk Assessment



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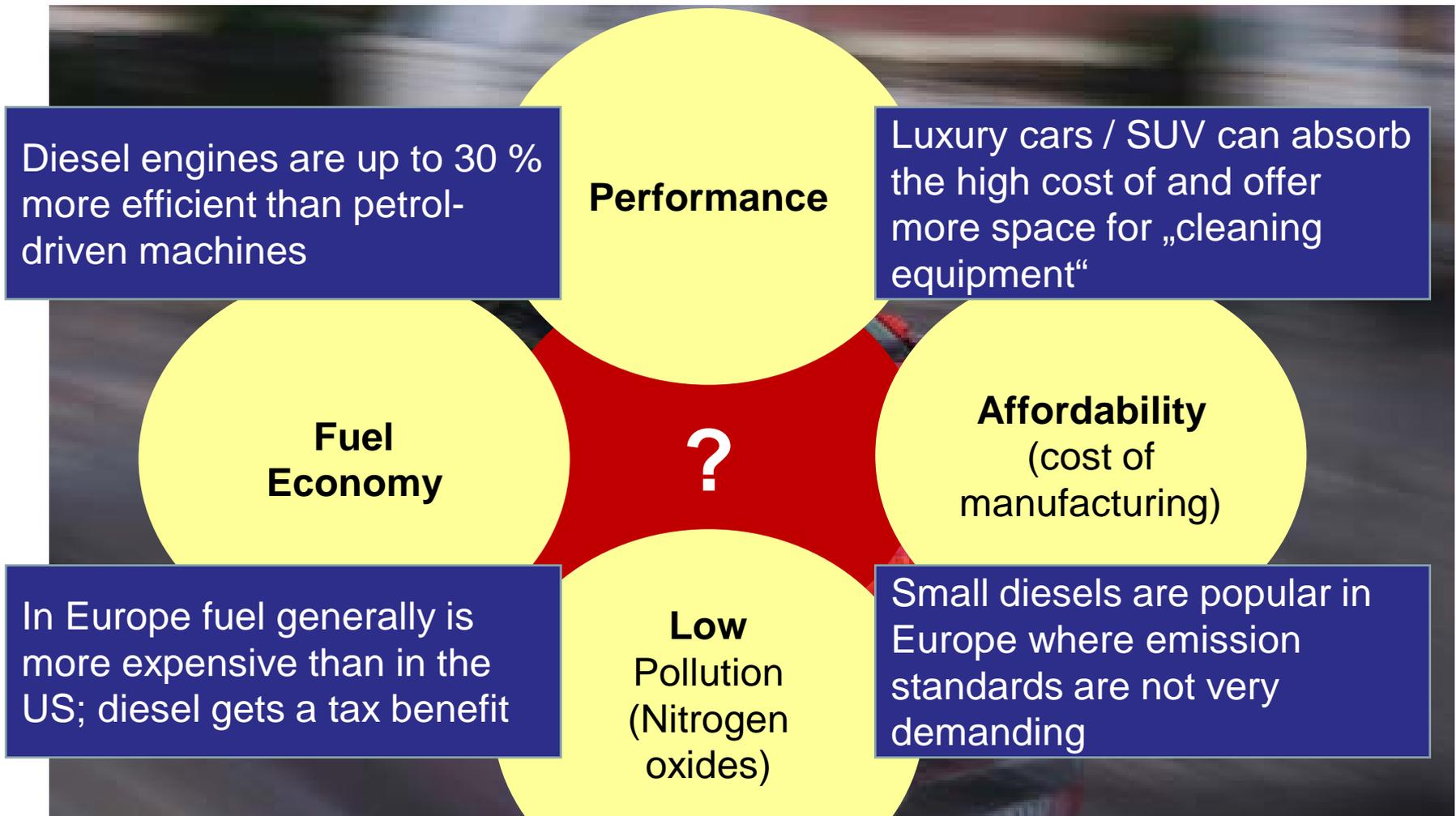
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Once upon a Time in America

- Diesel engines have been an efficient propulsion for trucks, ships and locomotives (low fuel burn, longevity...)
- European manufacturers (e.g. Mercedes-Benz) have successfully sold big-size cars with diesel engines (first popular as taxicabs)
- Many European manufacturers introduced diesel engines for small-cars to meet fleet-consumption rules in the US
- The US authorities set ultra-strict emission rules for cars which according to experts are nearly impossible to fulfill with small-size diesel engines
- Volkswagen sells a line of compact cars with an affordable diesel engine (a 2 litre modell called EA 189) fulfilling all the specifications
- In September 2015 authorities discover that the engines include a „defeat device“ – a software which recognizes test situations and adapt the burn behaviour accordingly

The Challenge



Volkswagen tries a small-diesel approach, while Honda sticks to petrol and Toyota prefers hybrid-electric technology

Enter EPA (Environmental Protection Agency)

Target 2025: corporate average fuel economy 4.3 l per 100 km (half the 2010 value!)

2014: EPA also regulates greenhouse gas emissions



Low fuel consumption reduces carbon dioxide by diesel engines

Diesel engines produce soot, smoke and dust particles which have to be filtered out



Diesel engines produce more nitric and nitrogen oxide, US EPA sets a maximum of 0,07 mg/mile (European standard 0,13 mg/mile)



Two Solutions

**Small and
cheap**

„Gas trap“ catalytic converter
reduces NOx but increases fuel
burn (CO2) and soot emissions



**Bulky and
expensive**

Selective catalytic reduction =
injection of urea and water (has to
be refilled every 10000km)



Volkswagen licenced the Mercedes
Blue-Tech SCR system but later
ended the agreement



A „Criminal Mindset“?

Volkswagen is ambitious to become no. 1 carmaker worldwide

Success in US market is crucial for global market share and profits

Non-compliance to EPA rules for the mass market product range

Extreme pressure on development engineers from top level managers

Manipulation of software to improve test results

Motivation

Justification

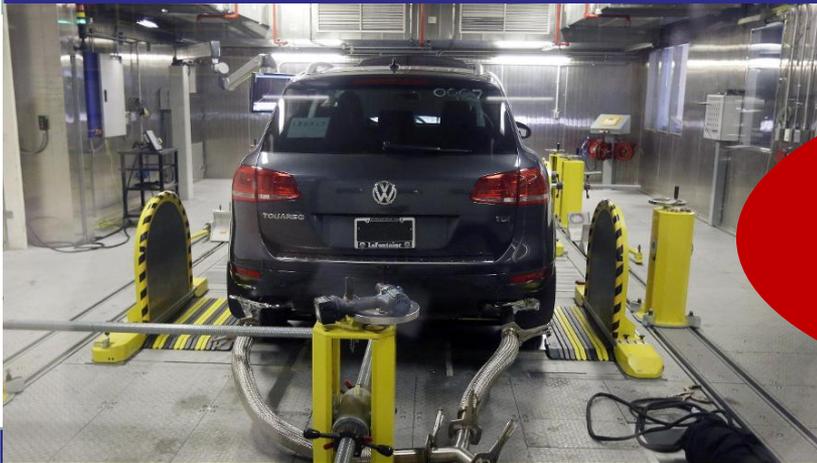
Opportunity



How to Cheat („Defeat Device“-Software)

Small and cheap

„Gas trap“ catalytic converter reduces NOx but increases fuel burn (CO2) and soot emissions

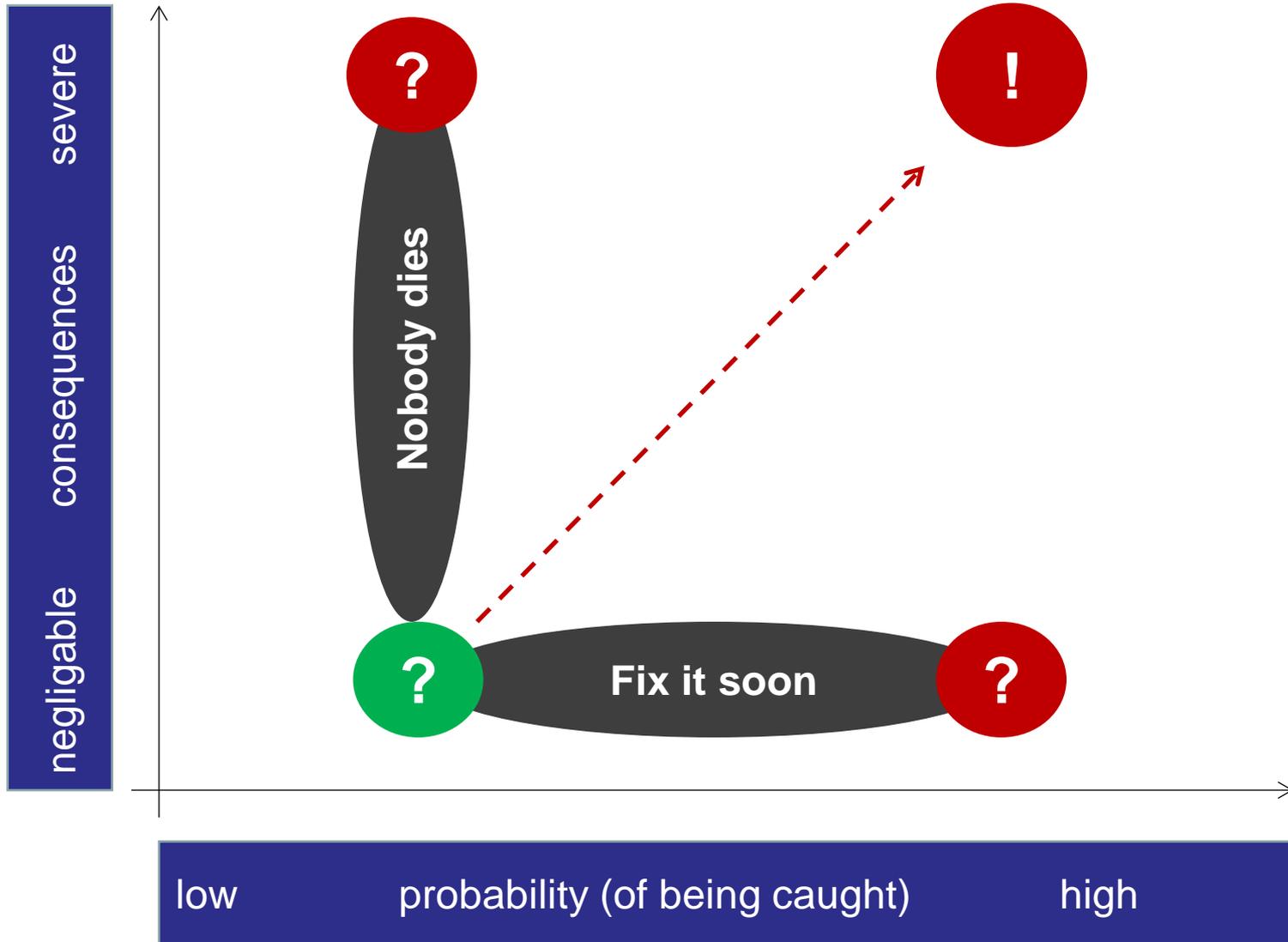


During road operation only a small amount of fuel is sent into the exhaust gas trap, so fuel efficiency is not affected.

Only when engine behaviour signals „test operation“ more fuel goes into the trap, so less NOx comes out at the rear end

Emissions in a standardized test situation are much lower than on the real world road. Up to 11 million cars of the Volkswagen group are equipped with the diesel engine in question.

...and Miscalculate



VW Shares Take a Dive



167,90 €

Shareholders lose
13,8 billion €
(market capitalisation)



Criminal
Offence (tax
issues)?

95,20 €

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Safety Thinking in Aviation

Safety is seen as dependent mainly on:



**Technical
Factors**

**Human
Factors**

**Org
Fac**

**Top management
priority?**

**Systematic
prevention of
of errors?**

**Awareness
of hazards?**

**Availiability
of resources?**

Just culture?

1950 – 1960 – 1970 – 1980 – 1990 –

Investigation of failures – a new paradigm



Traditional Approach

What ?

Who ?

When ?

Whom to blame?

Contemporary Approach

Why ?

How ?

How to prevent repetition?

„Just culture“ versus „blame culture“



“**Culture**” = an integrated system of learned behavior patterns which are characteristic of the members of a society and which are not a result of biological inheritance (*E. A. Hoebel*)

„**Just Culture**“ = A culture in which frontline operators or others are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated (*ICAO 2008*)

Implementing Just Culture

9 easy steps towards just culture...

- Just Culture policy documented
- ⊙ Definitions agreed about what is “acceptable” behaviour, and what is “not acceptable” (specific to, and aligned with, values derived from national, organizational and professional cultures)
- ⊙ Sanctions agreed for unacceptable behaviour
- ⊙ Process to deal with actions in the “grey area”
 - Just Culture policy communicated throughout the organisation
 - Reporting systems linked to Just Culture policy
 - Fair treatment being applied
 - Breaches of the policy being monitored (e.g., error punished or violations excused)
 - Reports being followed-up; actions taken to address error-producing conditions

...ok, 6 easy steps – and 3 difficult ones

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Open communication takes courage indeed



Things finally got better:

when we started to shoot the messengers,

the bad news ceased to roll in !

A Horror Scenario

Engineers manipulate test results in aircraft design, manufacturing, maintenance...

Accidents

Grounding of fleet



Recommendations for a Test Organisation

Make sure your engineers do not cheat just to please your top management (or your customers)

Keep everyone concerned informed about the fall-out risks of an attempted cheat gone awry (Volkswagen being a nice case study)

Take care to ensure an open communication / no-blame organisational culture based on trust

Be aware of early-warning indicators of non-compliant behaviour (intransparent procedures, failure to duplicate results...)

Exchange experience with other experts from the testing and simulation community (for example at Innotesting...)

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Safety Management in Aviation - and Beyond



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your attention

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