CHALLENGES IN FUTURE CARS
- INCREASED AUTOMATION AND SHARED MOBILITY

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Volvo Cars

FUTURE CARS

CHILD SAFETY

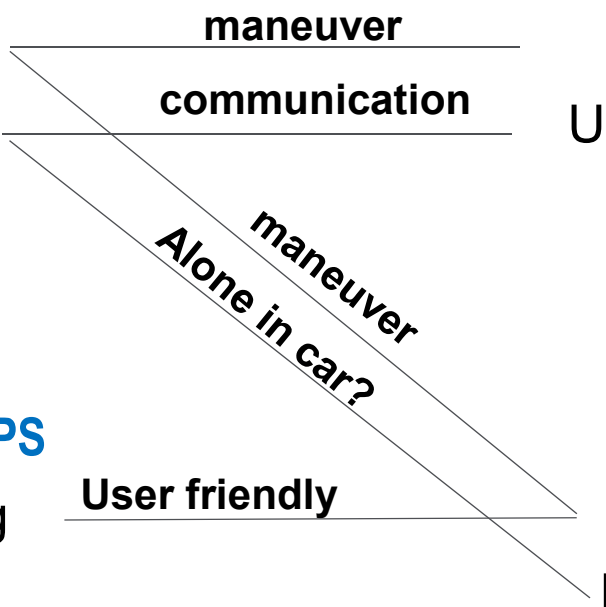
INCREASED AUTOMATION

Maneuver prior crash

Fully automated cars

NEW TYPES OF OWNERSHIPS

Car sharing, car pooling



OUTSIDE VEHICLE

Avoid impacts

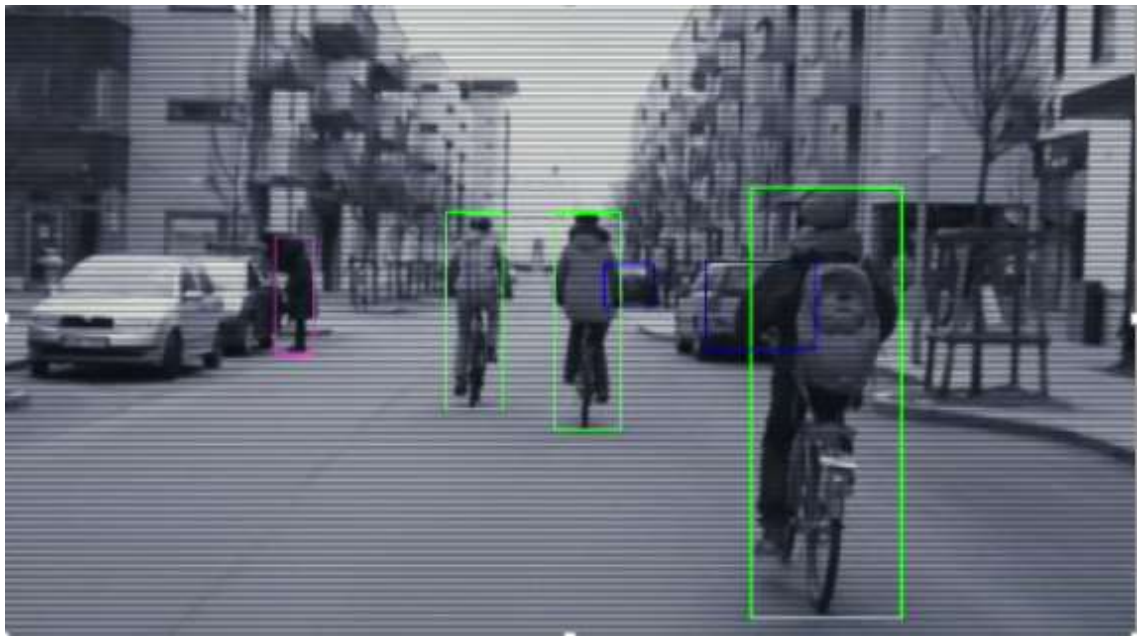
Understand intensions

IN VEHICLE

Protection in crash

Driver responsibility

THE CAR CAN SEE THE CHILD OUTSIDE THE VEHICLE



Download film at:
https://www.media.volvocars.com/global/en-gb/media/pressreleases/48219

VOLVO 360C CONCEPT - AUTONOMOUS CAR COMMUNICATION

How can an autonomous car communicate with other road-users?

- Inform surroundings about you own intensions – do not tell others what to do.
- Intuitive and based on human behavior and reactions.

https://www.media.volvocars.com/global/en-gb/media/pressreleases/237019

FILM

https://www.media.volvocars.com/global/en-gb/media/videos/list

search “360c safety story”

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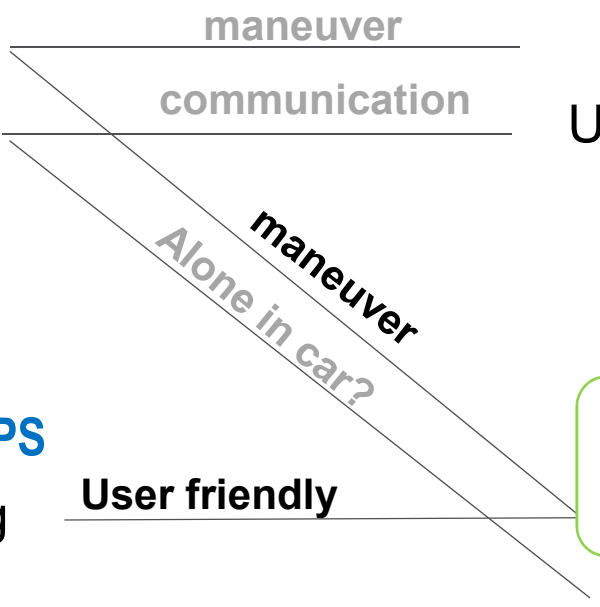

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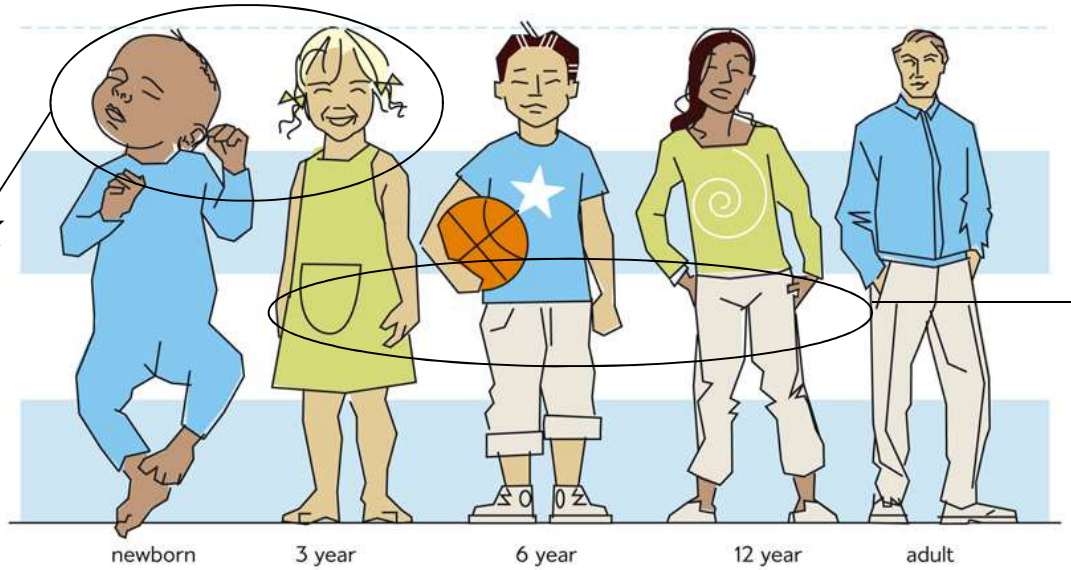
CHILD SAFETY IN FUTURE CARS

- Vision zero – everybody is important, at all trips
- Increased focus on travelling in different cars
  - Shared mobility, car pooling
- Increased level of automation

PROTECTION PRINCIPLES FOR CHILDREN IN CARS

Head is heavy and neck is weak



Pelvis bones are under development and legs are short

Rearward facing child seats

Up to at least 4 years old

Booster cushion/seat

Until 140 cm and 10 years old

HOW?

Follow the fundamental biomechanical principles for impact trauma:

- Restrain strong body parts
- Early coupling
- Distribute load
- Minimize relative motion between body parts
- Reduce contact forces to interior

USER FRIENDLY SOLUTIONS ARE ENCOURAGED

- CRS misuse and non-usage are common issues in today's vehicles

- Reasons of non-use of booster cushions today [1)]
  - Short trips (attitude)
  - In a hurry
  - Driving with others (not your own car)
  - Child refused
  - Child is too big for the booster

- Taxi travels
  - Order a taxi with CRS
  - Bring your own
  - Taxis are exception from legislation in some countries, i.e. children are allowed to travel without CRS

Source: [1)] Bingham et al. 2006

INCREASE CRS USAGE

How to?

- Legal requirements
- Enforcement
- Education
- Attitude/social pressure
- Ease of use
  - Accessible
  - Easy to install
  - Easy to buckle up

Important!

➢ Advanced tools and relevant test methods are needed to ensure good child restraint systems

Examples of 'Ease of use'

INTEGRATED

EASY TO BRING

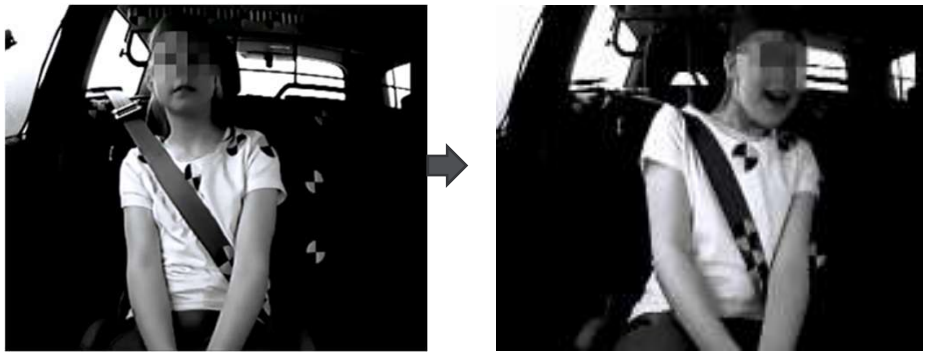
A compact rearfacing seat - concept

https://www.media.volvocars.com/global/en-gb/media/pressreleases/142275

BRAKING

***Ref**. Stockman et al., 2013, Baker et al., 2017*

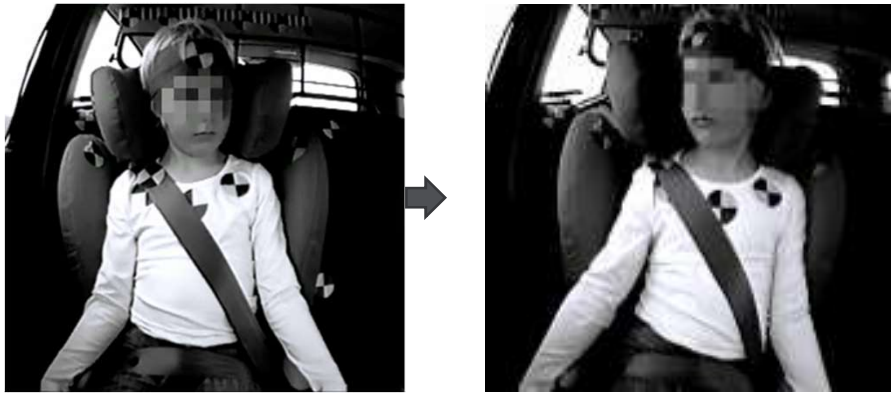
STEERING MANEUVER



Booster cushion

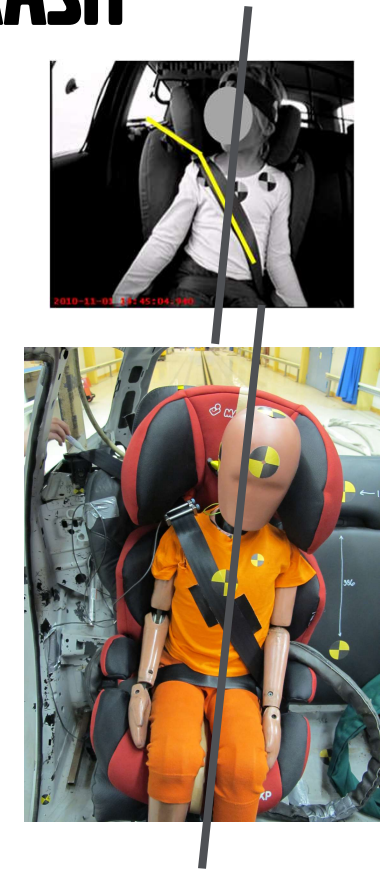
__Ref__. Bohman et al., 2011, Baker et al., 2018

Booster cushion



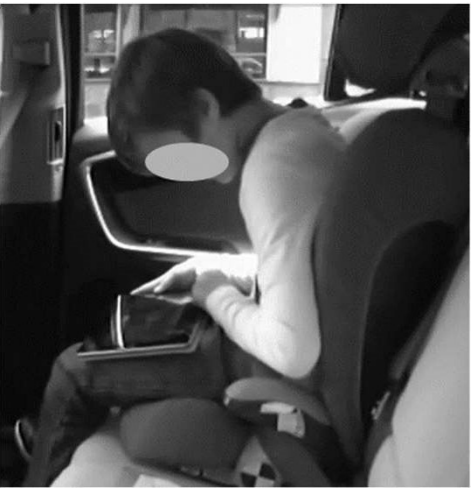
Booster seat

CRASH



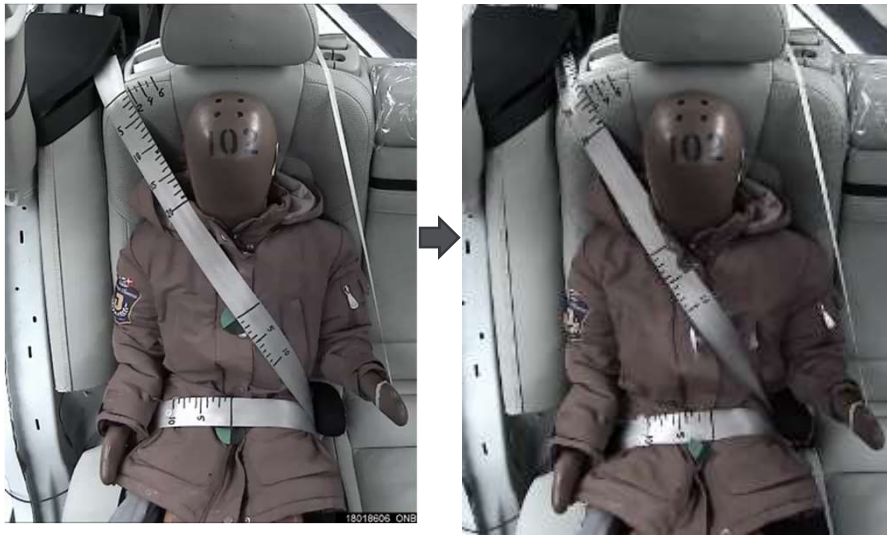
Ref: Jakobsson et al., ESV, 2011

CHILDREN DO NOT SIT LIKE CRASH DUMMIES



***Ref**: Andersson et al., 2010, Jakobsson et al., IRCOBI, 2011, Osvalder et al., 2013, Arbogast et al., 2016, Cross et al., 2017*

THE CAR AND THE CHILD SEAT PROTECT THE CHILD TOGETHER



Activation of seat belt pretensioner can reduce slack due to wearing winter coats

Ref. Jakobsson et al., 2017

AUTONOMOUS CARS – CRASH SAFETY

- Cars will still crash -> restraint systems are needed in the future!

- New seating configurations
  - All seats are available for passengers in an autonomous car
  - Adaptive restraint system – protect children and adults
- Activities -> sitting postures
- New types of restraints

examples

Autoliv life cell

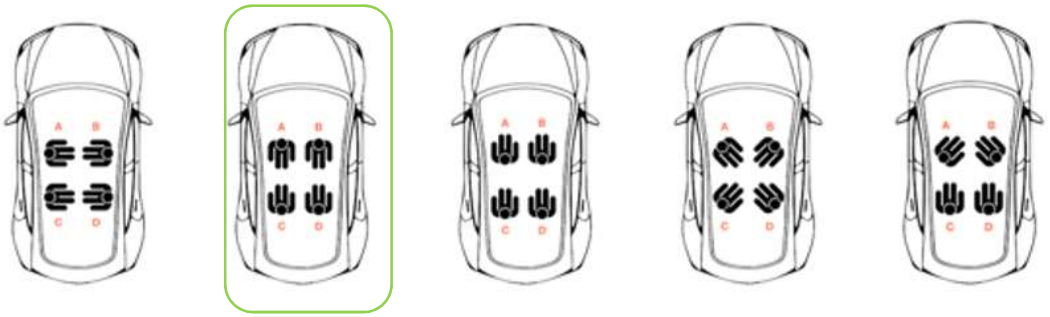
- Examples of research needed
  - Improved tools and methods
    - Whole crash: pre-crash and in-crash
    - Capable of reclined sitting postures
    - Various sizes of child occupants
    - Sensitivity to evaluate unintended consequences

Mercedes concept

Ref: Jakobsson et al., 2019

NEW SEATING CONFIGURATIONS

- Face to face – rearward facing!



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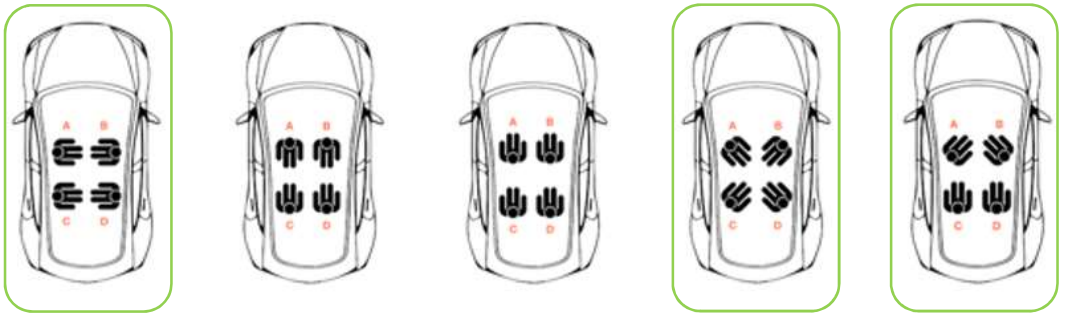
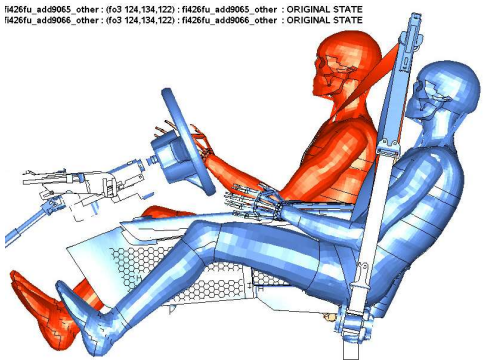


- Rotated seats

- Reclined



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Driver responsibility

maneuver

communication

maneuver

Alone in car?

User friendly

DRIVER RESPONSIBILITY

Potential challenges with children lacking supervision

- How will children be kept safe if a supervising adult in the vehicle is sleeping or impaired?
- What if the autonomous vehicle breaks down or is re-routed to an unknown location?
- What if a child cannot communicate a problem with the autonomous vehicle?

Source: https://www.safekids.org/press-release/blue-ribbon-panel-now-time-consider-child-passenger-safety-self-driving-vehicles

CHILDREN´S VISIONS OF FULLY AUTOMATED VEHICLES

Visionary study by Autoliv

Comparing results of the children to adults

- Children had a more positive attitude towards restraint system to ensure safety
- Children had more & different interior ideas – includes more screens

➢ Important to include children in studies of the future

Ref. Jorlöv et al., 2017

CHILD SAFETY IN FUTURE CARS

INCREASED AUTOMATION AND NEW TYPES OF CAR OWNERSHIPS

- Vehicles can see the children outside the vehicle
- Child safety in cars is a joint responsibility
  - Make every trip a safe trip – accessibility to (adaptive) restraint systems
- Autonomous cars
  - Same protection principles as today
  - The driver is missing – challenges to solve

- Important to include children in studies of future challenges, NOW!

Thank you for your attention!

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SAFER
VEHICLE AND TRAFFIC SAFETY CENTRE AT CHALMERS

FFI Fordonsstrategisk Forskning och Innovation

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