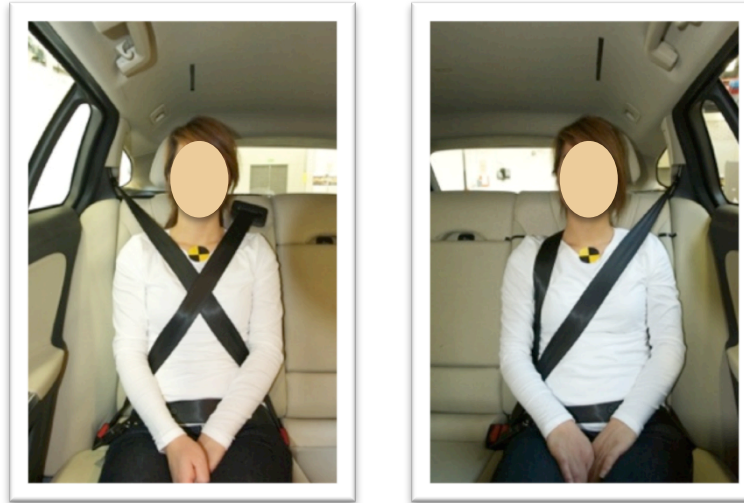


# Comfort and Attitude Evaluation of Extra Seat Belts in the Rear Seats



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# Background

- 50 million people injured in traffic each year
- Traffic accidents leading cause of death for children & young adults in Europe
- Seat belts are an important safety feature which contribute to saving lives and reduce the risk of injury
- In certain crash configurations (far-side, oblique, rollovers) the ordinary three-point belt may not provide enough protection



# Background

## **In spite of effective protective systems - people are still injured**

- No belt usage at all
- Wrong type of protective system (due to age/height)
- Misuse (incorrect mounting, belt misfit)
- Involuntary postures during crash
- Voluntarily chosen postures



# Background

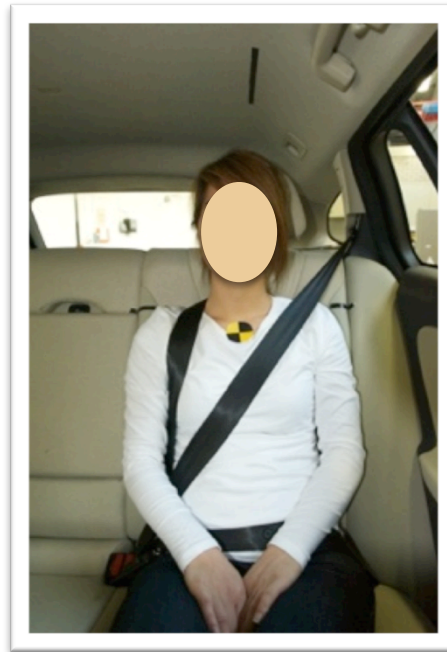
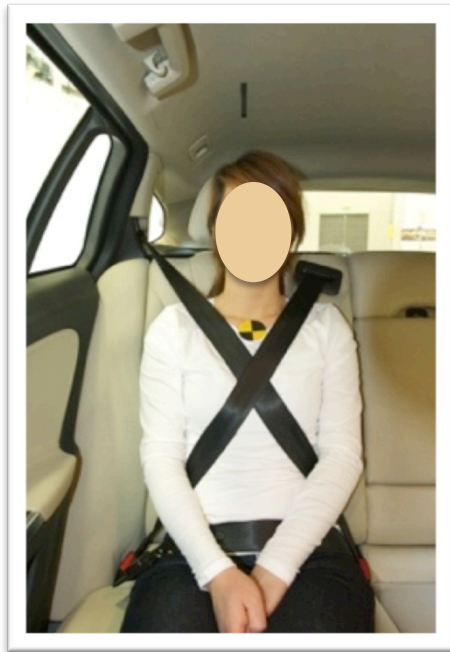
- Involuntary postures - during manoeuvres  
Due to vehicle movement – increased risk of the shoulder belt slipping of
- Voluntary chosen non-optimal postures – on-road driving  
Due to activities, discomfort, possibility to move freely





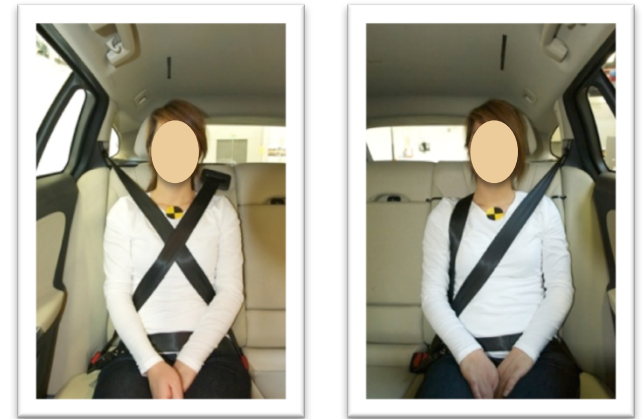
# Background

- Can extra seat belts solve out-of position problems in the back seat?



# Background – User involvement

Important to involve children when developing *their* new safety systems



- As subjects
  - Experienced comfort/discomfort during on-road drive (Osvalder et al., 2015)
  - Attitudes and aspects for success (Osvalder et al., 2017)
- Products without a good reputation and positive user experience might have difficulties being accepted

# Study Objectives

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1. To identify and analyze children's **initial impressions** of extra seat belts in combination with the ordinary three-point belt in the rear seat of a passenger car, and their **attitudes** toward them - **focus group study**
2. To explore children's **comfort experience** of extra seat belts **during on-road driving** in the rear seat of a passenger car, and investigate how the use of extra belts affect children's attitudes towards the product

# The Extra Seat Belt Concepts

- Backpack
  - An extra belt over the inboard shoulder
- Criss-Cross
  - An extra belt across the torso



# Study 1: Attitudes – Focus groups

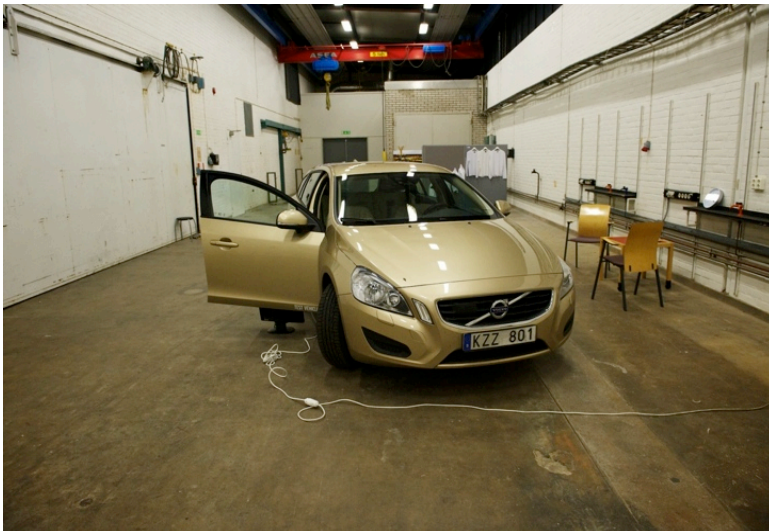
- Used in empirical studies to collect data from actual users and use – a 2 hour group discussion with a trained moderator
- To explore what children think and feel about seat belts and interaction with them – their attitudes and interests
- Fundamental questions:
  - Would they want extra seat belts?
  - Would they use it in their car?
- Two focus groups: 6 children each, 8-10 years





# Focus group: Test procedure

1. Discussion about ordinary seat-belts
2. Introduction of the extra seat-belt concepts
3. Actual prototypes tested in car, a few minutes
4. Discussion of the tested concepts



# Results: Seat belts of today

***All children always used seat-belts and were very safety minded***

## ***Positive issues***

- Comfortable to lean on
- Protective in a crash
- Gives a feeling of safety

## ***Ideas for improvement***

- Softer belt
- Other colors than black
- Belt over both shoulders
- Better adjustable in height
- More elastic (easier to move)

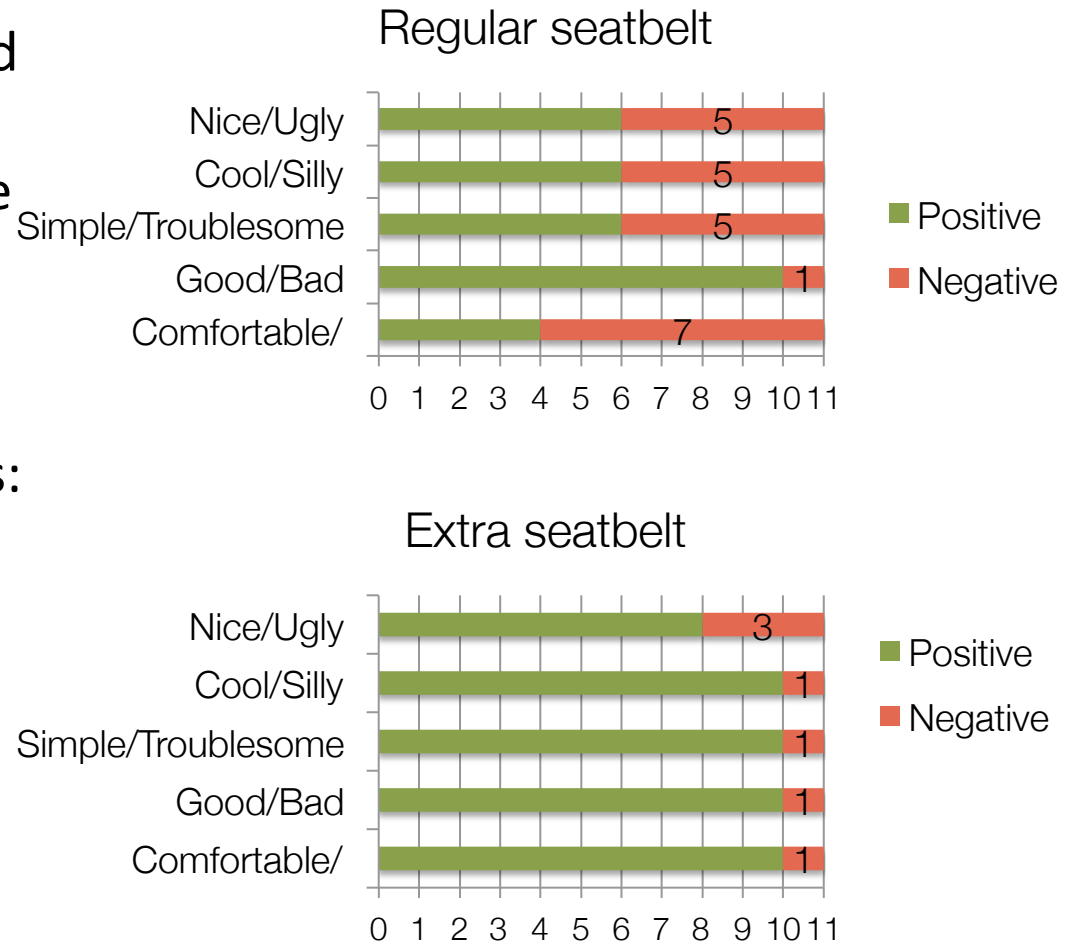
## ***Negative aspects***

- Chafing on the neck
- The belt locks and gets stuck
- Difficulty moving within the belt
- Difficult to buckle up
- Uncomfortable



# Results: Extra Seat Belts

- Very positive: due to increased safety and modern product
- Negative aspect: hard to move
- Might take it off if travelling far, due to discomfort
- Not use it, if in a hurry
- Nearly all preferred criss-cross: feels more safe
- Wanted an extra seat belt in their own car
- Their parents would love it, and can pay extra for it!



# Study 2: Comfort – On road drive

- Two cars: Criss-Cross or Back Pack in rear seat
- One hour ride with each concept
- Pre-determined route
- Objective and subjective data collection
- 15 children, 6-10 years  
6 youths, 10-15 years  
(11 adults, 25-74 years)




# Subjective data collection

- Questionnaire
  - Every 20 min during each 1 hour ride
  - Discomfort changes over time
- Perceived discomfort tasks
  - Emotional facial expressions
  - Coloring of inconvenience
  - Contradicting words about emotions
- Semi-structured interview regarding comfort experience

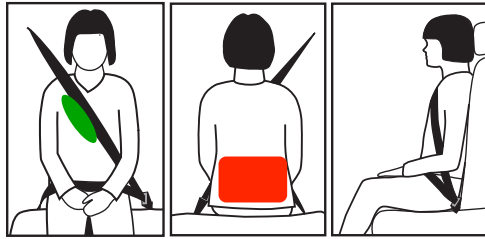
**B5**

IBK - Fyll i efter 60 min, innan du knäpper av dig bältet

1. Nu när du sitter i baksätet på bilkudden med bältet på dig, hur känner du dig då? Ringa in det ansiktsuttryck som du tycker passar in bäst.



2. Markera på bilderna nedan:  
- Med röd penna om du känner skav, tryck eller att det gör ont någonstans.  
- Med blå penna om /vart det känns bra eller skönt.



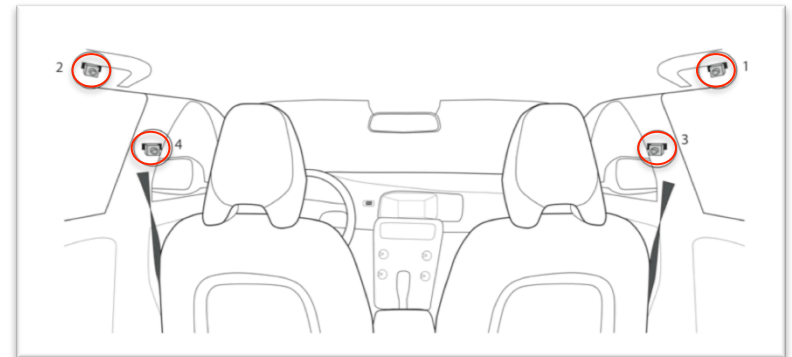
3. Ringa in ett av orden på varje rad som beskriver hur det känns nu med tanke på:

Bältet		Bilkudden	
Bra	Dåligt	Bra	Dåligt
Säker	Osäker	Säker	Osäker
Töntigt	Häftigt	Töntigt	Häftigt
Mjukt	Hårt	Mjukt	Hårt
Spänt	Avslappnat	Spänt	Avslappnat
Känns som vanligt	Känns ovanligt	Känns som vanligt	Känns ovanligt
Skönt	Obeqvamt	Skönt	Obeqvamt
Fri	Instängd	Fri	Instängd

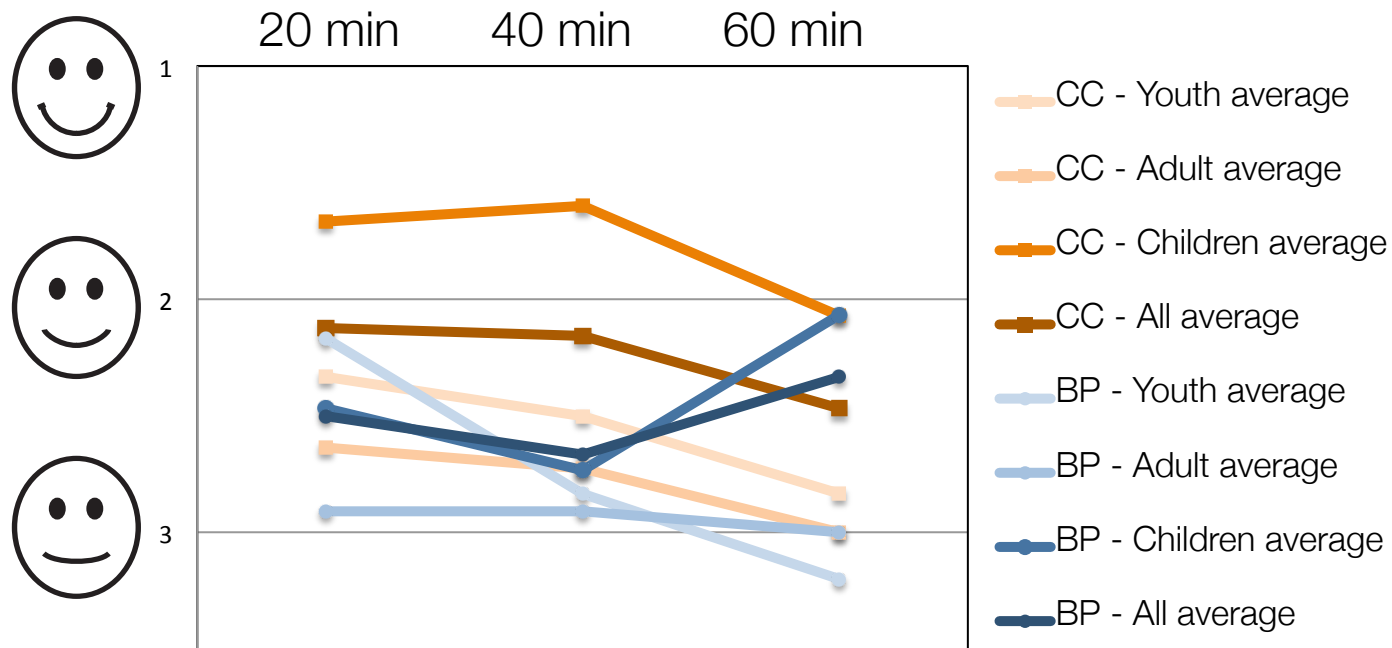


# Objective data collection

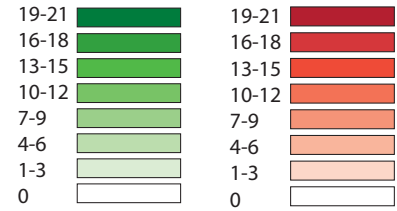
- Video cameras inside the car
  - Front/oblique view
  - Side/top view
- Evaluated parameters
  - Sitting behaviour
  - Seat belt fit



# Results: Overall emotional expression

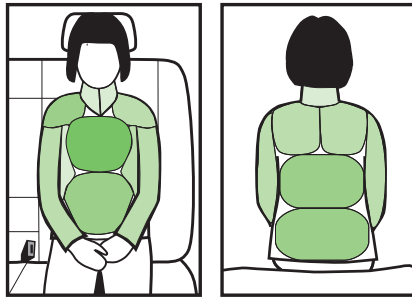


# Results: Discomfort mapping

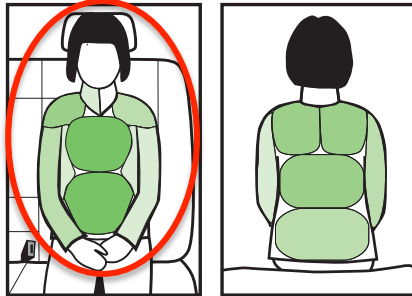


## CC – Children & Youths

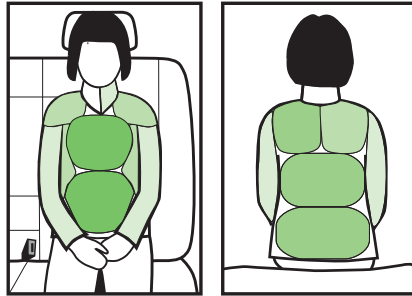
CC-Children&Youth-20min



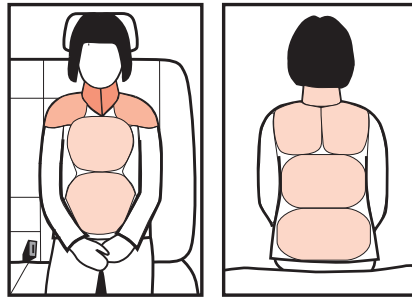
CC-Children&Youth-40min



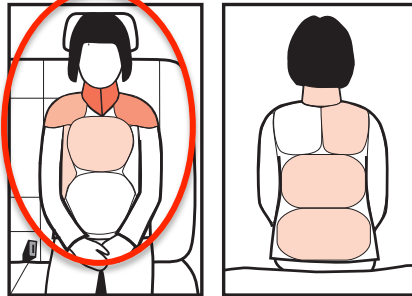
CC-Children&Youth-60min



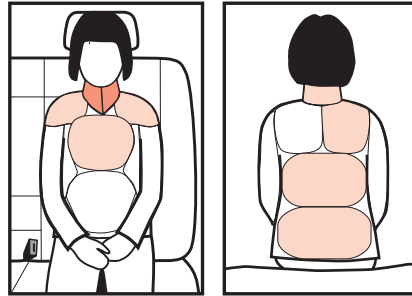
CC-Children&Youth-20min



CC-Children&Youth-40min

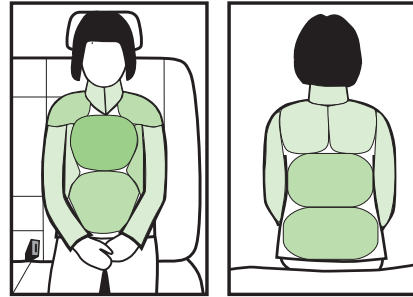


CC-Children&Youth-60min

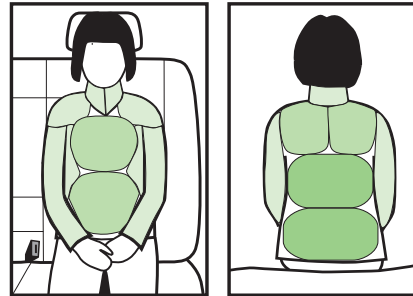


## BP – Children & Youths

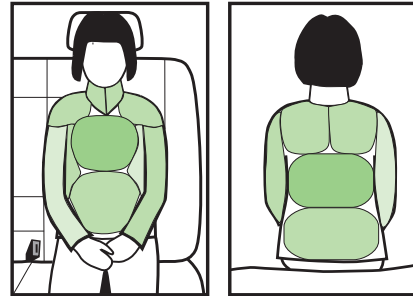
BP-Children&Youth-20min



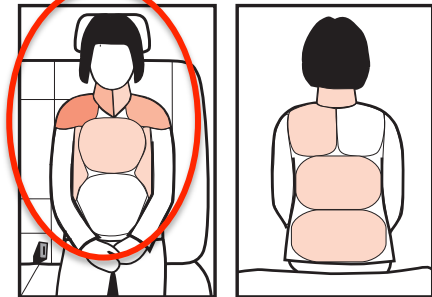
BP-Children&Youth-40min



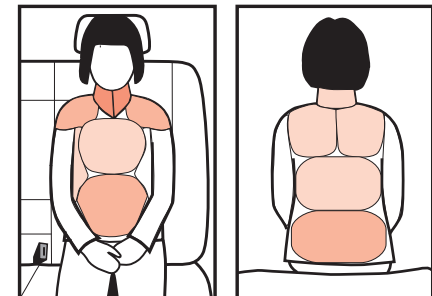
BP-Children&Youth-60min



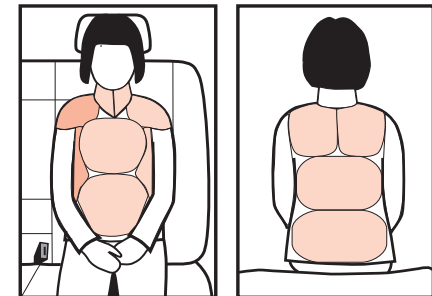
BP-Children&Youth-20min



BP-Children&Youth-40min



BP-Children&Youth-60min



20 min

40 min

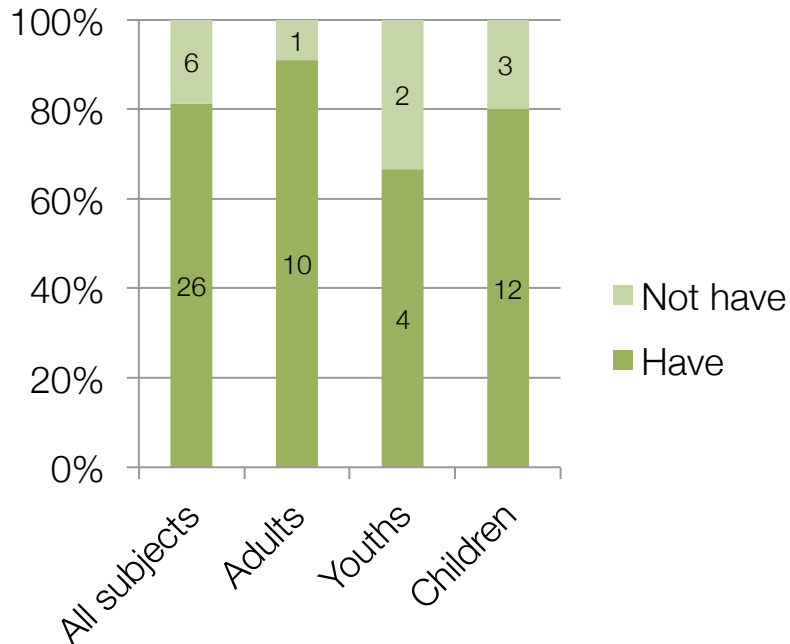
60 min

# Results: Interview after 1 hour drive

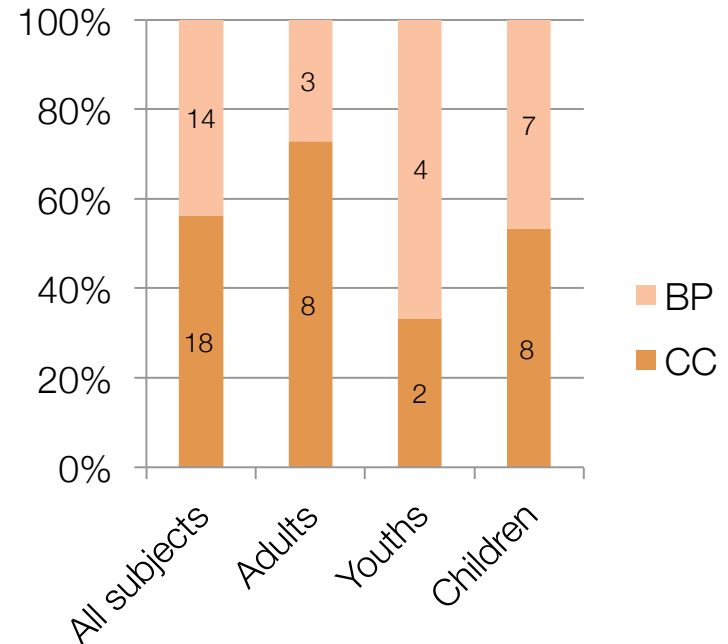
81% wanted an extra seat belt

56% preferred CC

Would you like to have an extra seat belt?



Which concept do you prefer?



# Interview: Arguments Criss-Cross

- Everything felt better than BP
- Symmetry
- Much more comfortable, safer and easier to move than BP
- Besides the chafing, it felt safe and serious
- Funny, like a roller-coaster
- Feels as it would be safer in a crash
- Did not chafe as much as BP





# Interview: Arguments Back Pack



- Easy to put on and off
- More comfortable, CC strangles
- Simpler than CC
- Felt more free, not as restrained
- Felt safer, did not move around as much
- CC was trickier and caused chafing
- Felt locked-in by CC

# Conclusions: Attitude study children

- Seat belt usage was not questioned at all!
- The three-point belt was experienced as very safe and always used despite causing discomfort!
- Very positive attitudes toward extra seat belts. Criss-cross preferred. Main reason for motivation was perceived increased safety!
- Main reasons for not using extra belts were discomfort, a feeling of being trapped, and that the belt system was hard to apply
- Design the extra belt together with the ordinary seat belt as one system



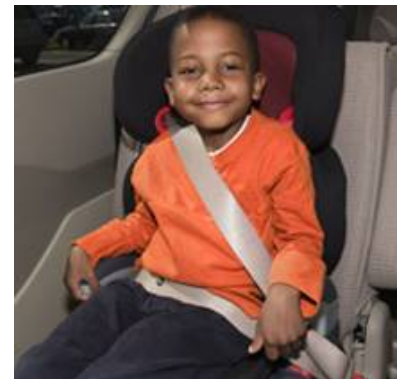
# Conclusions: On-road drive

- Both systems were accepted & provided an increased feeling of safety – 80% wanted an extra seat belt!
- Seat belt fit and comfort are supplementary influencing factors when it comes to gain acceptance
- Criss-cross was appreciated for its symmetry and comfort - but the belt could slip up toward the neck causing discomfort
- Back-pack was appreciated for easy handing and no shafting to the neck – but could cause discomfort due to asymmetrical belt geometry



# Limitations of studies

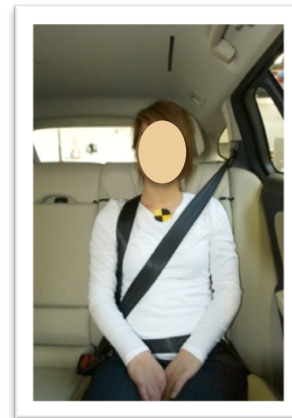
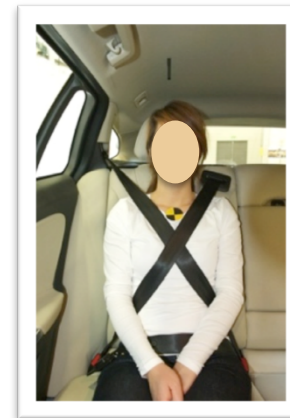
- Performed in Sweden – with one of the world's highest seat belt usage rates
- Swedish people have a generally high safety consciousness level
- Children can be excited and positive by participating and testing new products
- The possibility to generalize the results are limited
- Need to conduct similar studies in other countries



# Publications

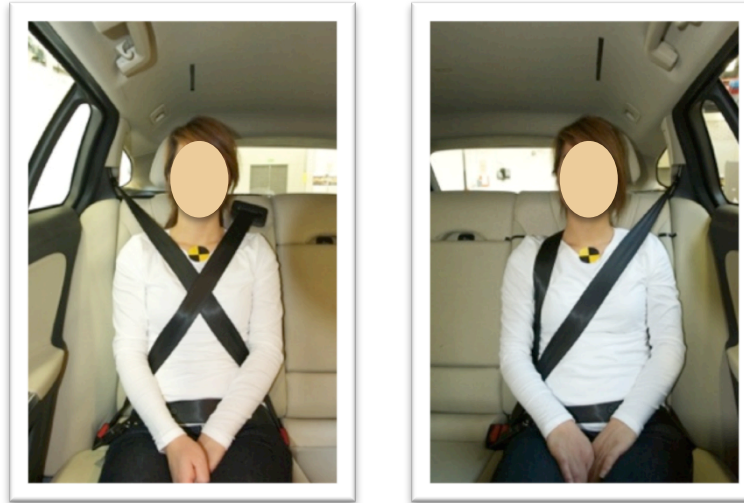
Osvaelder, A-L., Bohman, K., Hansson, I (2017). *Adult's and Children's Attitudes towards Extra Seat Belts in the Rear Seats.*  
**IRCOBI** Conference, Antwerpen, 2017

Osvaelder, A-L., Hansson, I. och Bohman, K. (2015) *Children's and Adults' Comfort Experience of Extra Seat Belts When Riding in the Rear Seat of a Passenger Car.*  
**Traffic Injury Prevention**, Vol. 16 (2015), p. 46-51.





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