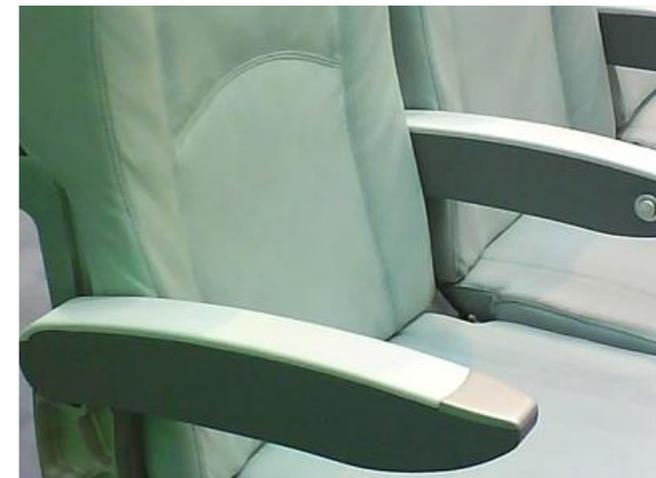


# Comfort

December 2<sup>nd</sup>, 2013

prof dr Peter Vink



International Conference  
**INNOVATIVE SEATING 2012**  
13 FEBRUARY 2012 | Maritim Rhein-Main Hotel Darmstadt, Germany



Prof. Dr. Peter Vink,  
Faculty of Industrial Design Engineering,  
Delft University of Technology  
advisory board member



**New chairman, judges and categories in Crystal Cabin Awards**  
It's all change for 2012's Crystal Cabin Awards

# Are you feeling comfortable?



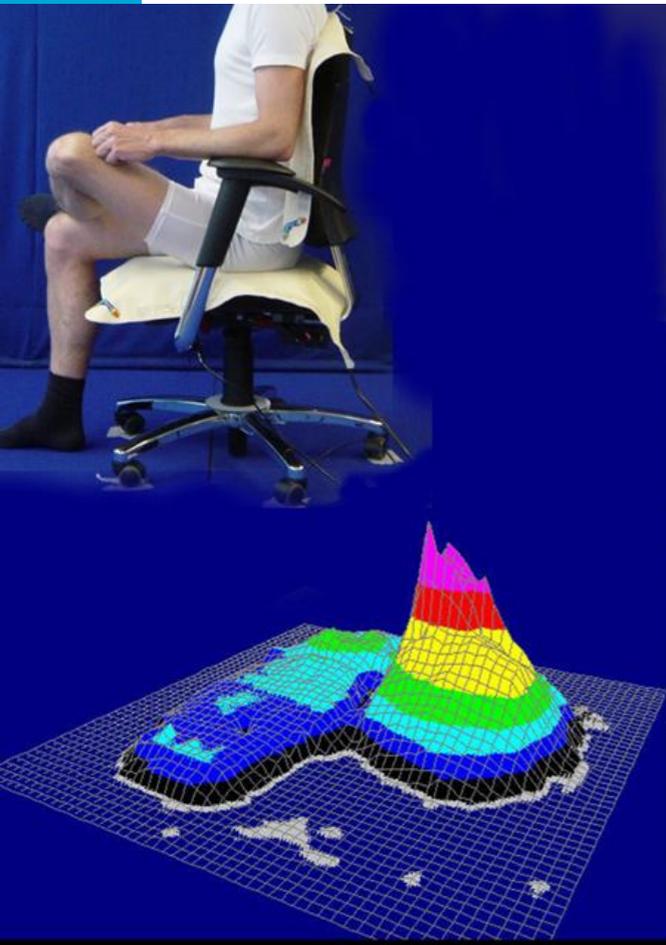
# Why comfort?



comfort can increase sales (Vink, 2005)

discomfort predicts back and neck complaints (Hamberg, 2008)

# factors related to (dis)comfort



discomfort



fatigue  
pain  
posture  
stiffness  
heavy legs

comfort



luxury  
safe  
refreshment  
well-being  
relaxation



(Zhang et al., 1996)

# discomfort - complaints

## Peak LPD (>2):

- RR 1.79 low back pain (n=865)
- RR 2.56 neck pain (n=1001)

## Cumulative LPD (sum>3 of 6 recs/day)

- RR 2.35 neck pain (n=2342)

## 3 year follow up

(Hamberg et al., 2008)

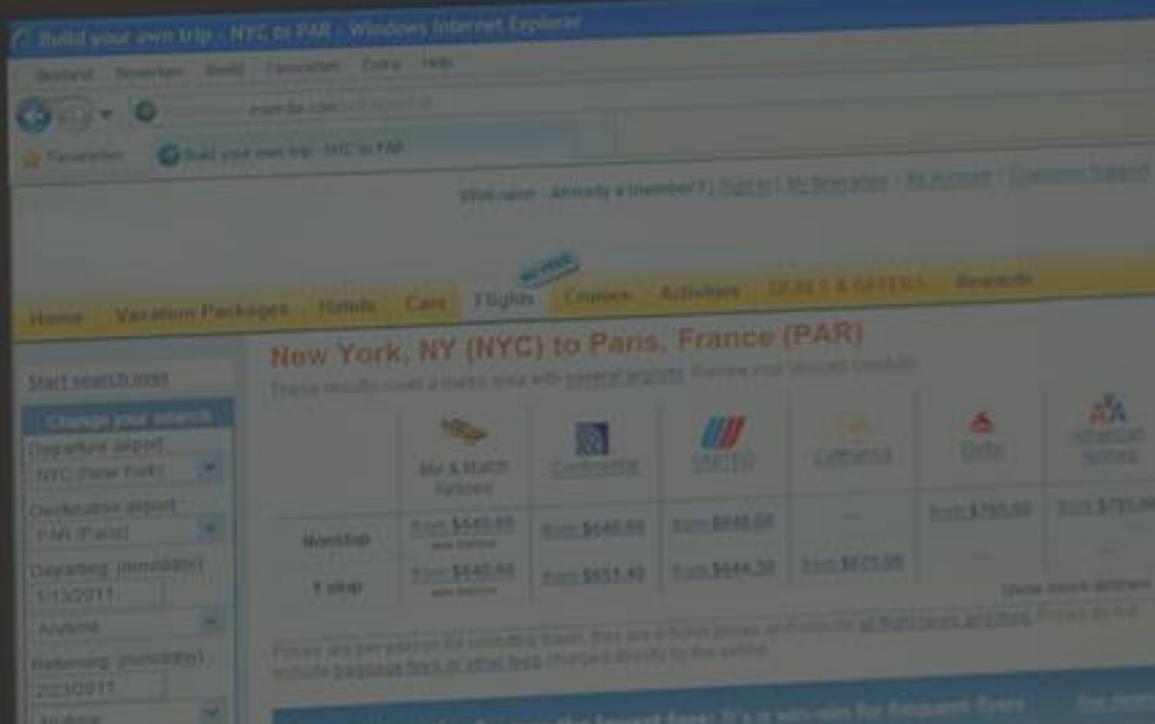
# the comfort experience process

first sight

short term comfort

expectations

long term comfort



Vink & Brauer, 2011

(virtual)

Usage

Expectation

First sight



Product

Interaction

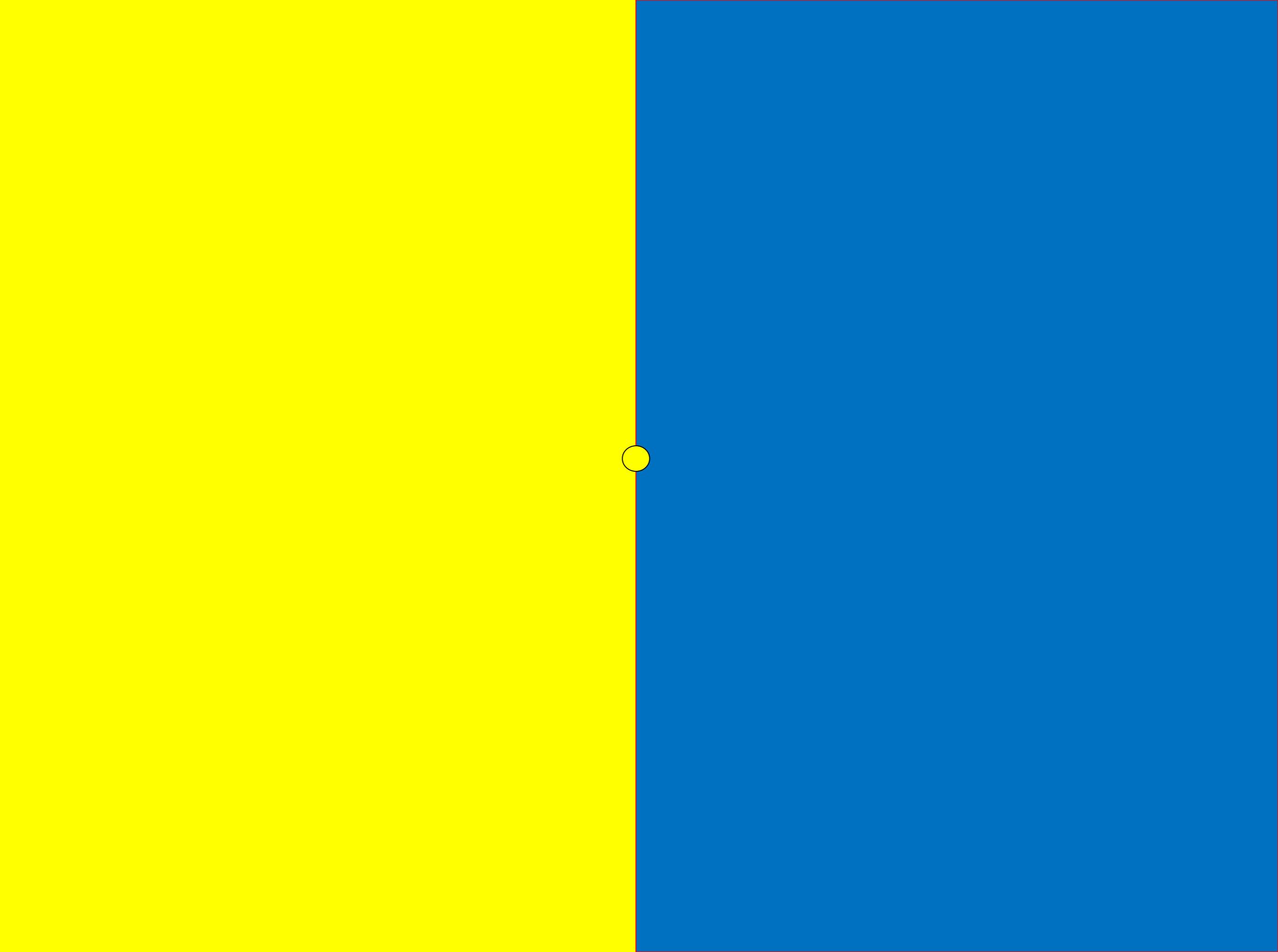
Effect

Perception



Vink & Hallbeck, 2012







three cases



1. New ways of work (NWW)
2. Light weight car seat
3. anthropometrics and aircraft seats



# Conclusions

## *Research:*

- observation is essential: focus on activities
  - test the effects: clear input for design

## *Design:*

- set priorities based on user demands
  - Test various prototypes

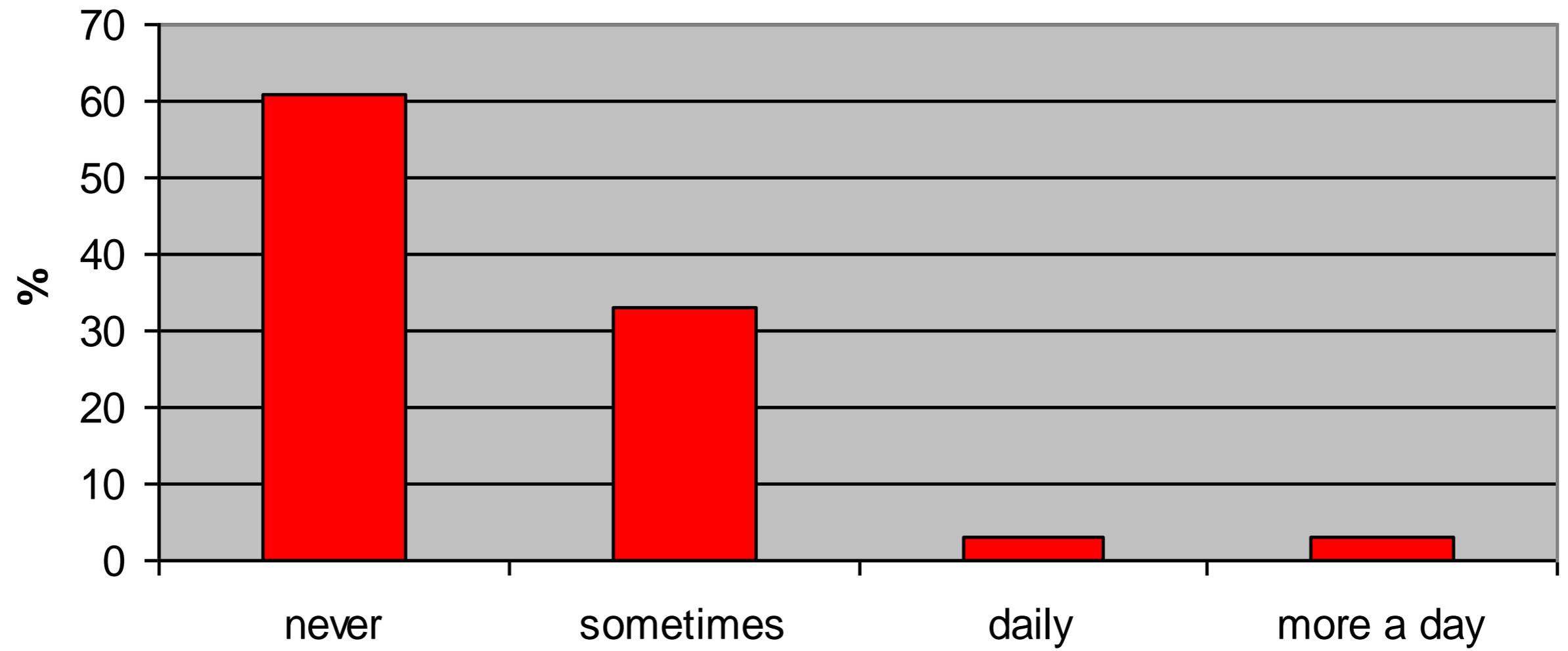
# Designers make nice office chairs





a cheap and simple chair: four controls

# How often to adjust the chair (n=100)



Vink et al., 2007

three cases



1. New ways of work (NWW)
2. Light weight car seat
3. anthropometrics and aircraft seats



# Case 1: New ways of work



# Where highest experienced productivity?

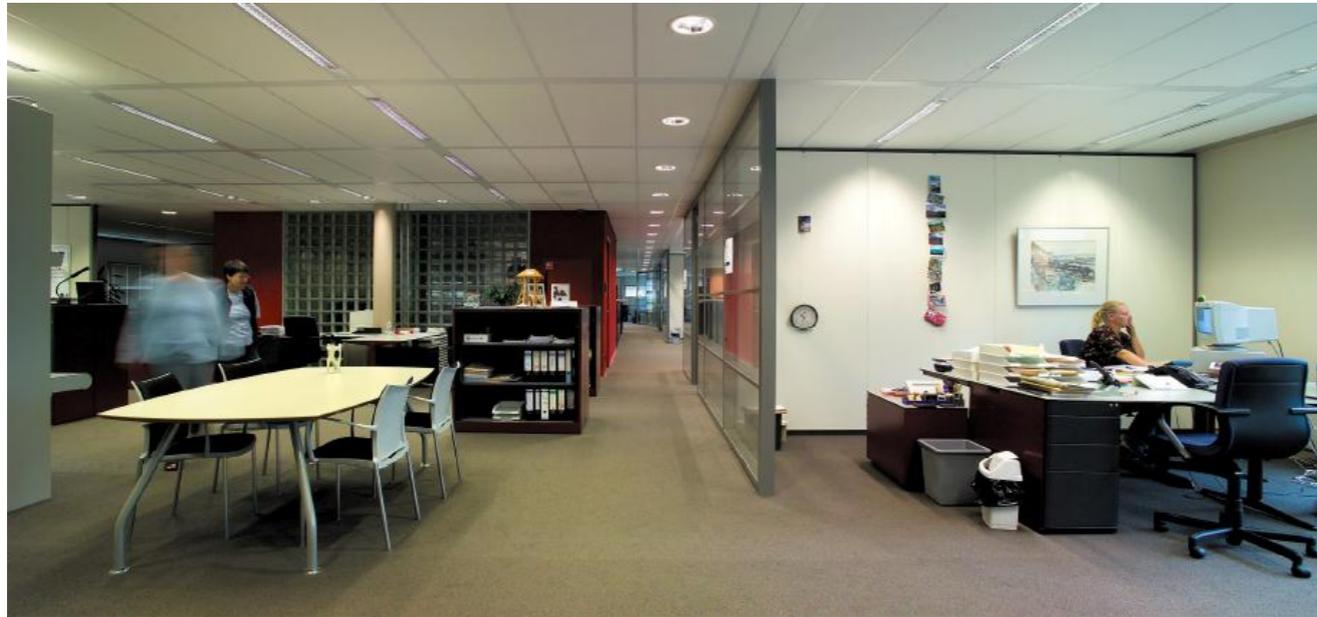


a. combioffice



b. 2-person rooms

# Where highest experienced comfort?



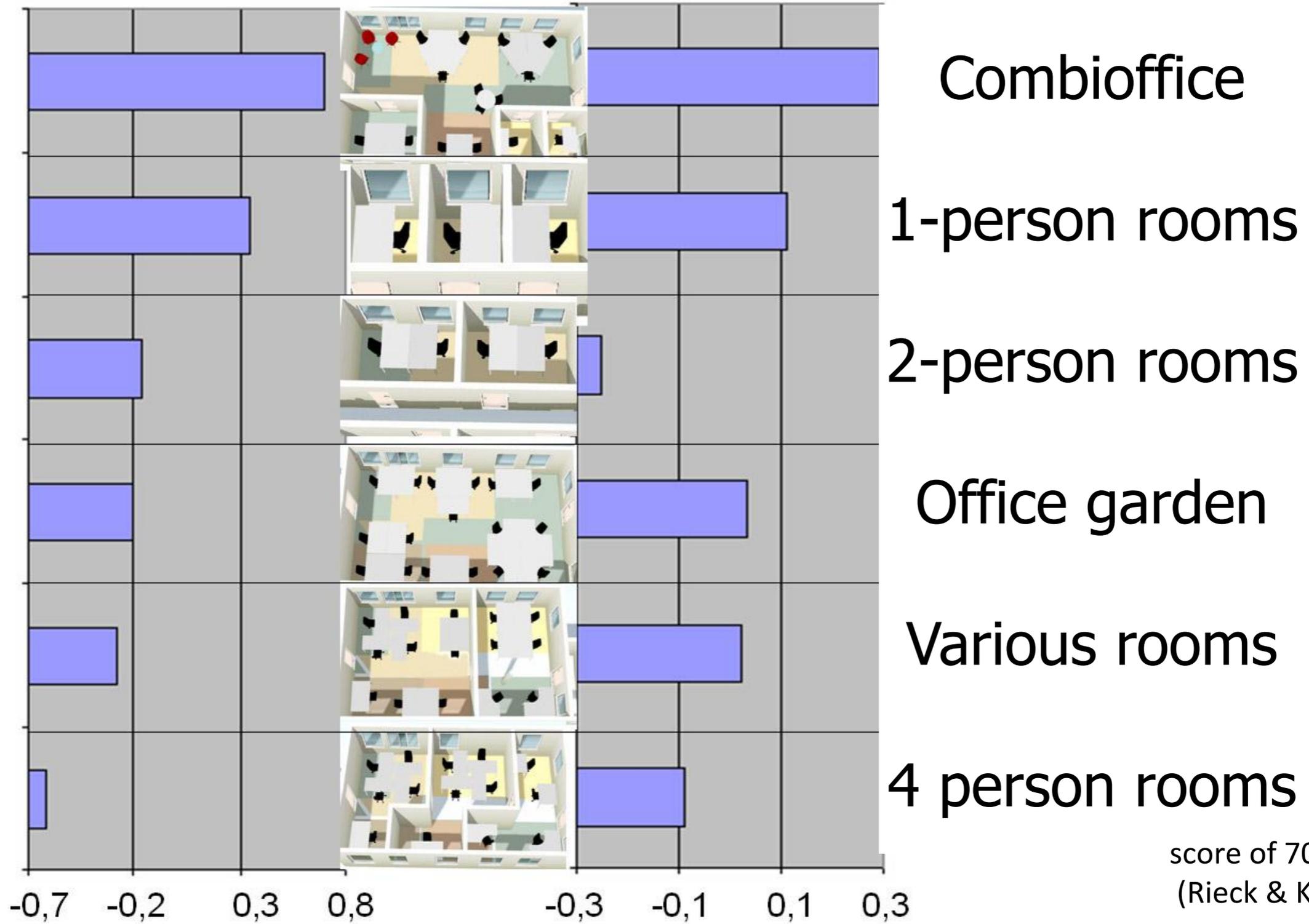
a. combioffice



b. 1-person room

# comfort

# productivity



score of 706 subjects  
(Rieck & Keller, 2005)

# Beanbag comfortable for NWW?



# Why combi? Advantage of...

Concentration space

bellcel

Open office space

Loungework station

Various meeting rooms

disadvantages?



# Often interior design based on belief/vision

This study is unique:

- Pre- post measurement
- Control group
- Objective (RFID) data (n=75)
- Questionnaires (n=106)
- Statistics



(Blok et al. 2012)

# change

- No owned desks
- Combioffice
- More lounge, various meeting rooms
- Concentration rooms
- Working at home/while travelling
- Two dpts: procedures/internal oriented (I) and
- marketing/ communication (C)



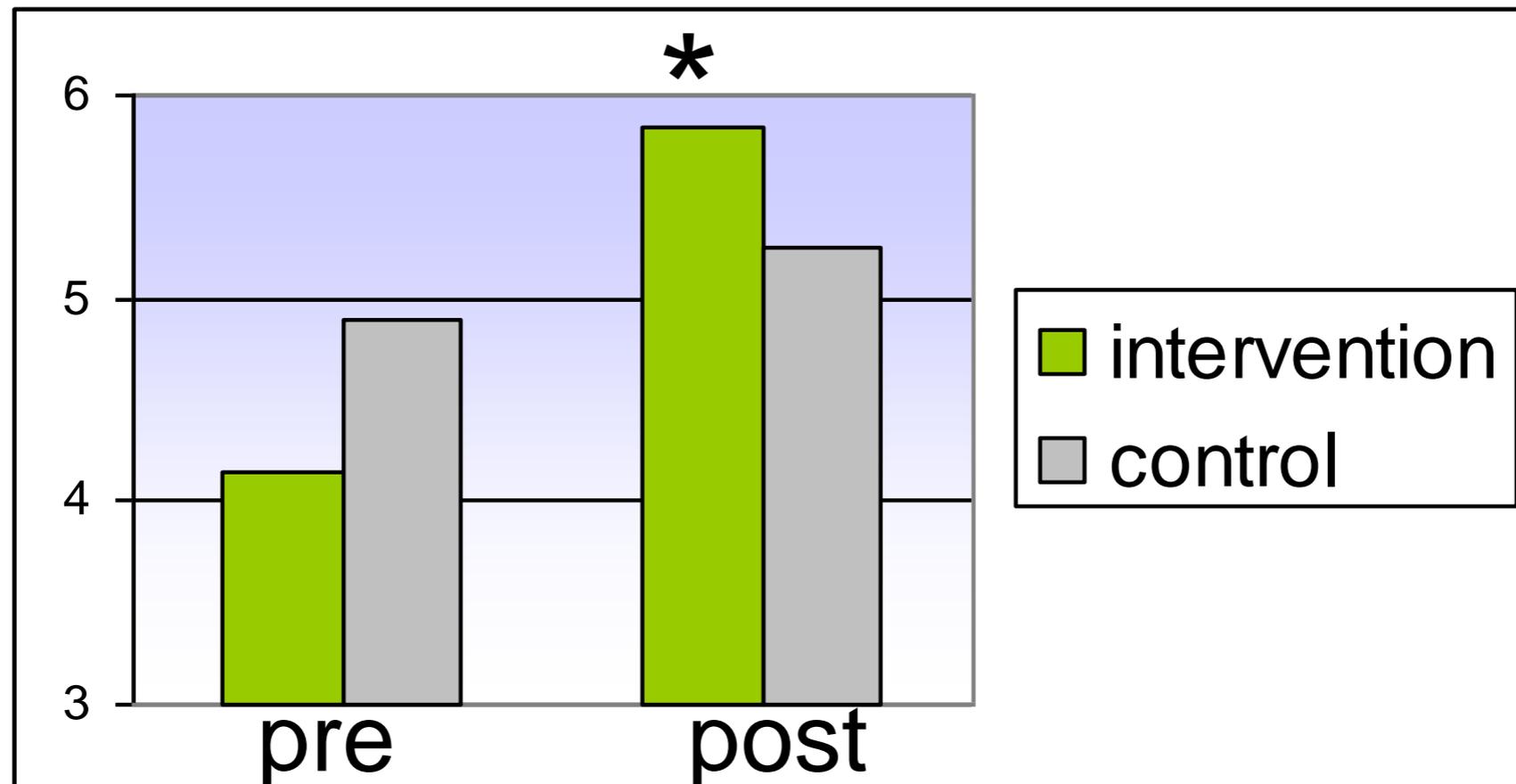
# Effects on:



- pleasure in work;
- health;
- productivity;
- innovation;
- representativity;
- communication and
- use of space.

# Results (1)

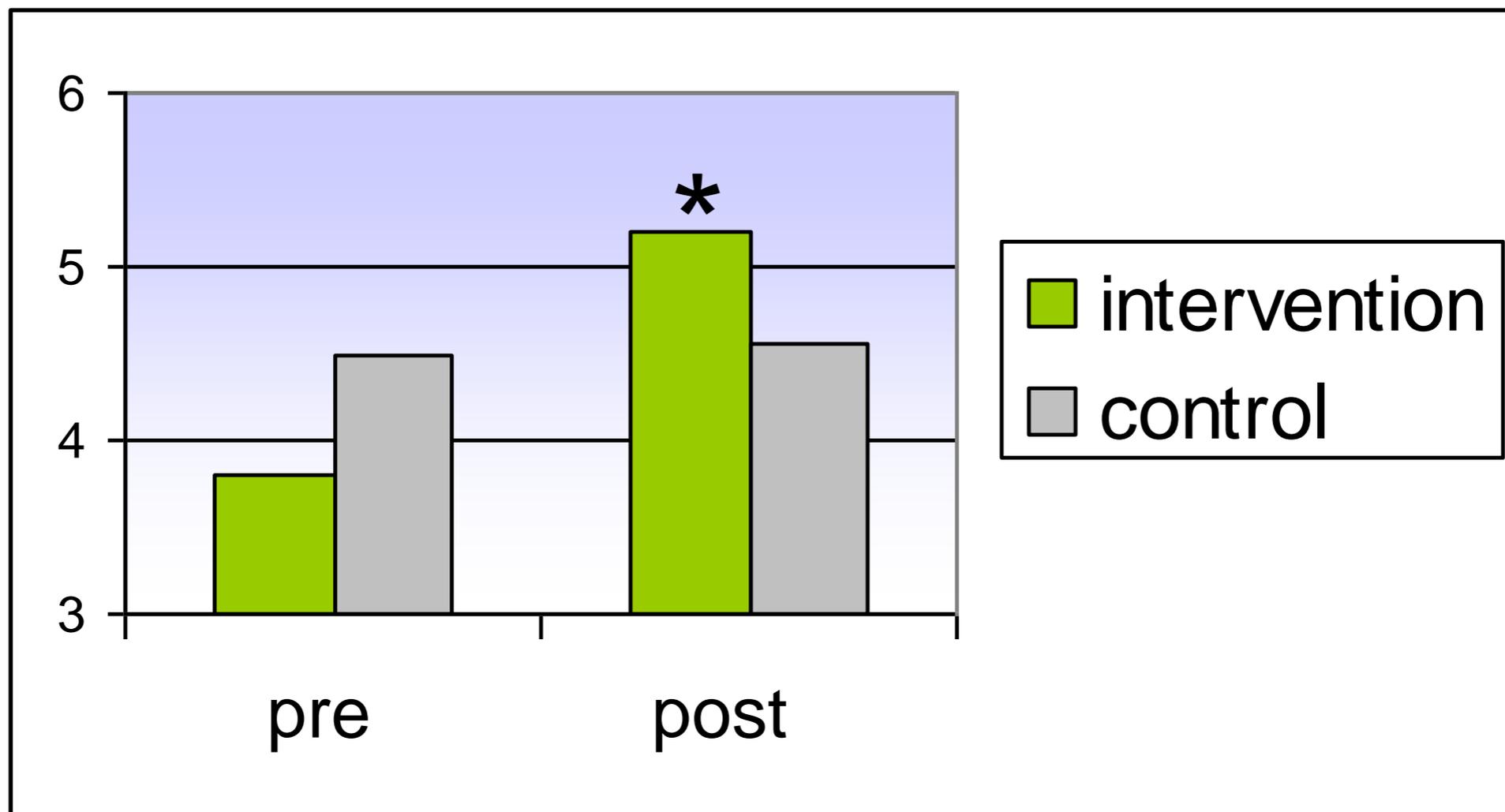
Productivity by collaboration ( $p < ,05$ ) improved:



The environment supports productivity by collaboration, scale 1-7, 1=very bad

## Results (2)

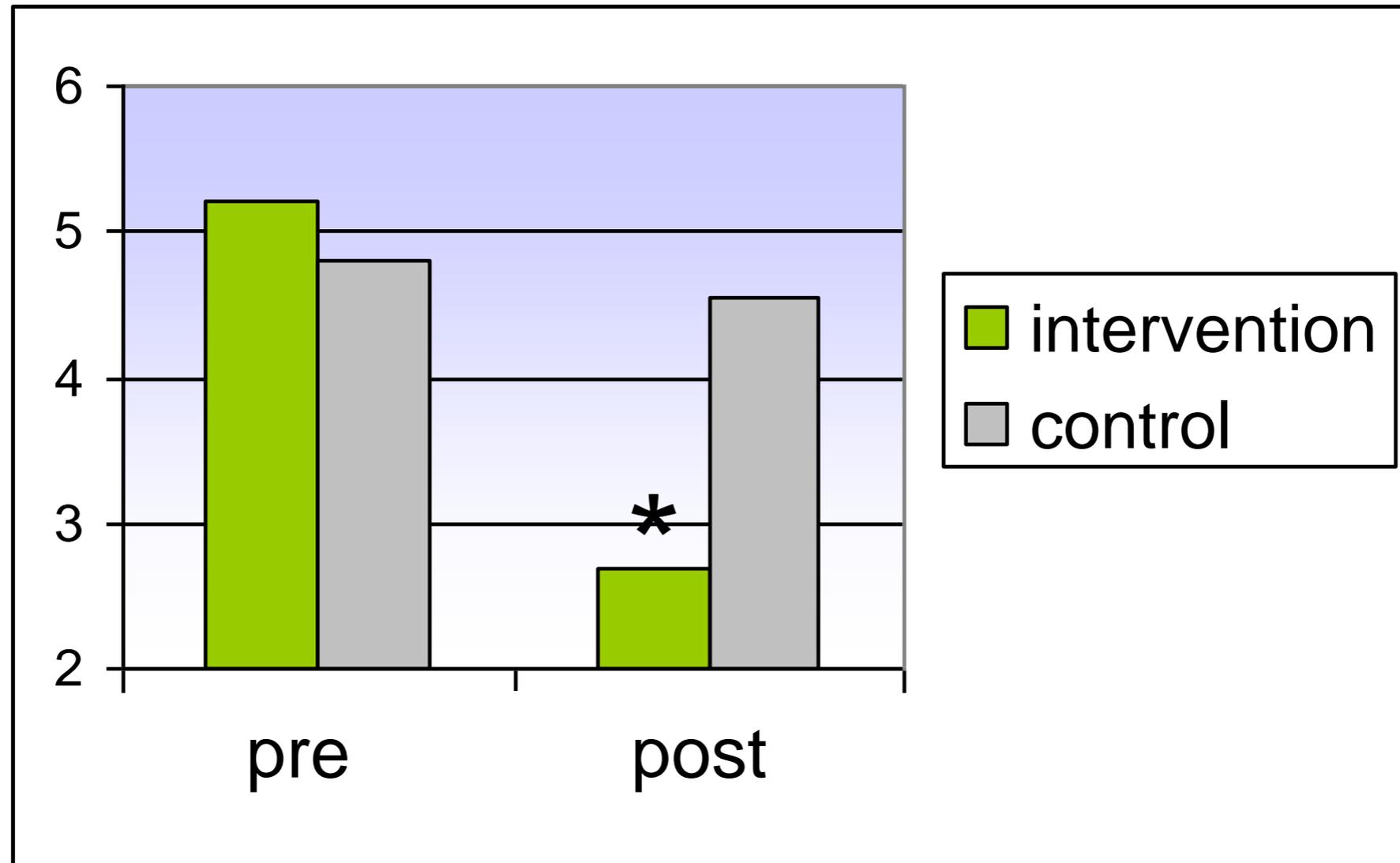
Innovation/creativity better ( $p < ,05$ ):



The environment supports creativity in work, scale 1-7, 1=very bad

# Results (3)

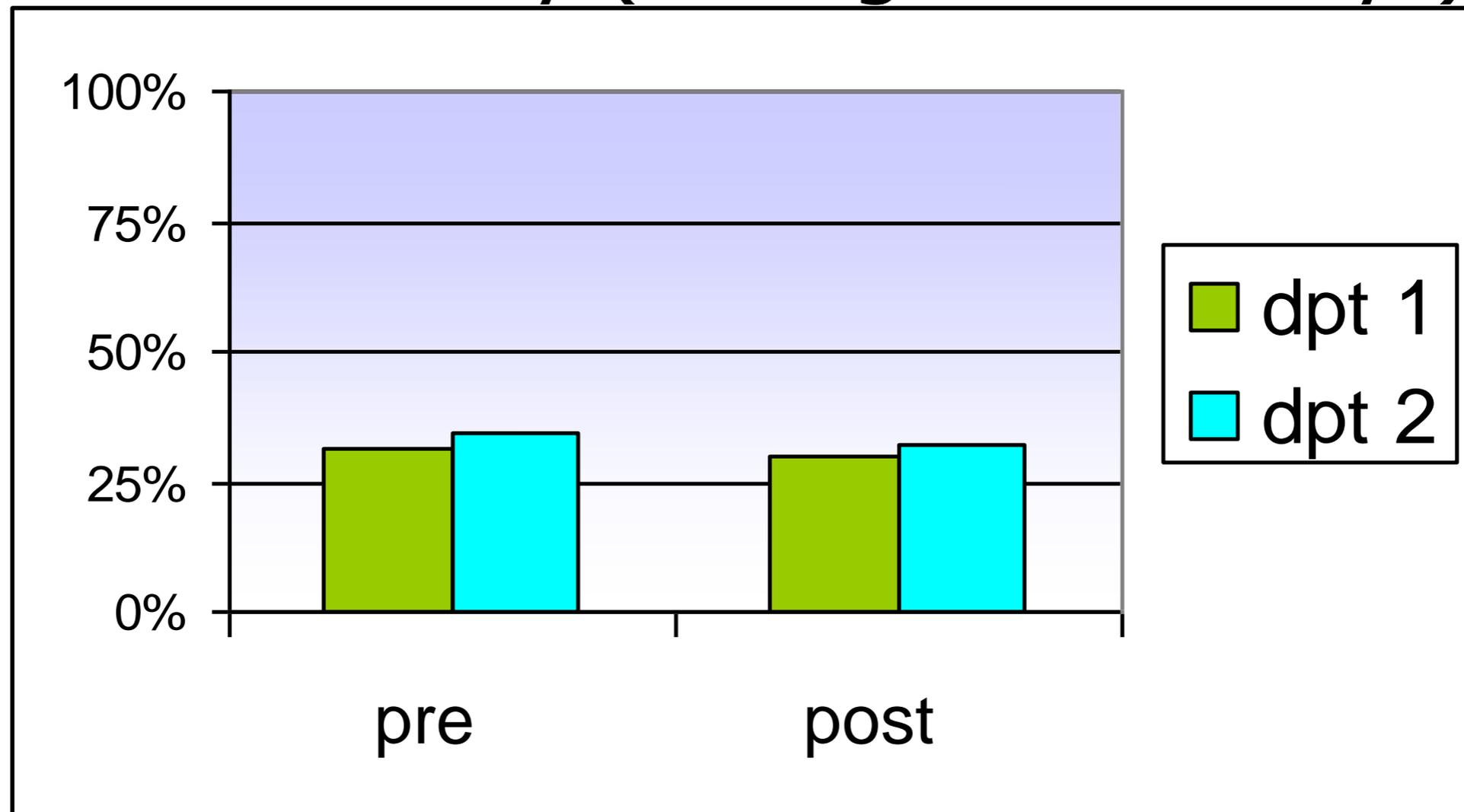
Privacy (personification) sign ( $p < ,05$ ) less



The environment supports the personification of the work place, scale 1-7, 1= very bad

# Results (4)

Percentage meeting spaces not used during the whole day (average over 5 days)



# Measured effects

Pleasure in work

=

Health

=

Productivity

+/=

Innovation

+/=

Representativeness

++

Privacy

--

Communication

+/=

Use of space

+ (enough space)





THE UNIVERSITY OF TEXAS AT AUSTIN  
INSTITUTE FOR ENERGY STUDIES  
AWARDS  
TO  
Peter J. Vitek  
Chairman  
for outstanding contributions  
to the  
Energy Future and Innovation Act  
January 2011

The Hal W. Hendrick Distinguished  
International Colleague Award

to

Peter Vink



for outstanding contributions  
to the  
human factors and ergonomics field

September 2011

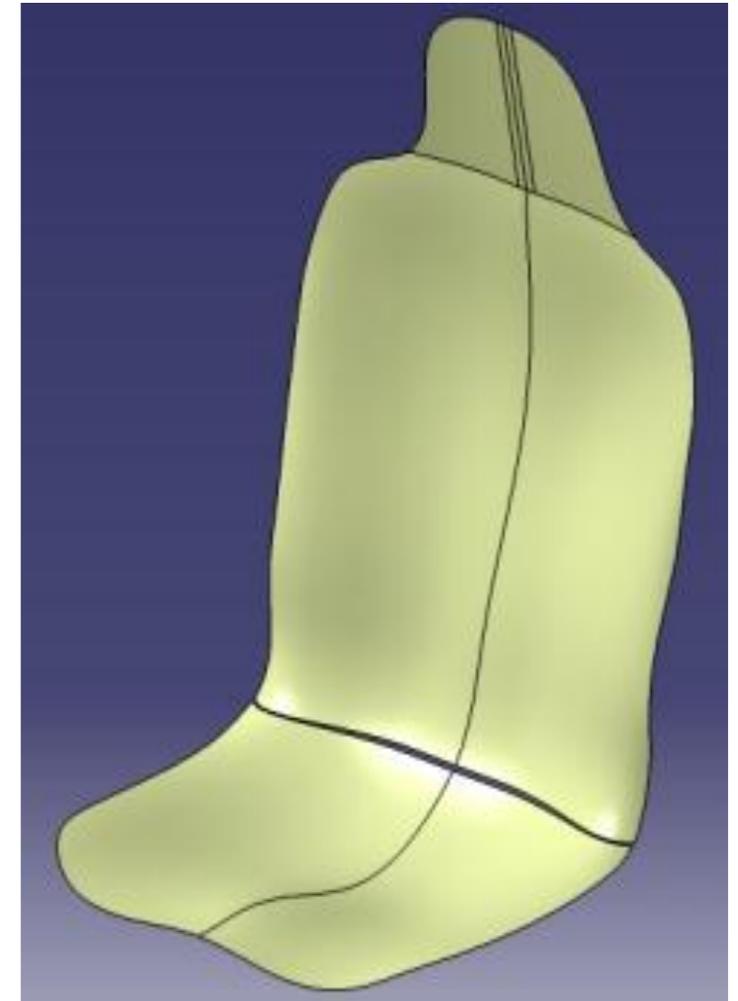
three cases



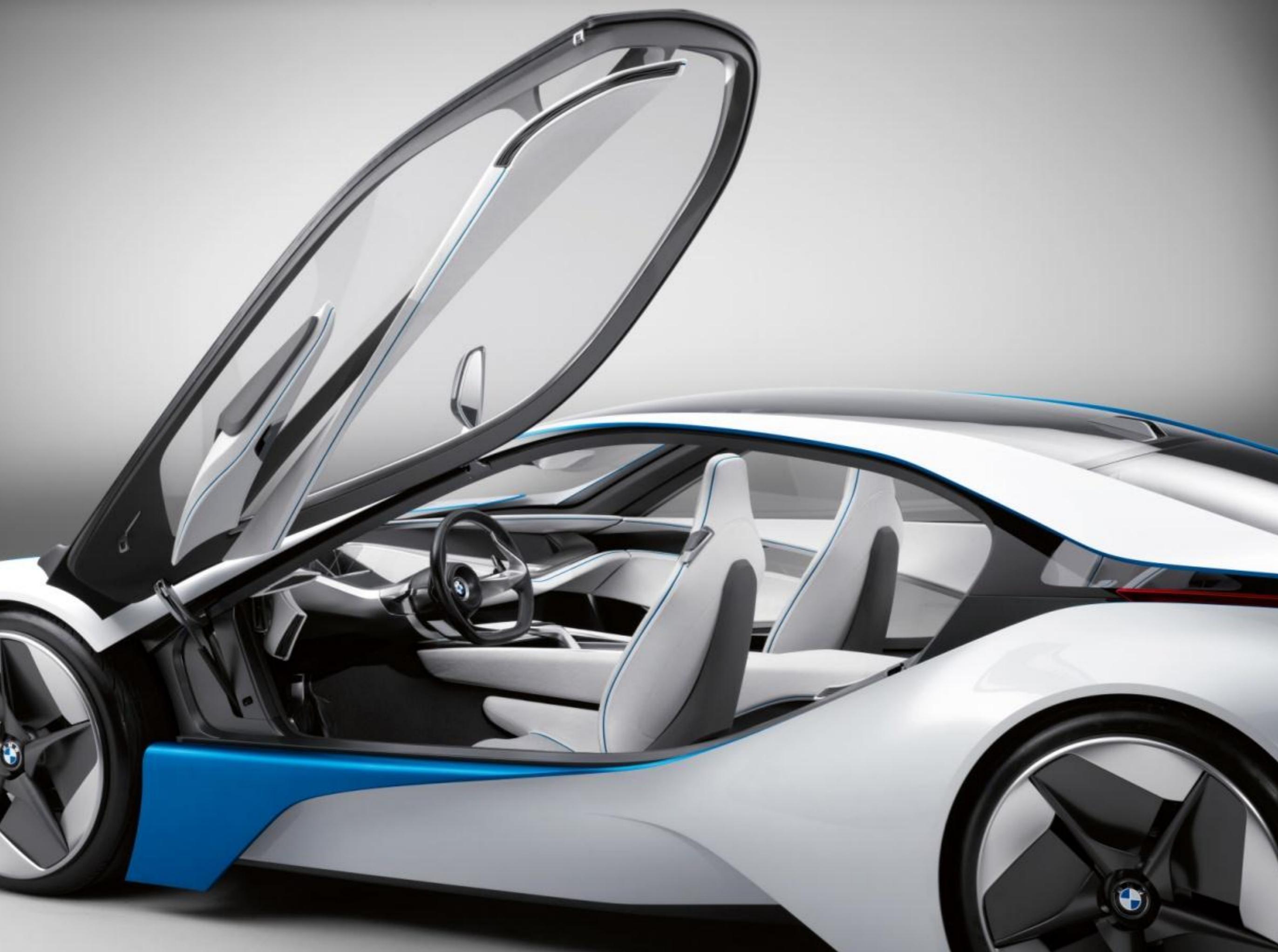
1. New ways of work (NWW)
2. Light weight car seat
3. anthropometrics and aircraft seats



# 3d scanning 25 subjects → catia



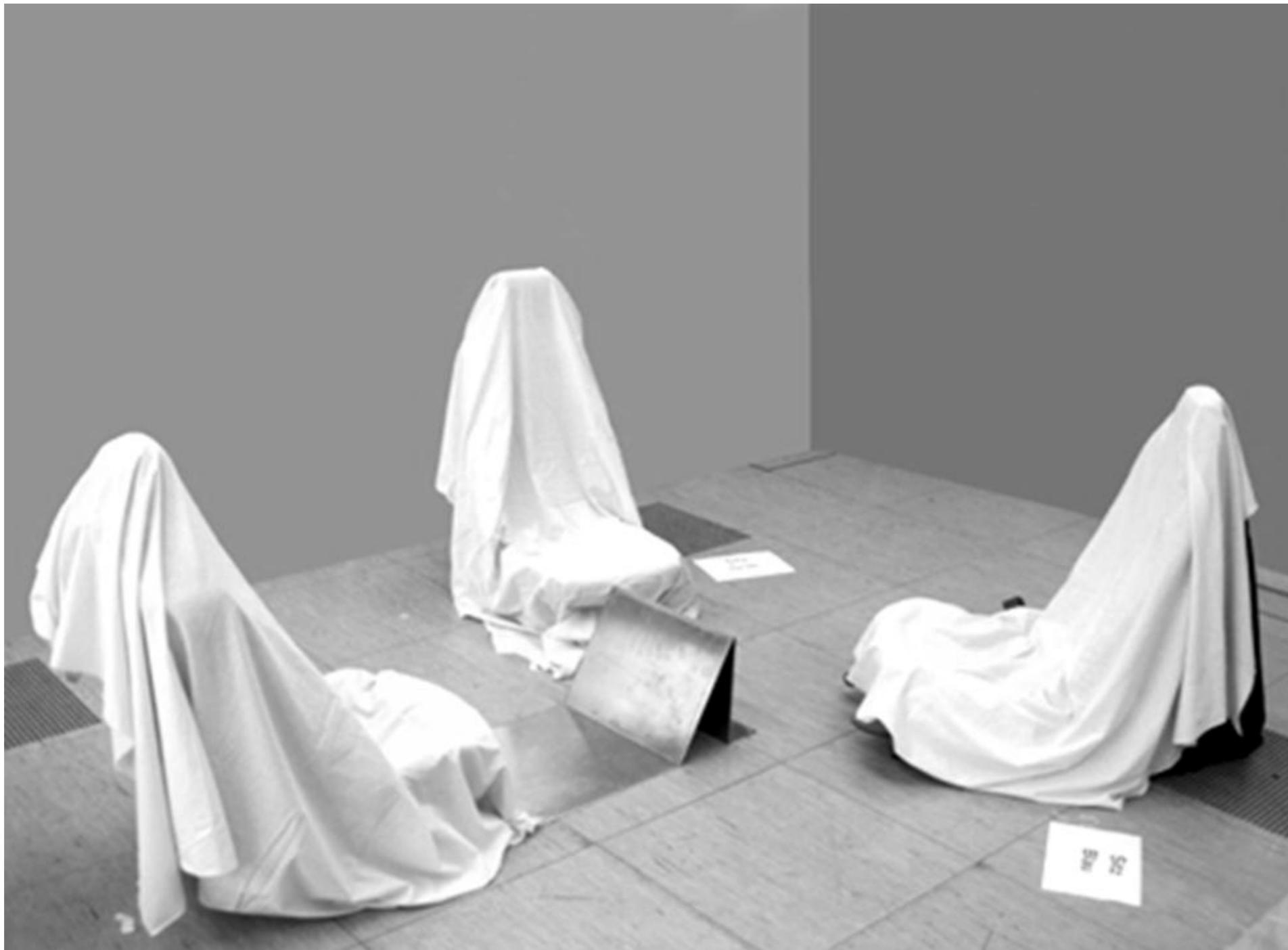
(Franz 2010)



# Seat test 6 seats: too difficult

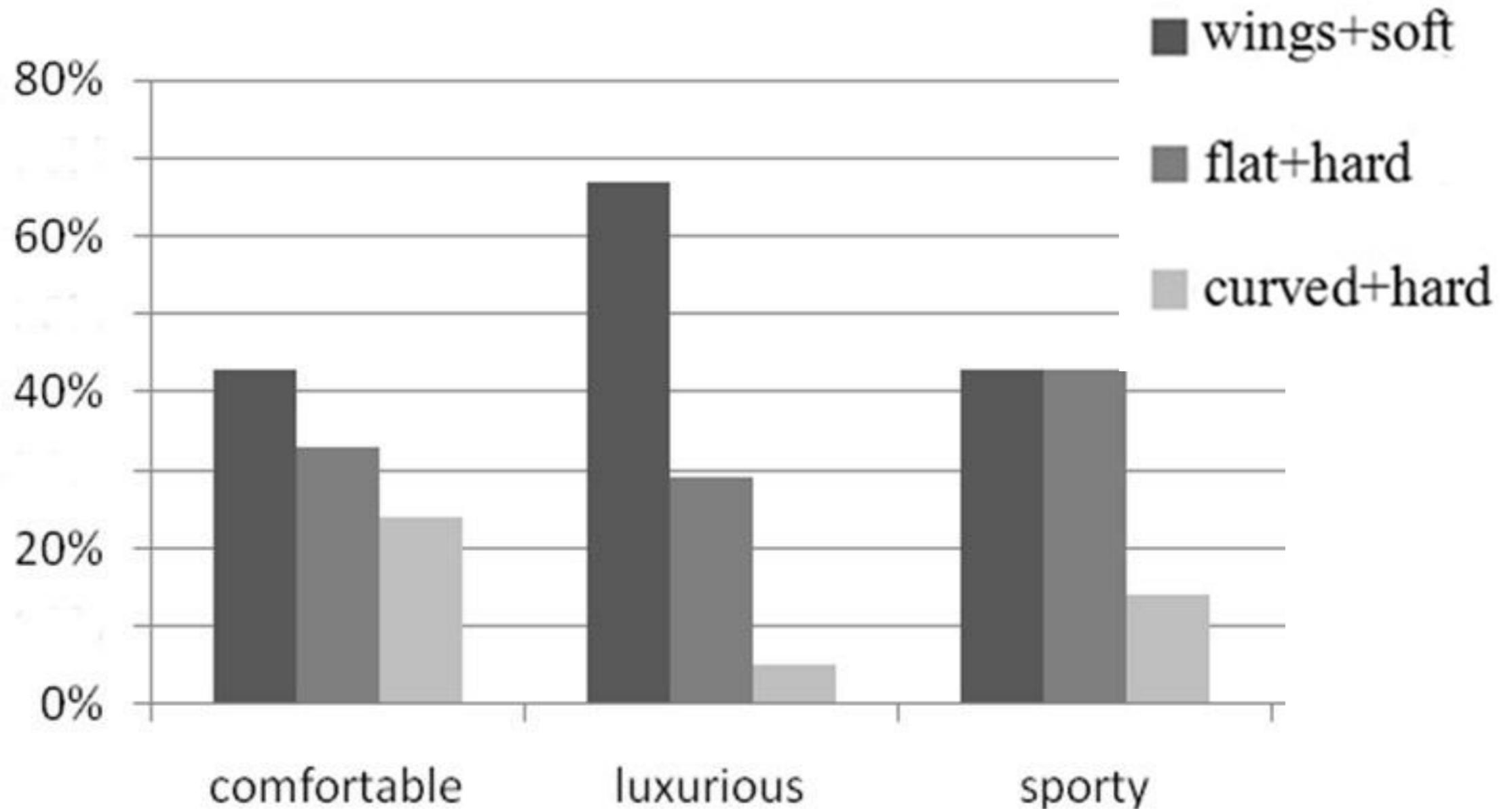


# Three seat tested

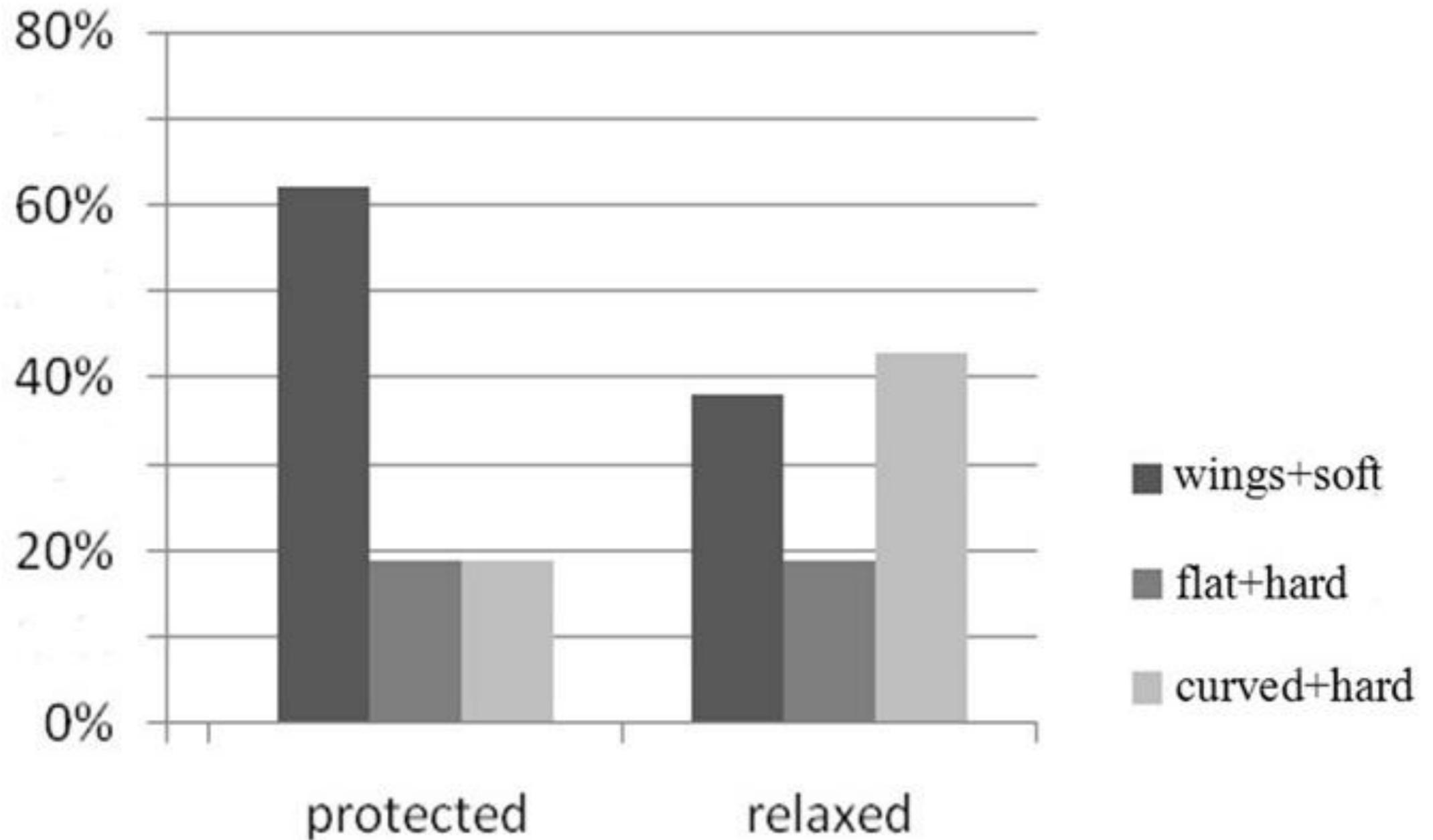


(Kamp 2012)

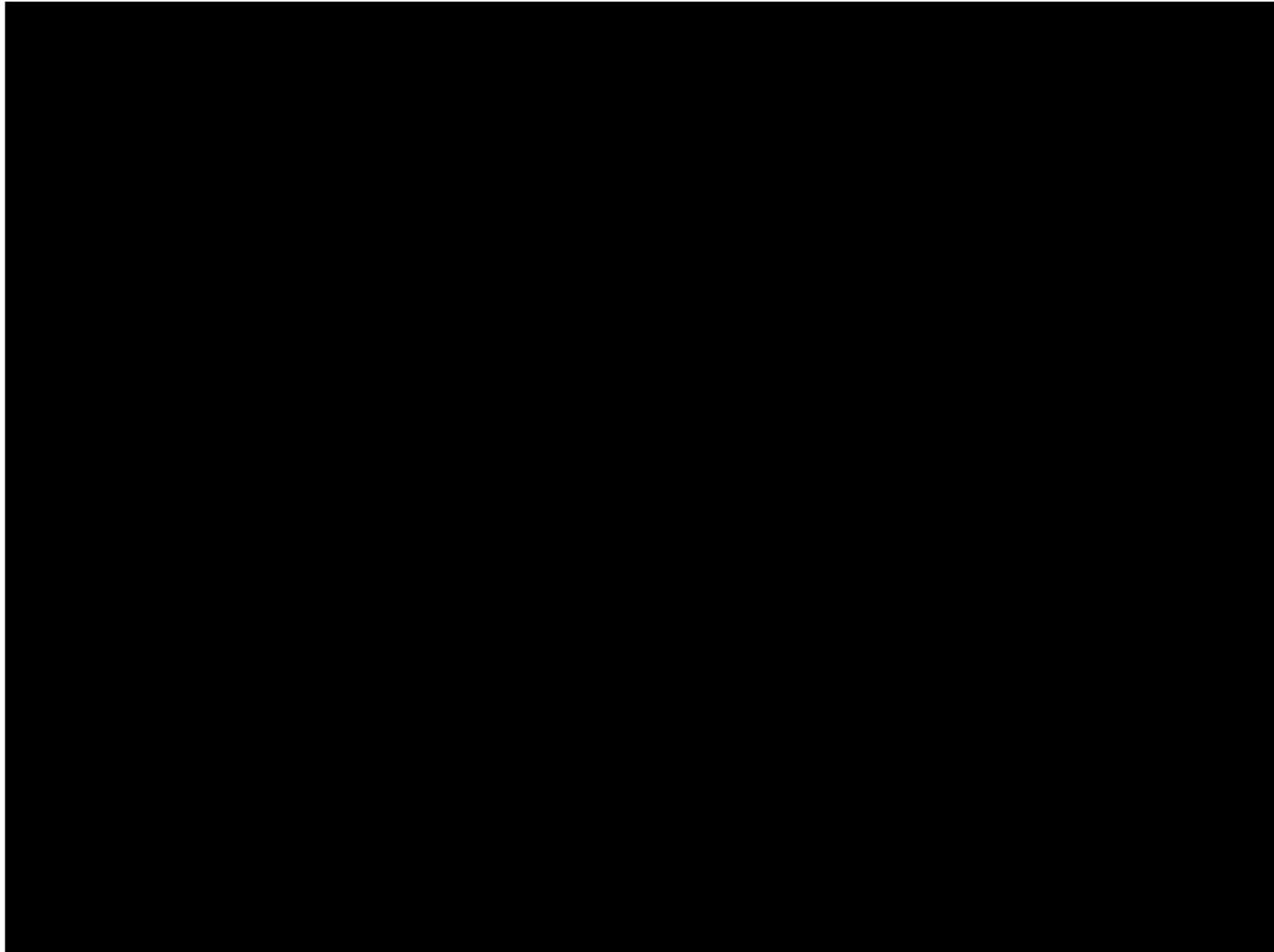
# Three seat tested



# Three seat tested



# Test necessary



three cases



1. New ways of work (NWW)
2. Light weight car seat
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20–30 years of difference: can you see it?

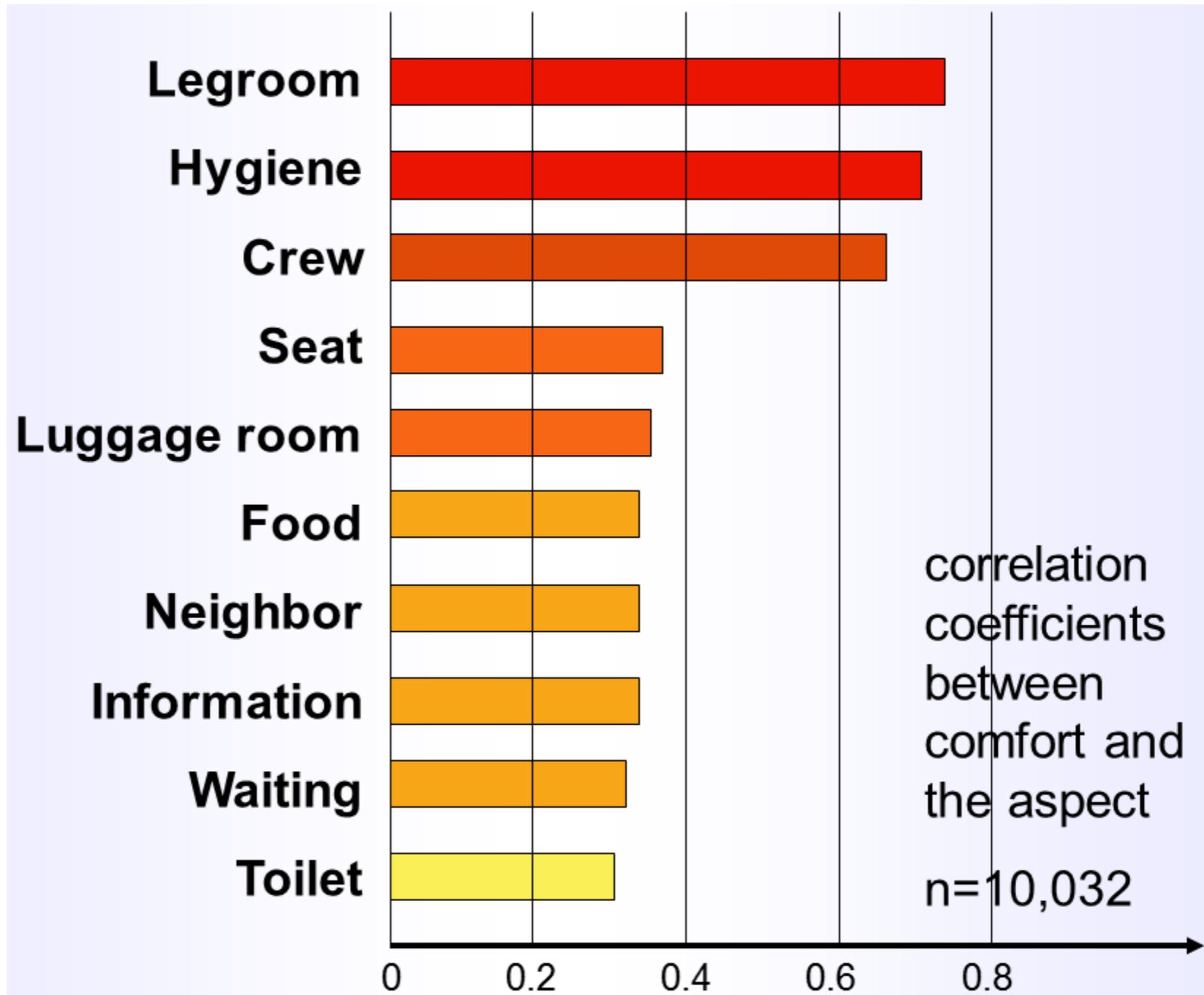


# There are changes, more:

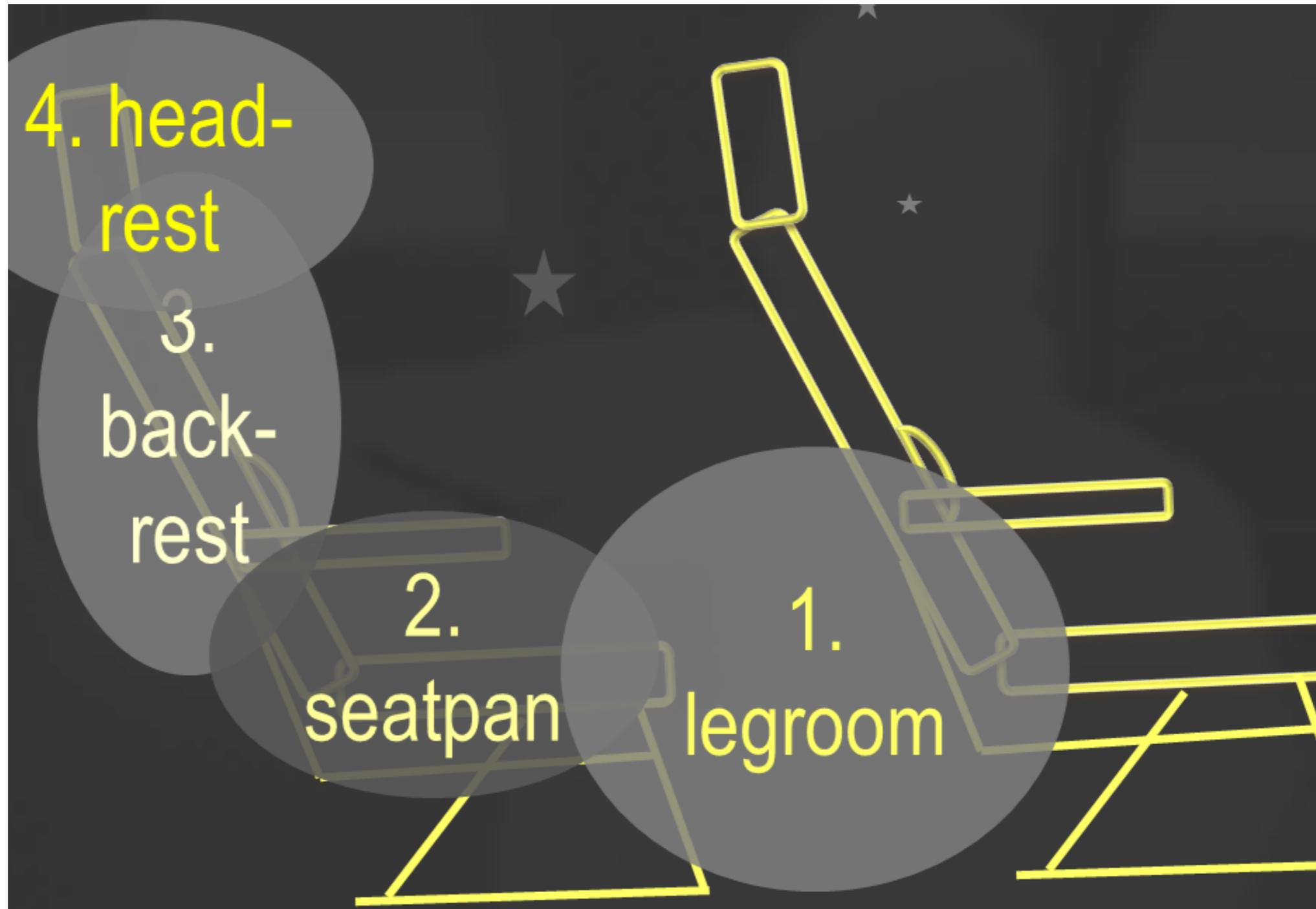
- flying
- companies
- comfort
- differentiation
- possibilities by technology  
(VR, lighting, entertainment (life TV))
- transparency (pitch and comfort scores on internet)
- .....



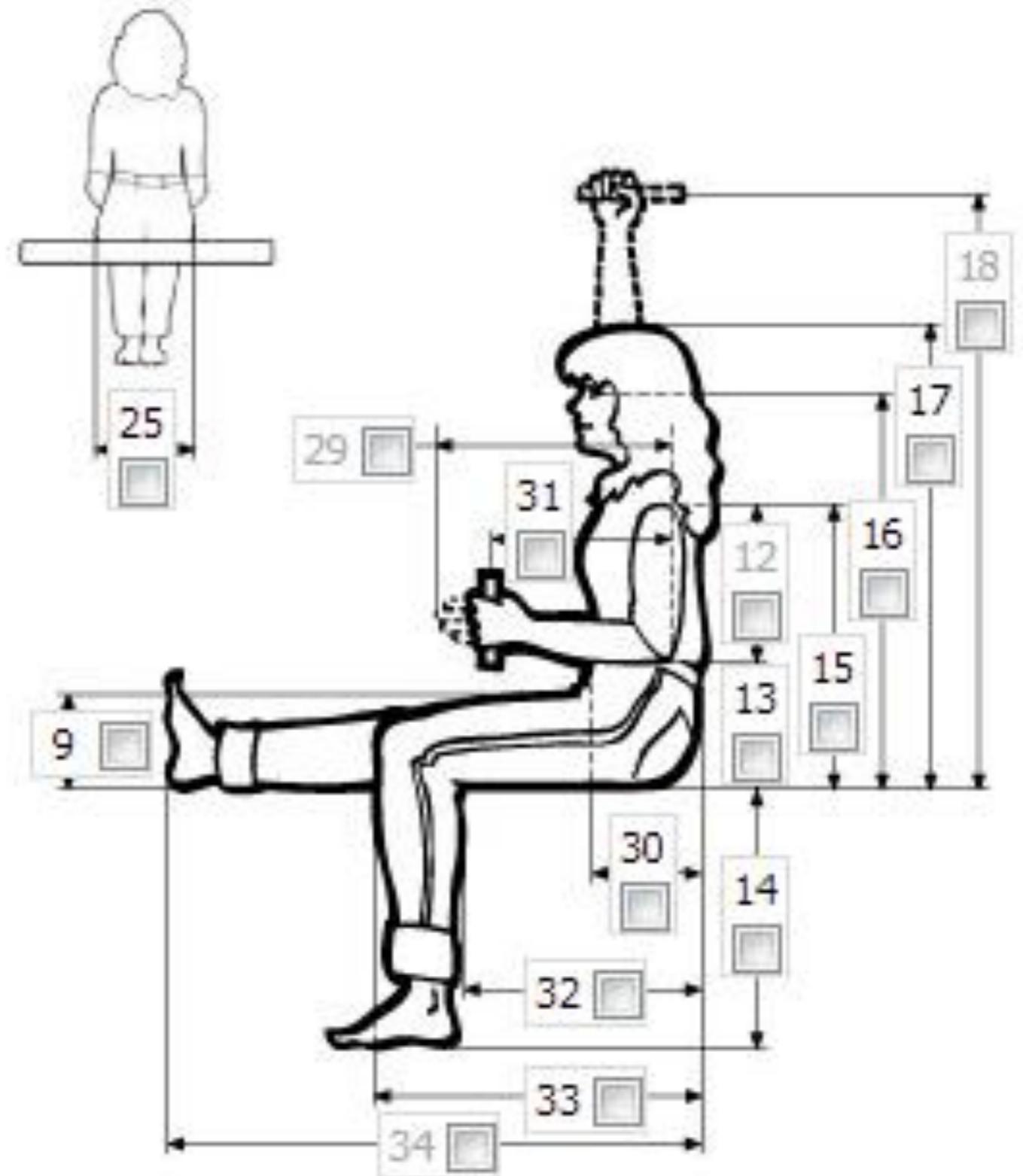
# Vink & Brauer, 2011:



# anthropometric data as seat design input



[www.dined.nl](http://www.dined.nl)



# 1. Legroom: priority nr one



Hip-knee space minimal 665 mm = 26.2"  
(p95 world population, [ww.dined.nl](http://ww.dined.nl))

for p95 male Dutch it's: 705 mm = 27.8"

# 1. Legroom



+ enough shin clearance and footspace  
see also Boeing guidelines  
(Vink & Brauer, 2011)



166 mm = 6.5"



distance between tray table and top of seat  
pan (p95 Dutch population 31-60 years,  
[www.dined.nl](http://www.dined.nl))

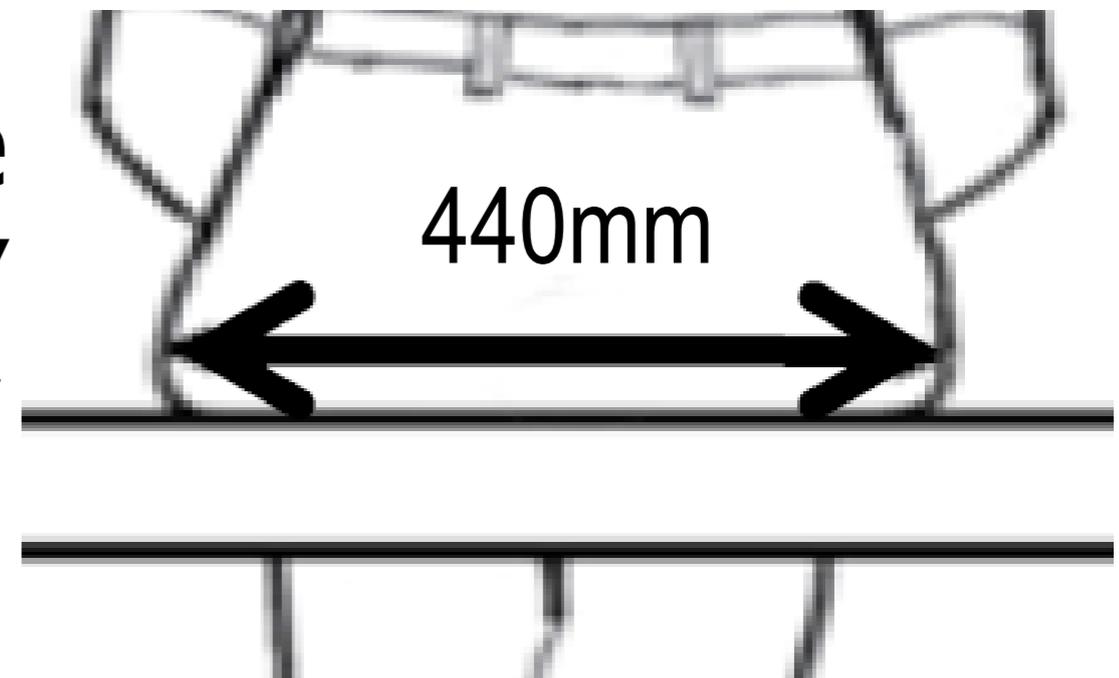
## 2. Seatpan

Width between armrests:  
(Emirates' 777-300ERs  
10-abreast with  
17-inch wide seats)



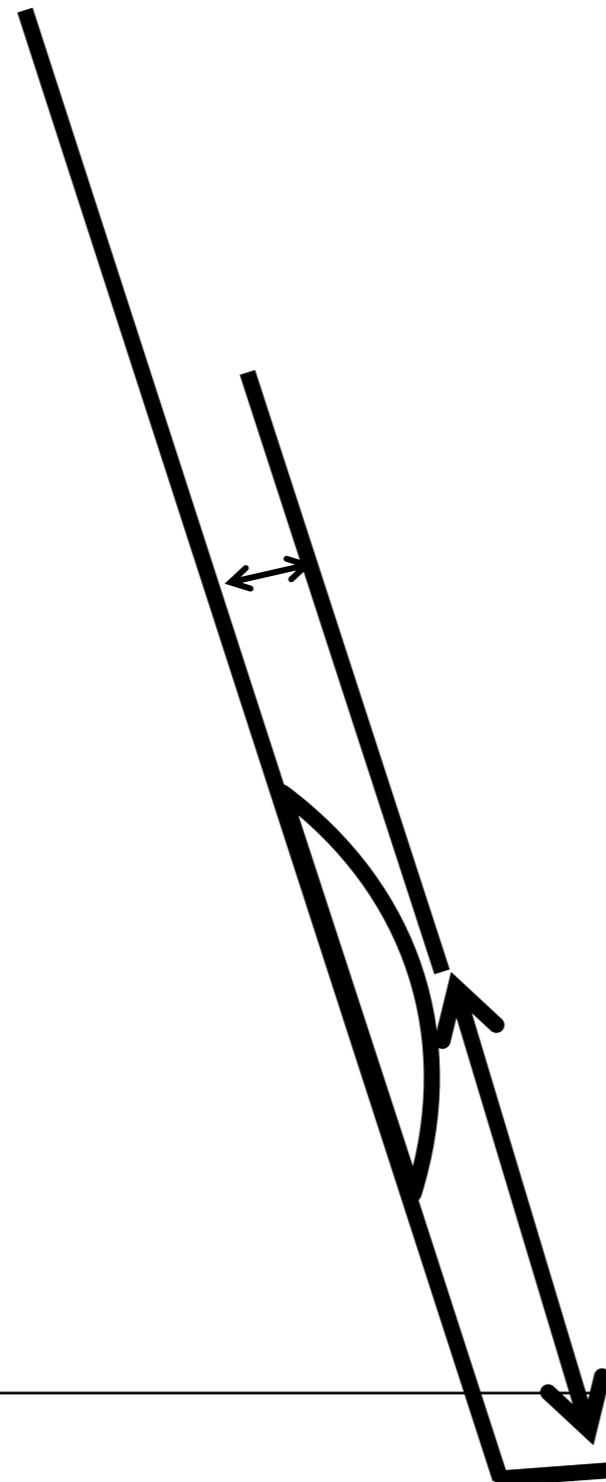
hip width p95 Dutch male

- 1982: 408 mm = 16.1"
- 2004: 440 mm = 17.3"
- 2026: ?472mm?



Source: [www.dined.nl](http://www.dined.nl)

### 3. Backrest: lumbar support

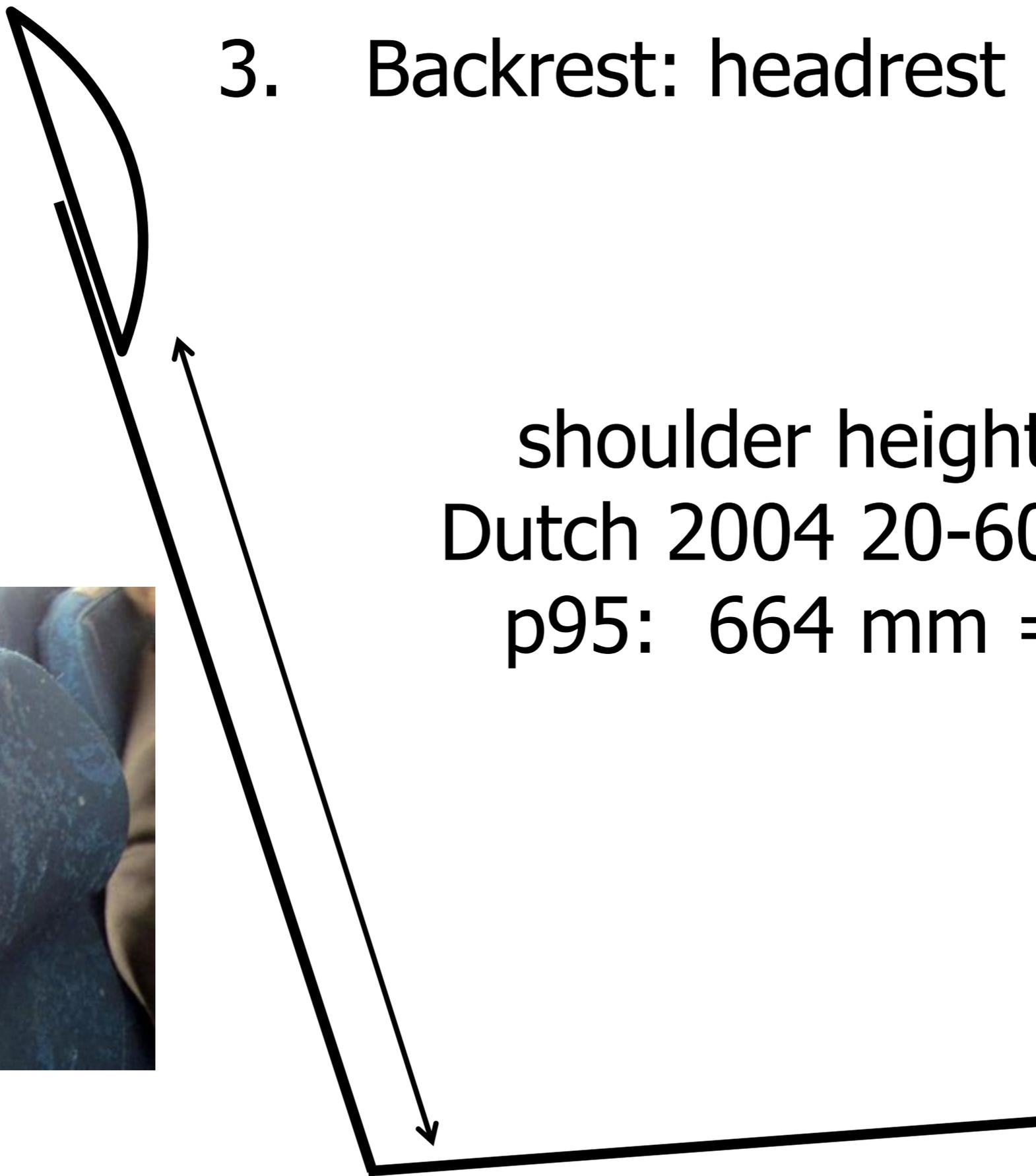


max 30 mm = 1.18"  
(Carcone & Keir, 2007)

South-African  
middle of lumbar support  
120-280 mm above seat pan  
avg 192 mm = 7.56"  
(Korte, 2013)

### 3. Backrest: headrest

shoulder height sitting  
Dutch 2004 20-60 years:  
p95: 664 mm = 26.1"



three cases



1. New ways of work (NWW)
2. Light weight car seat
3. anthropometrics and aircraft seats



HAL W. HENDRICK DISTINGUISHED  
INTERNATIONAL COLLEAGUE AWARD



PETER VINK



THE HUMAN FACTORS AND ERGONOMICS SOCIETY  
presents  
The Hal W. Hendrick Distinguished  
International Colleague Award  
for  
**Peter Vink**  
for outstanding contributions  
to the  
human factors and ergonomics field  
September 2011

# Examination (1)

First sight influences the seat comfort after 10 minutes sitting

A. yes

B. no

Rieck en Keller found that employees experienced the following office **less** productive

A. Office with 2-person rooms

B. Combi office

## Examination (2)

The human contour while sitting in a car is studied 10 years ago

- a. yes
- b. no

The number of cases in this lecture is

- A. three
- B. four

## Examination (3)

Discomfort compared with comfort is more related to

- a. Heavy legs and pressure distribution
- b. First sight and luxury

P95 hip width in 2004 was 17.4". All airplanes are now suitable for this size:

A. yes

B. no

## Examination (4)

The correlation between the knee space and the Comfort in the study of Vink & Brauer (2011) is

- a. 0.73
- b. 0.71

Winner of the H Hendrick Award 2011 is

- A. Marijke Dekker
- B. Peter Vink