

Summarizing Workshop: *User Centered Design – Applying it on Passenger Safety in Cars*

*Child Occupant Protection: Latest
Knowledge & Future Opportunities*

September 16, 2026
World of Volvo, Göteborg, Sweden



INJURY BIOMECHANICS
GLOBAL INC





Workshop Focus & Format

PURPOSE

- Apply user-centered design to passenger safety across all occupants of different ages, sizes, & capabilities
- Understand how comfort, usability, posture, and behavior influence real-world protection and restraint use
- Identify which occupant adaptations and behaviors meaningfully reduce safety and which can be safely accommodated through design
- Bridge the gap between ideal safety-system performance & real-world use by incorporating human factors into future design and assessment



WORKSHOP FORMAT

- Day 1: 10–20 min individual presentations sharing evidence, perspectives, and gaps
- Day 2: Breakout groups of 6 people each answering 3 critical questions determined from Day 1 content
 - Groups reported back, compared ideas, and refined common themes

Day 1 - Topics

User-centered design approaches for passenger safety

- Explain the mechanism of user centric : determination of issues, users, systems, levers and interaction between all of this. **Philippe**
- How can we better understand and evaluate the interaction between occupant behavior and crash protection? **Philippe,**
- When Does Comfort Behaviour Compromise Safety? **Melina**
- Beyond Nominal Posture: A User-Centered Approach to Passenger Behavior and Safety, **Monica**
- Trusting the Technology: How Consumers value Science-Driven Auto Safety **Kristy**
- Which passenger characteristics and behaviors should we try to accommodate, and which should we try to change **Volvo**
- Should safety systems accommodate common user behaviors, or should design encourage safer behaviors? **Arun,**
- Is it better to nudge people toward safer behavior or make their typical behavior safe? **Jessica**
- Understanding Safety-Relevant Passenger Behaviour: Designing for Real Users Rather than Ideal Users, **AnnaLisa.**
- Distinction between “user error” and predictable adaptations to systems that may not adequately fit the passenger or the journey. **Sjaan**
- A cynics view on user-centered design – how can we leverage selfish behavior to advance safety? **Jason**
- Assessing older child user postures/behaviors, **Gretchen**
- Child safety/restraint use: current US trends and effort to increase correct booster/belt use, **Gretchen**

Human factors influencing passenger safety

- The interaction between comfort and protection systems (e.g., belt-to-neck issues observed in consumer testing) **Jessica, Mats**
- Variation in body shapes and life stages (e.g., aging populations, children, different anthropometries) **Gretchen, Sjaan**
- How passengers adapt their posture to relieve discomfort, potentially reducing protection **Volvo, Arun**
- Occupant behavior in increasingly automated vehicles, **Pierluigi**

Assessment methods and future research

- Are current assessment methods representative of real-world occupant behavior? **Volvo**
- Methods and tools for assessing the safety implications of occupant behavior and comfort-related adaptations **Kalle, Valentina**
- How can future testing, modelling, and evaluation methods better account for variations in occupant behavior and posture? **Volvo**
- Implications of new US child side impact protection regulations **Suzanne**

Other topics

- Safety voice – **John**

Day 1 – Cross-Cutting Messages

- Human behavior is a missing link between safety design and real-world protection
- Comfort-related adaptations are often predictable & therefore can be designed for or designed against
- High restraint-use rates do not guarantee good belt fit, good posture, or intended protection
- Not every non-nominal posture is dangerous; the field needs evidence to identify which ones matter
- Safety should be intuitive, comfortable enough to maintain, and forgiving across realistic occupant variation
- Human factors, design, biomechanics, passive safety, regulation, & consumer communication need to work together



Day 2 – Breakout Questions

- 1 How do we give people the information & the motivation they need to make safer choices?
- 2 Which user adaptations are safety-critical? How do we measure that?
- 3 What are 3 actions we can take?



Q1 - Shared Direction from the Groups

- Start with a simple, consistent core message that all stakeholders can reinforce
- Recognize different user groups: correct / consistent users, inconsistent or incorrect users, & persistent non-users
- Tailor the intervention to the person, life stage, seating position, vehicle, and journey
- Repeat guidance across the life course—one exposure is not enough
- Make correct restraint use easy to understand, easy to do, and easy to maintain



Q1 - Synthesis

WHERE TO REACH PEOPLE

- Schools, licensing, and life-stage education
- Employers, fleets, and workplace safety programs
- Dealerships or vehicle-shopping touchpoints
- Short videos, social media, influencers, & trusted public resources
- In-vehicle onboarding, infotainment, & targeted reminders

HOW TO MOTIVATE SAFER BEHAVIOR

- Make the safe behavior the easiest and most comfortable choice
- Use convenience, incentives, & positive reinforcement where appropriate
- Leverage social norms, regulation, & enforcement when needed
- Develop a recognizable belt-fit cue / icon
- Match the message, messenger, & moment to the audience



Day 2 – Breakout Questions

- 1 How do we give people the information & the motivation they need to make safer choices?
- 2 Which user adaptations are safety-critical? How do we measure that?
- 3 What are 3 actions we can take?



Q2 - Which Adaptations may be Safety-Critical?

- Shoulder belt under the arm or behind the back
- Lap belt positioned over the abdomen rather than low on the pelvis
- Excessive recline, lying across the rear seat, or feet on the dashboard
- Leaning / slouching / seat-track positions that change interaction with belts, airbags, or knee bolsters
- Unapproved clips, cushions, belt-positioning devices, and other aftermarket products
- Any position that moves the occupant outside the protective envelope of the restraint system

Key Gap: Define how far from nominal becomes meaningfully unsafe



Q2 - Synthesis

A staged research approach can separate common, low-consequence adaptations from high-priority risks

1. OBSERVE

- Naturalistic posture
- Human comfort / behavior
- Real vehicles

2. SCREEN

- HBMs across posture and size
- Vary belt fit and crash direction
- Map kinematics / injury metrics

3. VALIDATE

- Targeted PMHS / ATD tests
- Compare with crash evidence
- Focus on high-priority cases

4. TRANSLATE

- Define protective envelope
- Prioritize design changes
- Update assessment / messaging

Practical Principle: Start broad w/modeling; focus expensive testing on critical adaptations

Design Implication: make safe posture comfortable & make high-risk misuse harder to achieve



Day 2 – Breakout Questions

- 1 How do we give people the information & the motivation they need to make safer choices?
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Q3 – Breakout Synthesis

The breakout ideas converged on messaging, evidence translation, & a coordinated agenda

1. CONSISTENT BELT-FIT GUIDANCE

- Create a simple belt-fit icon / logo
- Co-design with different occupants and life stages
- Test clarity, practicality, and sustained use

2. PUBLISH & COMMUNICATE

- Bring evidence together in a consensus paper
- Pair it with public summaries, infographics, and short media
- Adapt the message to each audience

3. CALL TO ACTION

- Define the most important evidence gaps
- Set research / policy priorities and roles
- Create a multidisciplinary agenda for action



What is Needed to Make the Actions Stick?

- Bridge human factors / ergonomics with biomechanics, industrial design, and crash protection
- Develop common language and speak with one voice on core safety messages
- Create a credible central resource that translates evidence beyond academia
- Include designers, manufacturers, regulators, healthcare, insurers, employers, communicators, & occupants themselves
- Use joint research and cross-disciplinary conference sessions to maintain momentum
- Create a **consortium** or standing working group around user-centered passenger safety



Key Takeaways

- The challenge is not only whether passengers use restraints, but how they use them and why
- Comfort, trust, body variation, and travel context can change posture & belt fit
- User behavior should be treated as design evidence, not simply as error
- Research must separate harmless adaptation from safety-critical adaptation
- **Near-term opportunity:** common belt-fit guidance plus coordinated cross-disciplinary action
- **Long-term goal:** safety systems that remain protective for real people in real postures



**Goal: make correct restraint use intuitive, comfortable,
& protective across real-world occupant variation**

