



InnoRenew CoE

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Ergonomic Design of Furniture

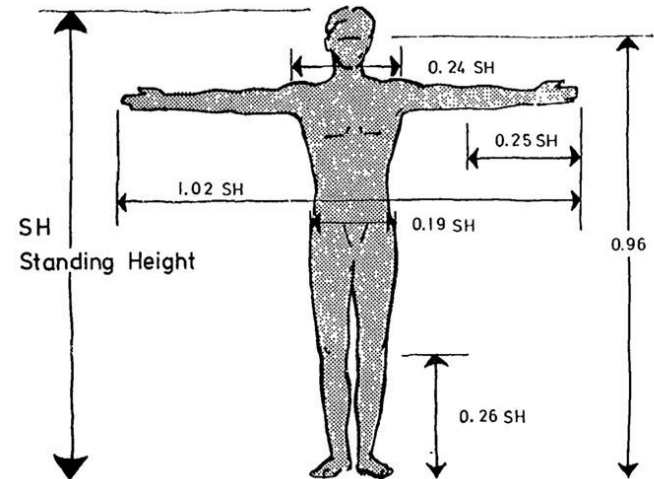
Nastja Podrekar

InnoRenew CoE

Koper, 7.3.2019

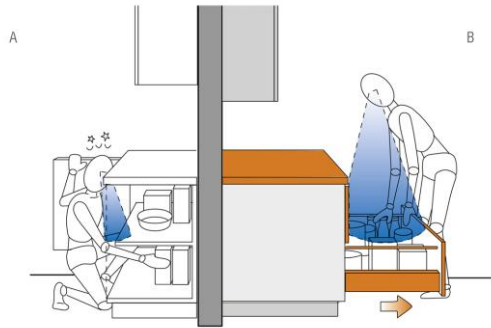
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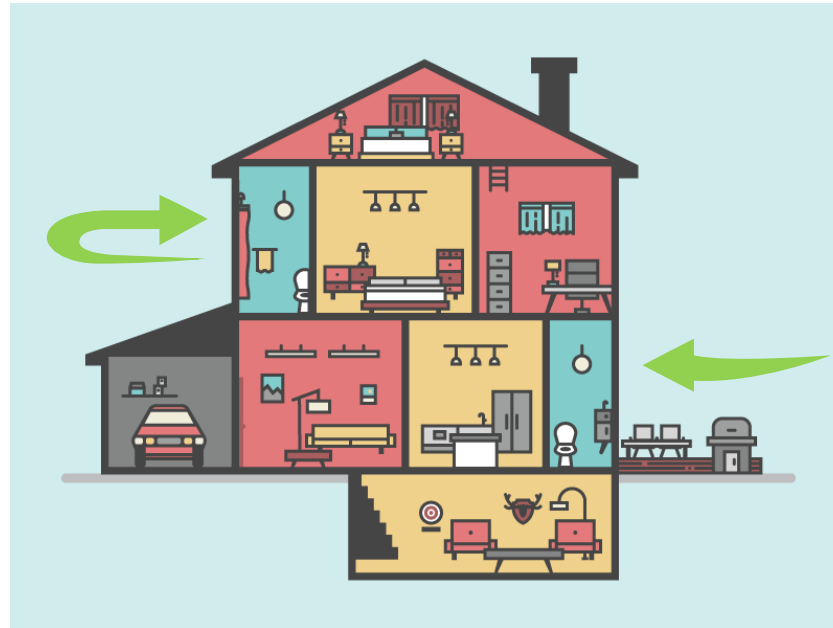


<https://www.ergonomics.com.au/what-is-ergonomics/>

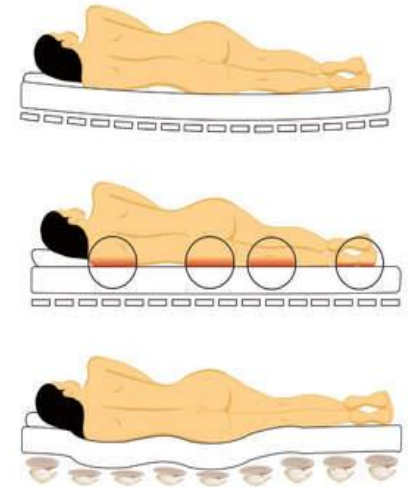
Ergonomics at Home



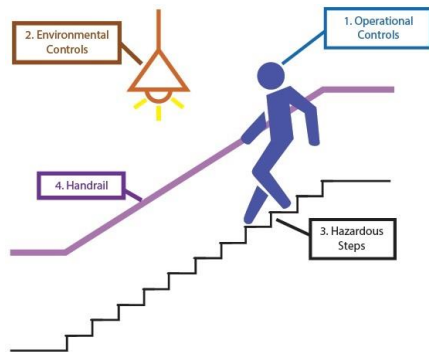
<http://www.valcucine.com/en/planning/ergonomics/>



<https://dribbble.com/shots/3839435-House-Cross-Section>



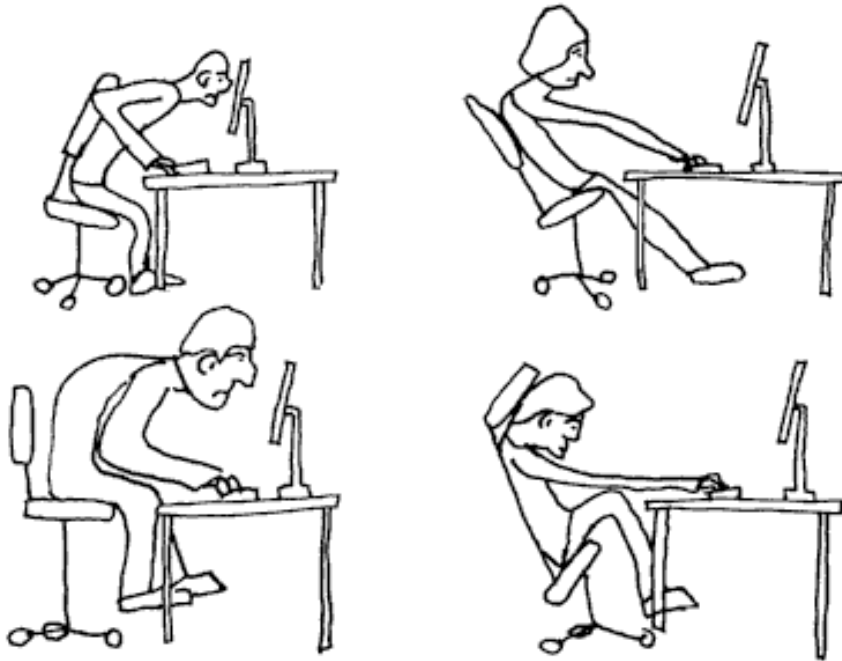
<https://www.kennstduenien.de/sc/hlafsystem-taunusstein-neuhof-wohnkonzepte-weimar-d395955.html>



https://www.hsa.ie/eng/Topics/Slips_Trips_Falls/High-risk_Areas/Stairs_and_Steps/



<https://www.ahrq.gov>



Workplace Ergonomics

Sedentary Behavior

- In the last 50 years an increase in sedentary jobs
- 1953: a higher incidence of cardio-vascular problems in bus and sorter drivers than in bus conductors and postal carriers (Morris, 1953)
- 2000 -> Sedentary behavior is recognized as an independent risk factor for several non-communicable diseases (Dunstan idr., 2012; Katzmarzyk idr., 2009; Matthews idr., 2012, Wilmot idr., 2012)

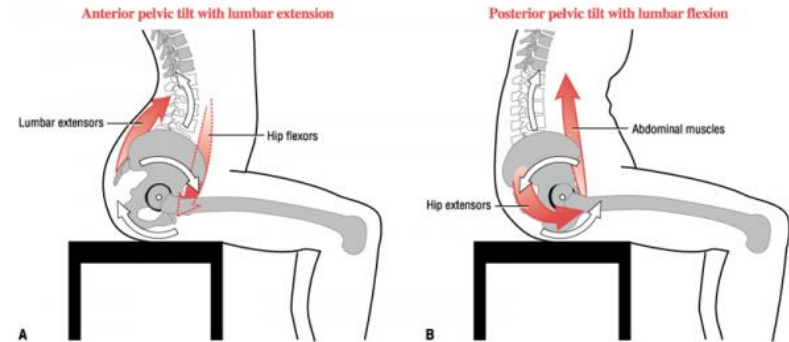


<http://blog.highperformancelifestyle.net>

Workplace Ergonomics

Kinematics of sitting

- Knees and hips are flexed
- Hip extensors are in stretched position
- Hip flexors are in shortened position



<https://runsmartonline.com/articles/strength/the-sitting-athlete/>

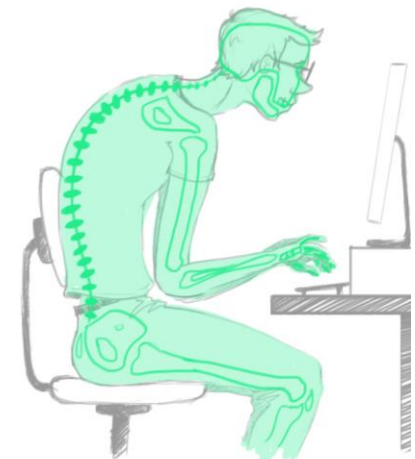


Sarabon, Voglar et al., 2015



Flexion of the lumbar spine

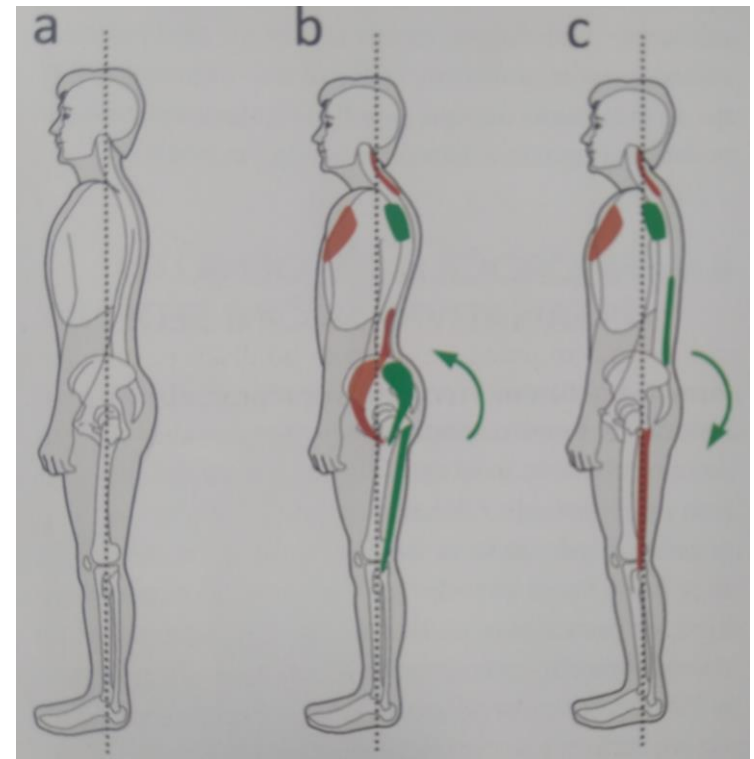
Extension



<http://blog.htmlfusion.com/diy-slouch-detector/>

Workplace Ergonomic

Possible impact of long-term uninterrupted sitting on standing trunk position.



Sarabon, Voglar et al., 2015

Imbalance between the muscle groups that control the position of the trunk when standing.



<https://runsmartonline.com/articles/str-length/the-sitting-athlete/c>

Ergonomic Workplace Design

- Maintaining the neutral position of the body
- Avoid static loads
- Adjustable furniture

Chair:

- Adjustable seat angle
- Adjustable seat height
- Adjustable seat depth
- Upholstered seat
- Adjustable backrest angle
- Adjustable armrest
- Chair wheels



<https://www.officereality.co.uk/prod/4443/ergox-double-ergonomic-desk-mechanical-elevation>

Table:

- Adjustable height
- Horizontal surface
 - Tilted table for reading/writing
- Under-desk clearance

Recommendations - Sitting

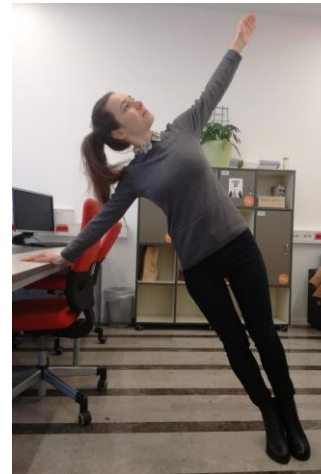
- Upper edge of the screen at an eye level or a few cm lower
- Shoulders relaxed
- Forearm resting
- Hip angle: 90° - 120°
- Knee angle: 90° - 140°
- Feet fully on the floor



Sarabon, Voglar et al., 2015

Recommendations – Active breaks

- Standing up/walking every 50-120 minutes for at least 10-20 seconds
- At least 2 a day: 5-10 minutes – active break
 - Stretching the muscles in shortened position
 - Activating the muscles in stretched position
 - Keeping the balance between the strength and flexibility



Workplace Design – New Approaches

Sit-to-Stand tables



<https://www.larryswanson.com/office-fitness/standing-desk/>



Cycle Desk



<https://exercisebikesexpert.com/exercise-bikes-get-fit-work/>

Treadmill Desk



<https://rochesterfitnessequipment.com/product/tr1200-dt3-desk-treadmill/>



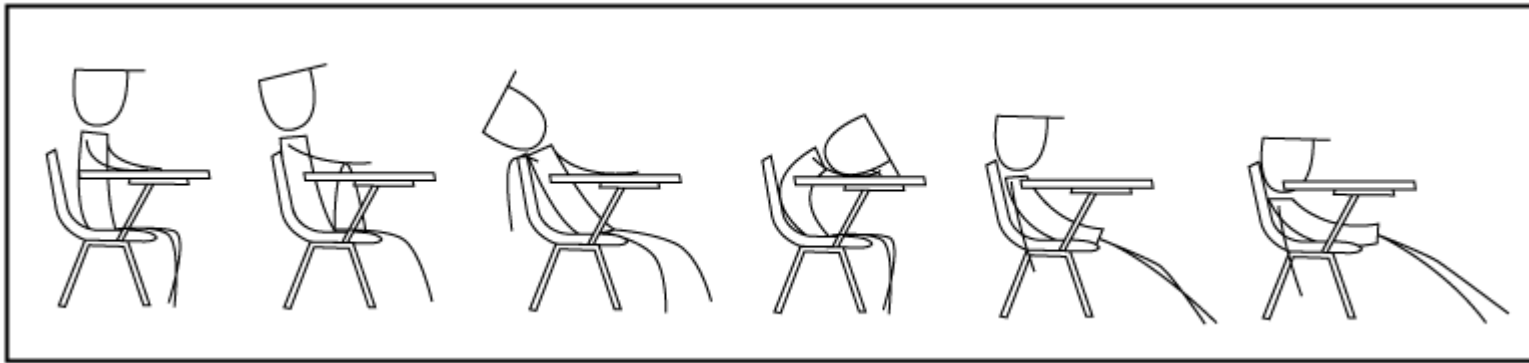
Research work – Active Office

Active Office

- Sit-stand table
- Cycling station
- Multi-position chair
- ICT reminders
- Training station

The project will design, construct and test **ergonomically adaptable office furniture** from **wood** to support **active working** environments that promote **user's health** and **reduce** time workers spend in **sedentary positions**.





<http://www.thedoghouseidiaries.com/2376>

Ergonomics in Schools

School Ergonomics

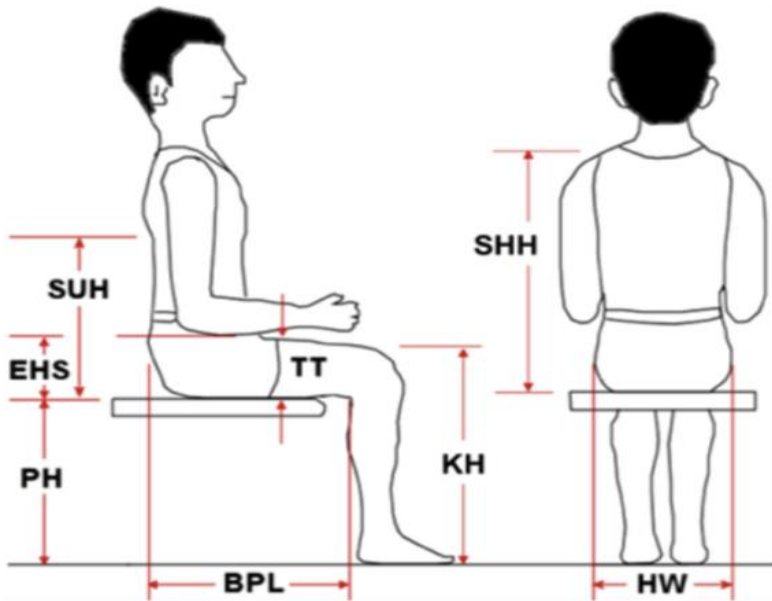
- Children and adolescents spend up to 8 hours in schools – mostly sitting

Problem: furniture-student mismatch:

- Desk height unsuitable:
 - 81 % (Guavali et al., 2006)
 - 80 % (Batistao et al., 2012)
 - 51 % (Dianat et al., 2013)
- Seat height unsuitable:
 - 71 % (Guavali et al., 2006)
 - 85 % (Castellucci et al., 2010)
 - 57 % (Batistao et al., 2012)
 - 60% (Dianat et al., 2013)



<https://www.wsj.com>



Research work – School Ergonomics

ErgoClass



Anthropometric Measurements

Furniture Not Suitable

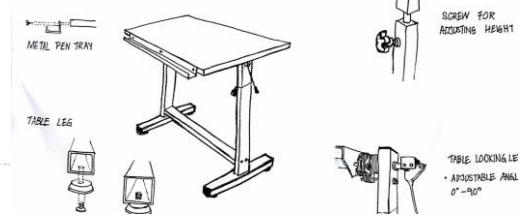
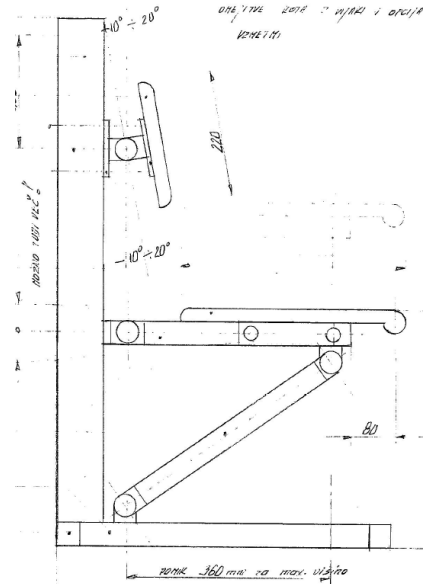
	No. students	% of students
Table Height	41	29,4 %
Seat Height	44	31,6 %
Seat Width	57	41 %
Seat Depth	54	38,8
Upper Edge of Backrest	4	2,8
Under-desk Clearance	136	97,8 %

- In collaboration with:
 - Škofja Loka Carpentry High School
 - Additional measurements: Secondary Technical School Koper, University of Primorska, Primary schools Šmarje

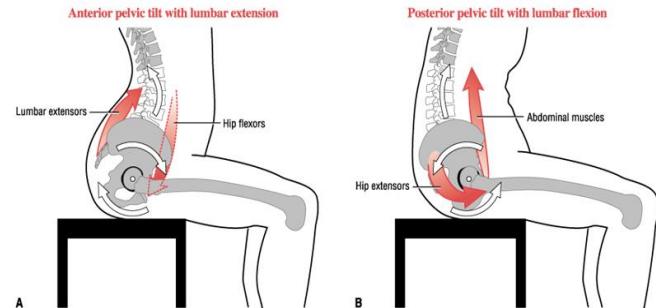


ErgoClass

- Development of adjustable school furniture
- Determine the most suitable parameters:
 - Based on anthropometric measurements and standards
 - Seat: height adjustable, depth adjustable, width, inclination?
 - Backrest: width, height adjustable, tilt adjustable
 - Table: height adjustable, tilt adjustable, sit-to-stand



Questionnaires : comfort/discomfort



<https://letsbands.com/en/blog/pelvic-tilt-hollow-back-back-pain/>



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Thank you for your time.