

# Project 01

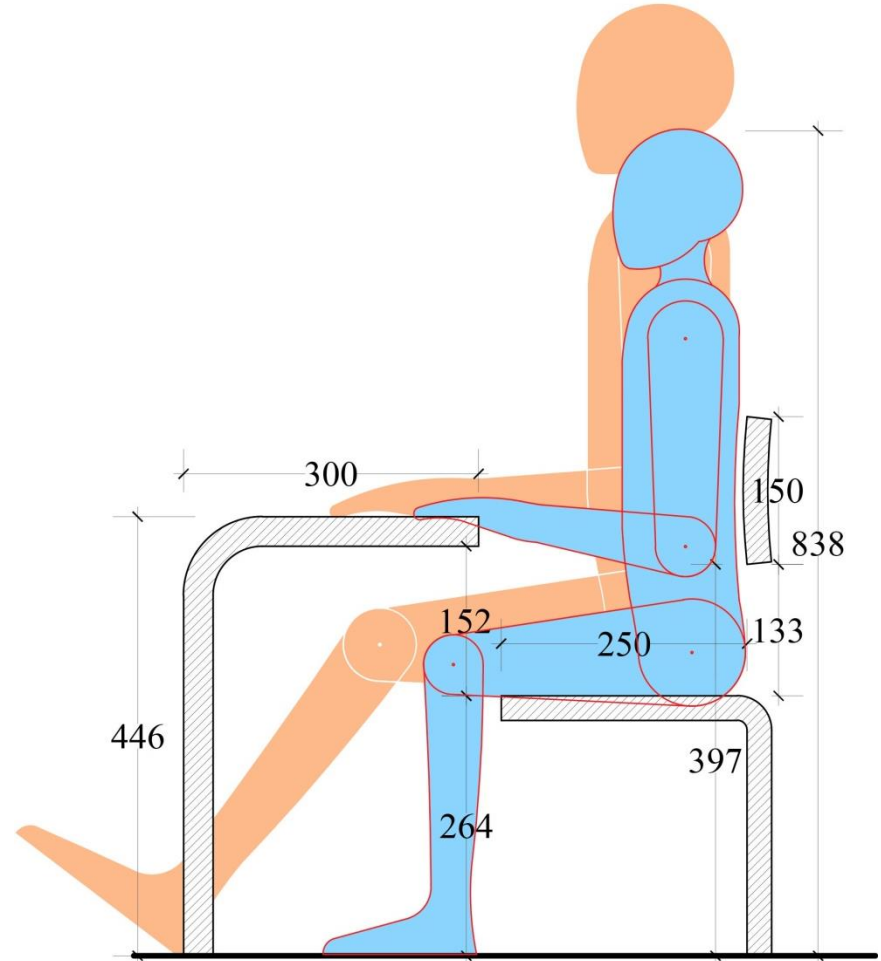
Under the supervision

Of

Prof. G G Ray

By

Sukanta maharana  
roll No. 176130001



**Ergonomic Standards for  
primary school furniture; Dimensional aspects  
(age group 6-8 years)**

## **Why furniture ?**

It involves full body interaction and gives an opportunity to understand anthropometry and ergonomics better.

## **Why primary school furniture ?**

For the first time in life kids acquire seating posture for prolonged time.

## **Why age group 6-8 ?**

Starting to practice prolonged seating posture.  
There are no ergo. standards for kids furniture.

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- There are no ergo. standards for kids furniture.

**Are the furniture used in Indian schools,  
ergonomically correct ?**

## Approach

- Market study.
- Visiting schools, talking to teachers and parents.
- Possible problem identification.
- Understanding the body dimensions.
- Understanding the bio-mechanics.
- Finalise the percentile(%ile) value consideration.
- Development of drawings according to %ile value taken.

- Make mannequins of 5<sup>th</sup> %ile and 95<sup>th</sup> %ile value.
- Use the mannequins on drawing to check correct %ile value for different components.
- Finalise the %ile value of different components and make final skeletal drawing.
- Make concept for the furniture using the final %ile value.
- Make scale models of the concepts.

## Activities performed on school furniture :

- Basically used to sit and study.
- Kids keep their lunch box, water bottle, book, and school bag in it.
- Kids use it as their dining table.
- Kids use it to play various games.
- Kids fight on the same table.
- Kids jump on the furniture.
- Kids move the furniture around class room.

## Existing school furniture :



Source : <http://www.popcornfurniture.com/school-furniture/single-desks-benches-chairs-series/>  
<http://www.classroomfurniture.in/>



Source : IIT Bombay campus school, Kendriya Vidyalaya IIT Bombay, Aman Day care IIT Bombay.

## What does school administration look for before procuring furniture ?

- Table and chair should be attached.
- There should be place to keep school bag and water bottle.
- Low height table top.
- Edges should be rounded and smooth.
- Material quality should be good for durability.
- Preference for coloured furniture.
- It should be stable.

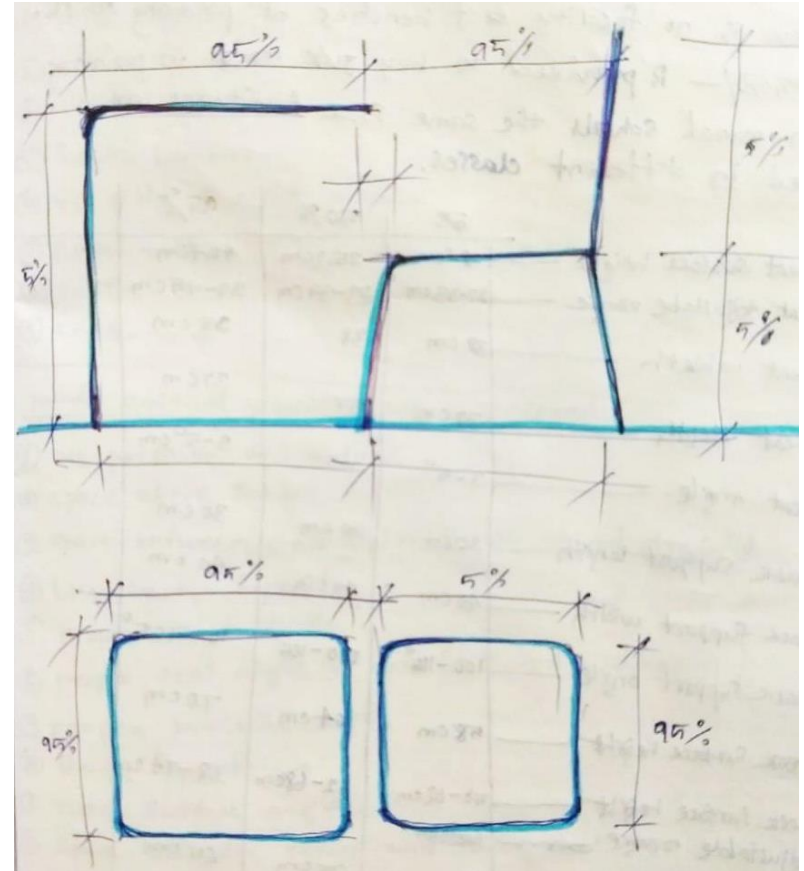
## Problems

- Possible back pain due to sustained bending body position leads to slip disc.
- Possible Numbness in legs and leg pain due to incompatible seat height.
- Possible numbness in hand due to pressure under wrist against table edge.
- Possible neck pain due to sustain forward bending position.
- Possible shoulder pain due to incompatible table top height.
- Getting in or getting out and stand in-between is difficult due to improper spacing

\* These problems are identified through literature survey and personal questioner with the parents and teachers.

## There are four basic parts in school furniture :

- The table.
- The chair.
- The space between table and chair.
- The space for keeping school bag and water bottle.



## The table :

The table has four components

- Table top **height**
- Table top **depth**
- Table top **width**
- Table top **angle**

## The Chair :

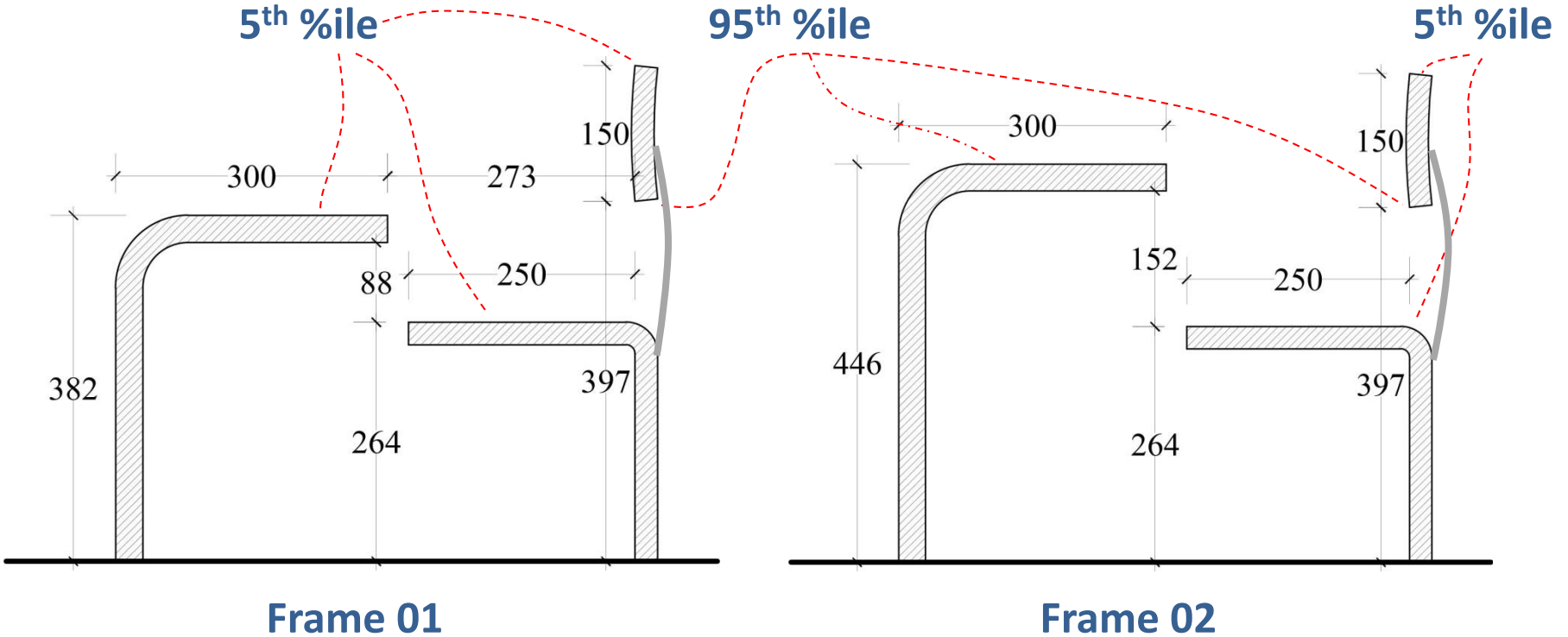
The chair has six components

- Seat height
- Seat depth
- Seat width
- Seat angle
- Backrest top and bottom height
- Backrest angle

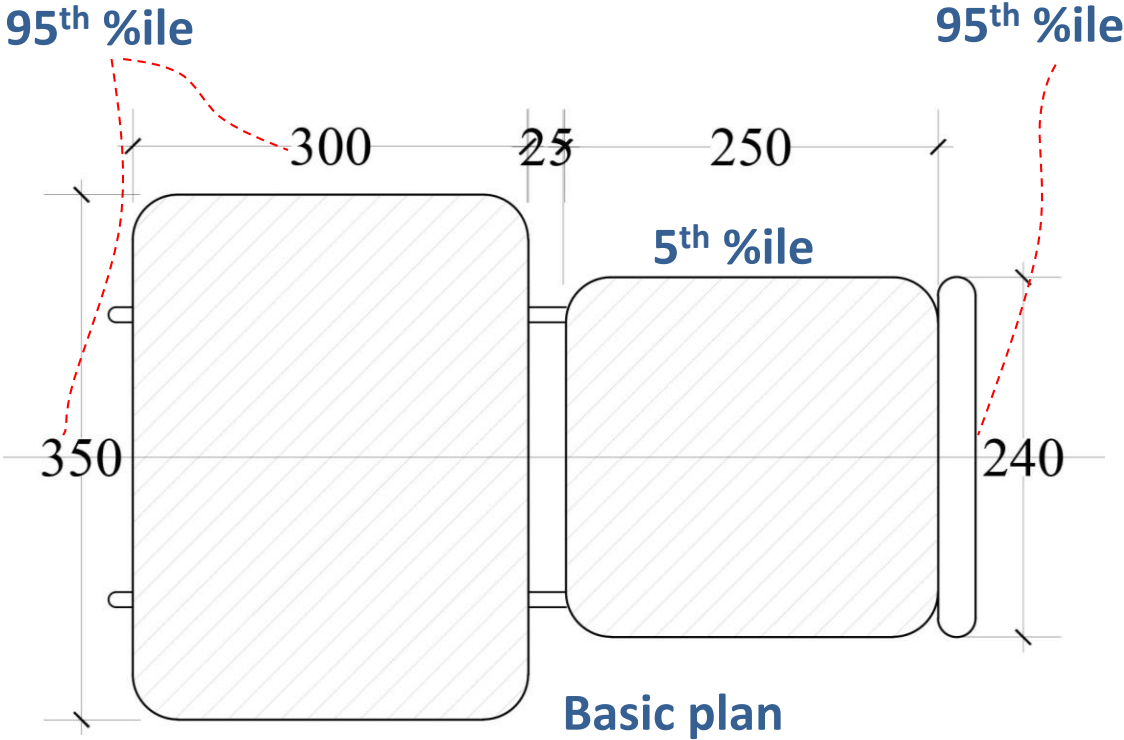
## **The space between table & chair :**

- Distance between table and chair
- Leg clearance

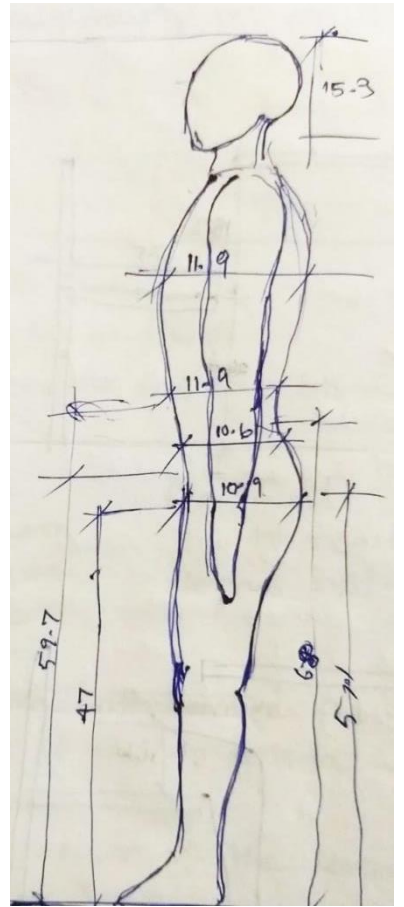
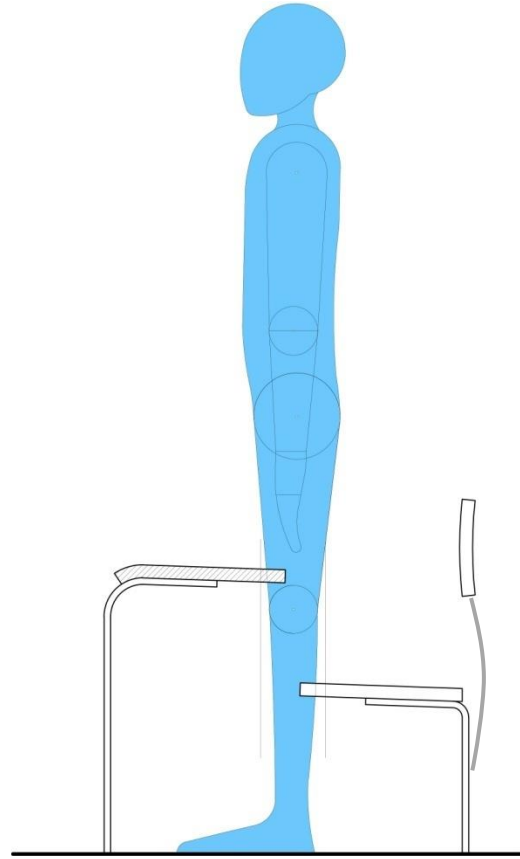
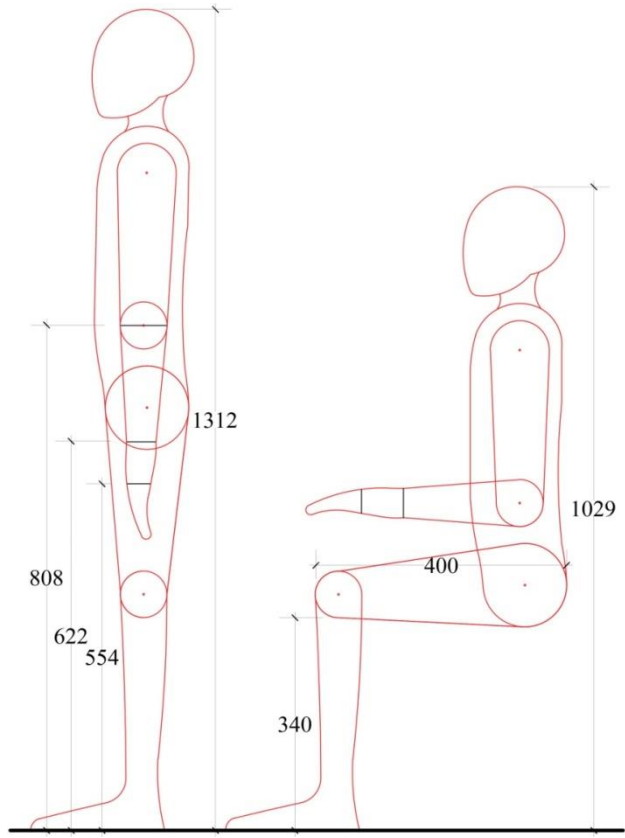
# Skeletal drawing with different %ile values :



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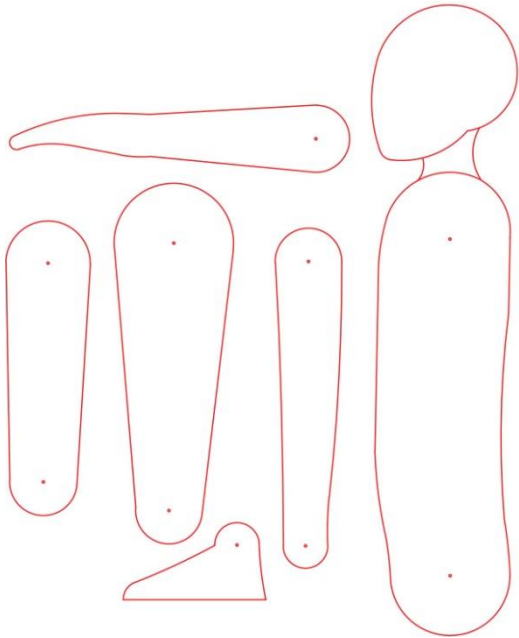


# Mannequin making :



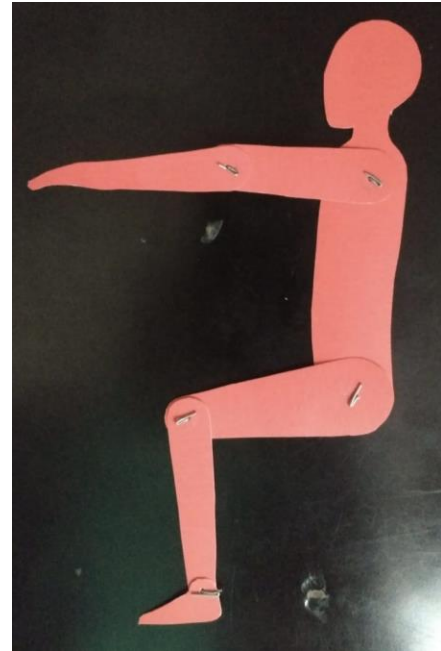
Source : "Anthropometry of indian school children" by G G Ray and N Sadhu.

## Mannequin making :



95<sup>th</sup>  
%ile

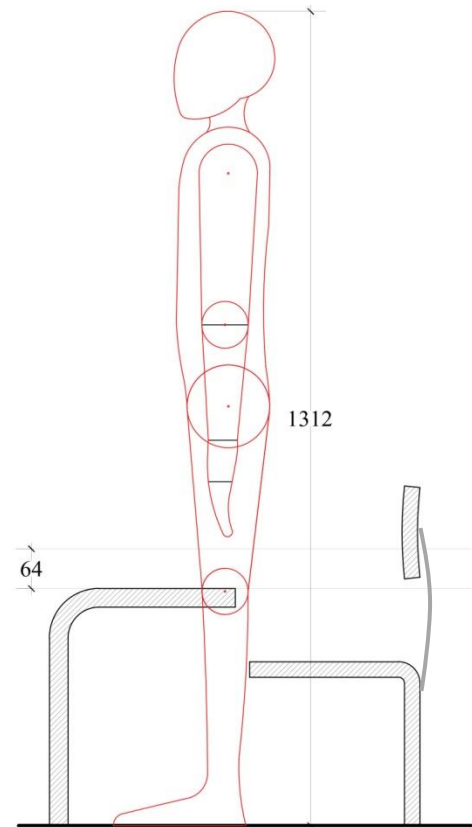
5<sup>th</sup>  
%ile



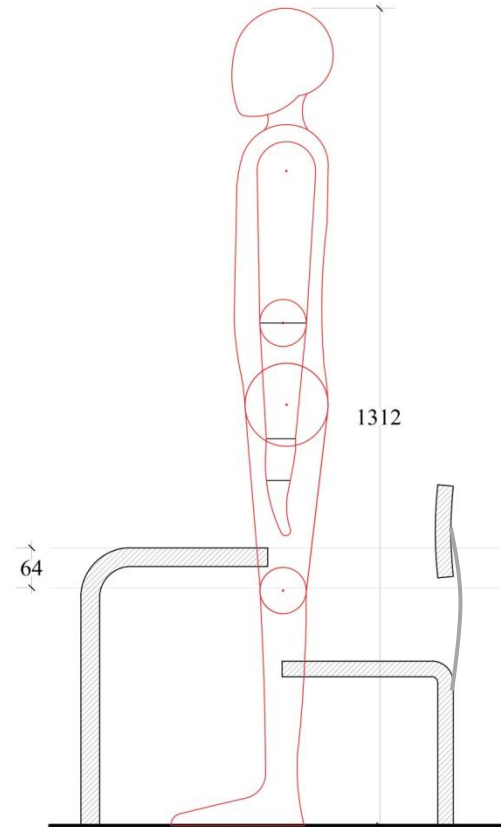
Source : "Anthropometry of indian school children"  
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# Using mannequin to get correct values :

95<sup>th</sup> %ile  
Mannequin

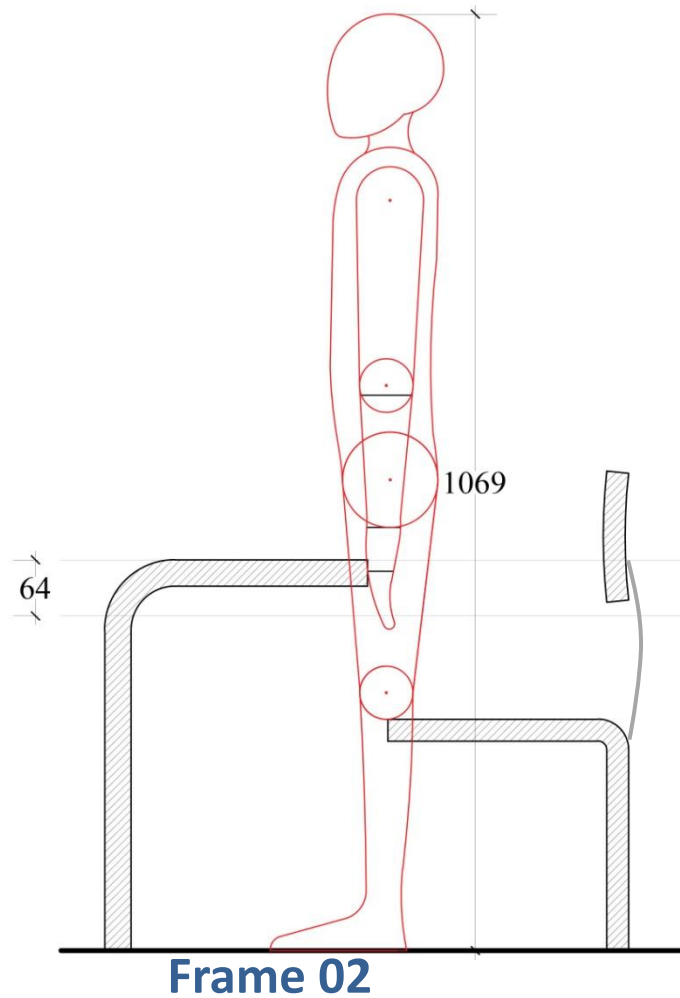
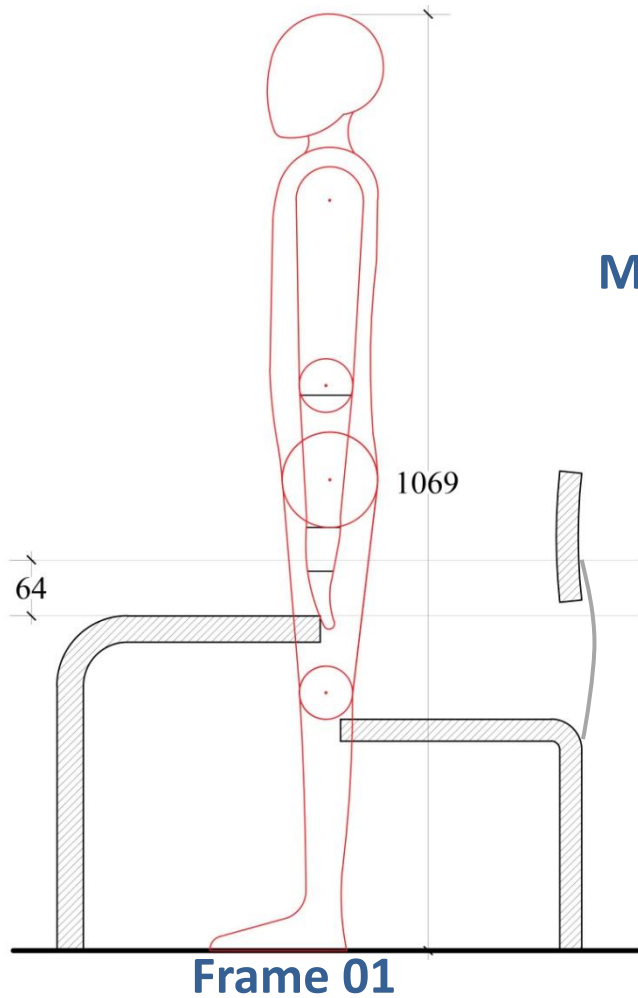


Frame 01

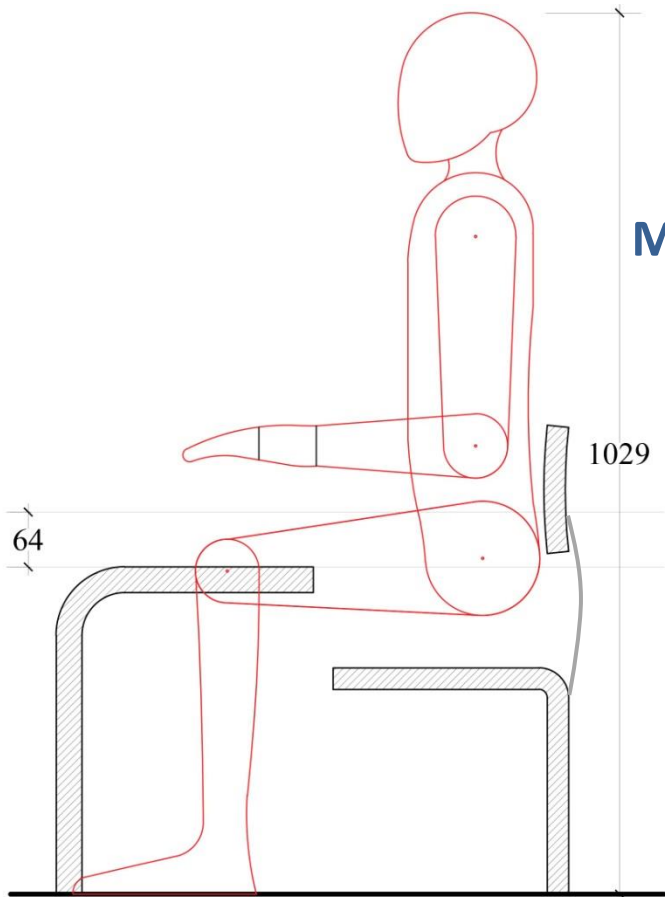


Frame 02

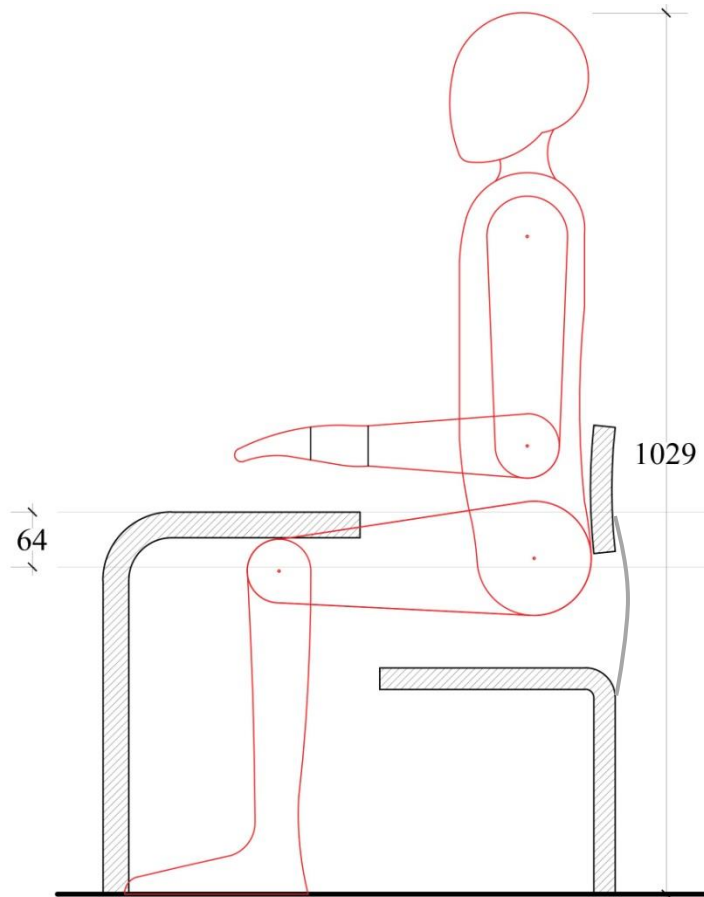
**5<sup>th</sup> %ile  
Mannequin**



**95<sup>th</sup> %ile  
Mannequin**

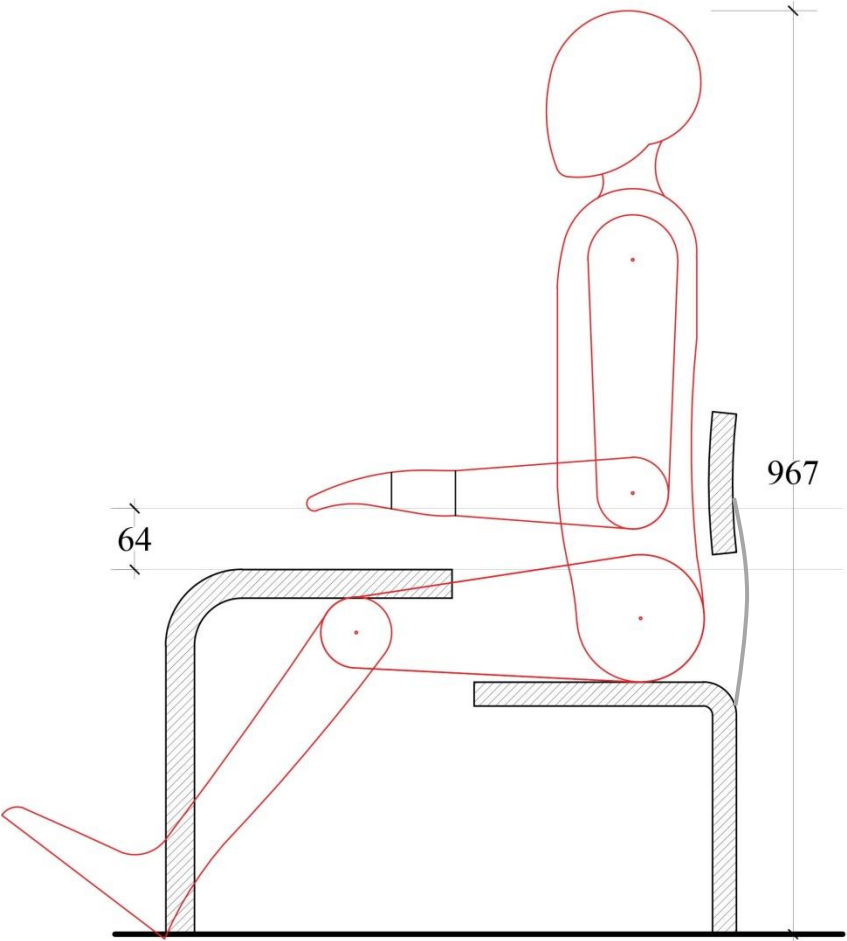


**Frame 01**

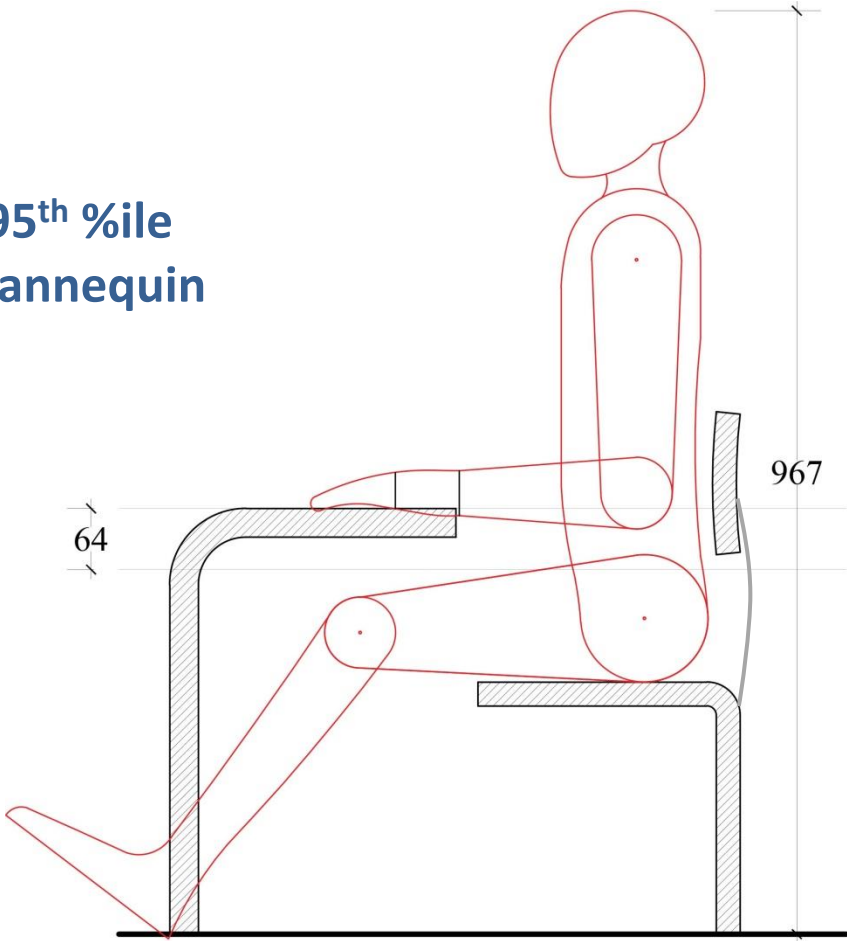


**Frame 02**

**95<sup>th</sup> %ile  
Mannequin**

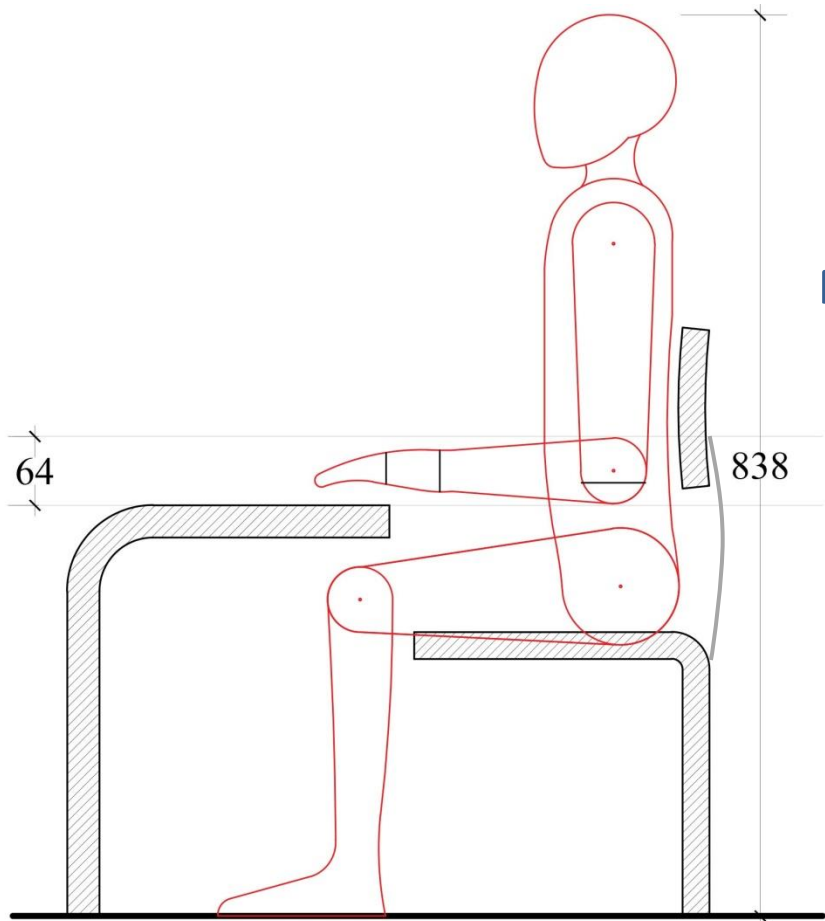


**Frame 01**

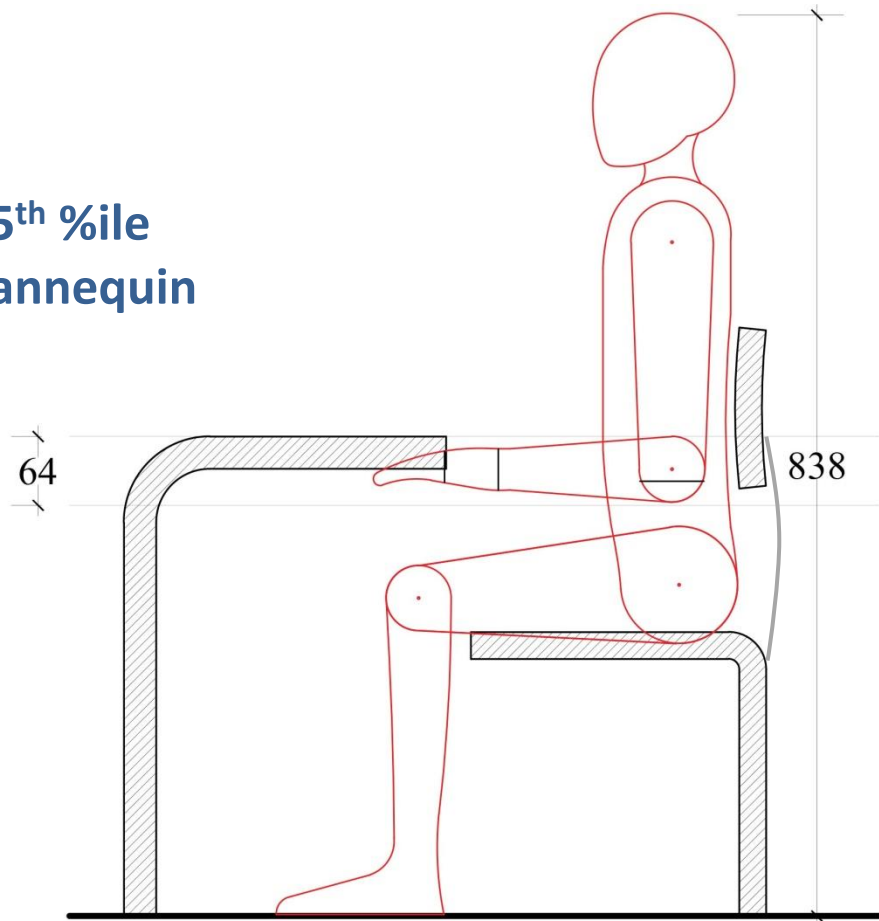


**Frame 02**

**5<sup>th</sup> %ile  
Mannequin**

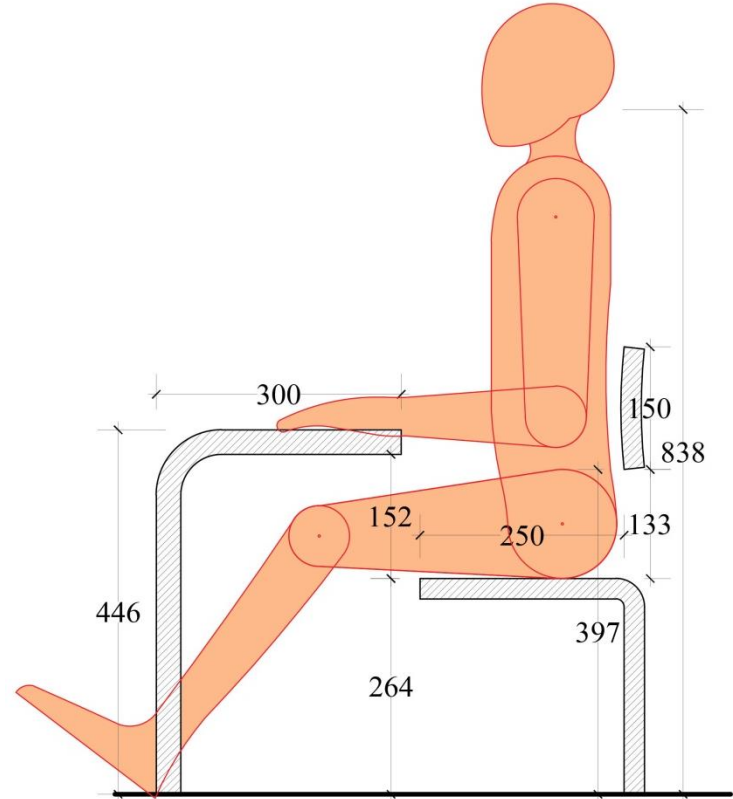
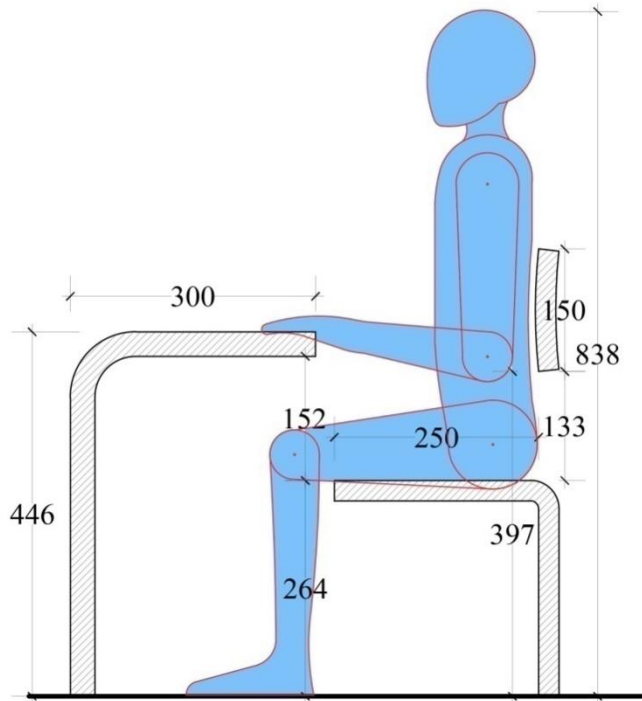


**Frame 01**



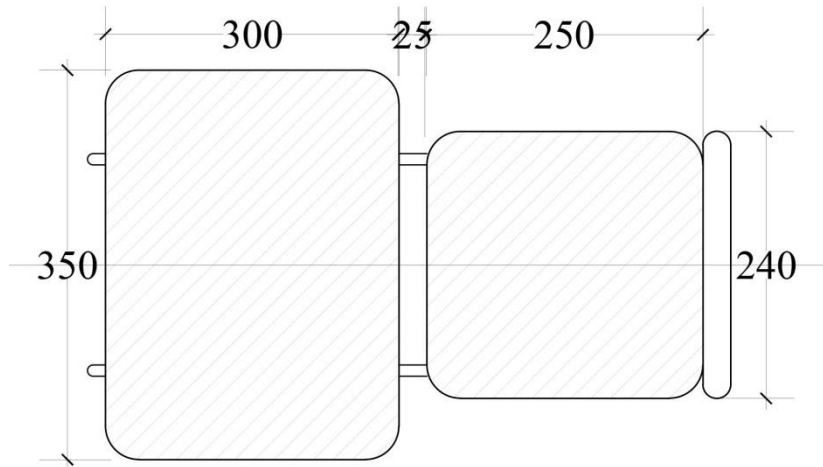
**Frame 02**

# Frame 02 with 5<sup>th</sup> and 95<sup>th</sup> %ile mannequin :

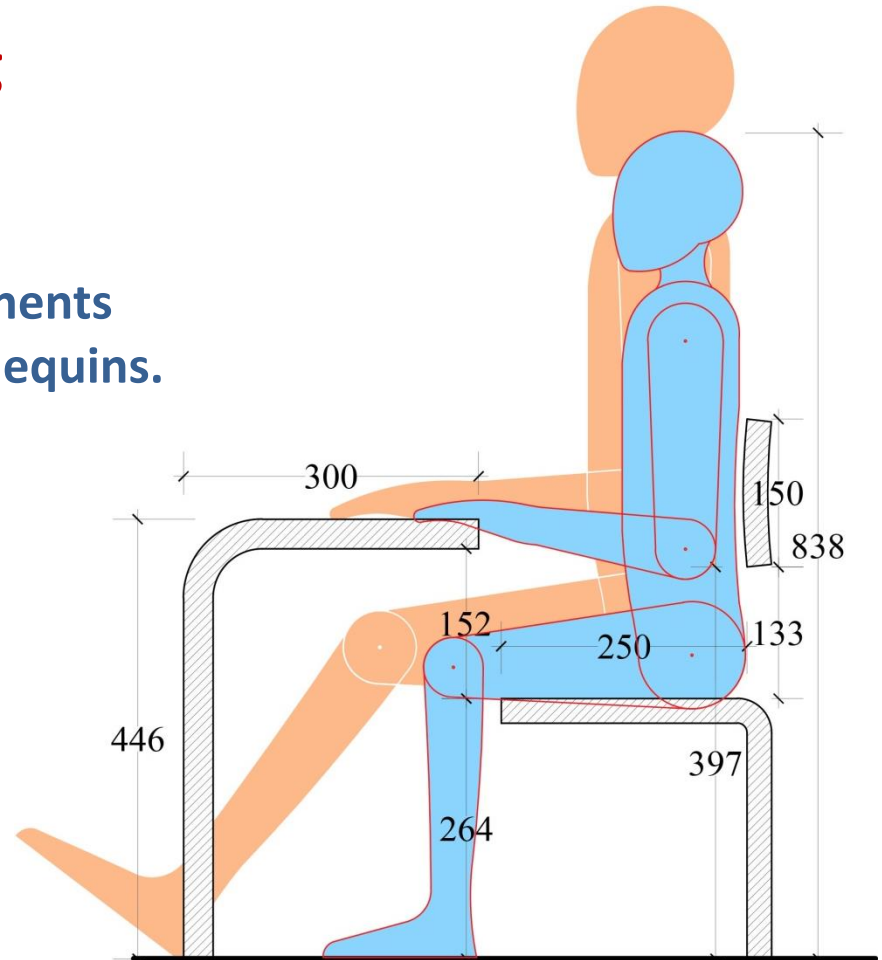


## Frame 02 with superimposing 5<sup>th</sup> and 95<sup>th</sup> %ile mannequin :

This drawing is to show the final dimensions of the different components and cross checking with both mannequins.



Basic plan



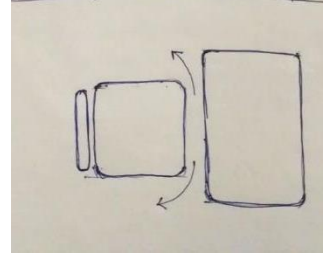
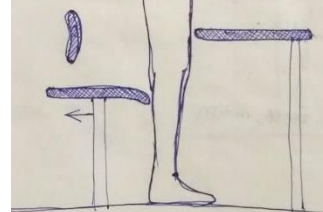
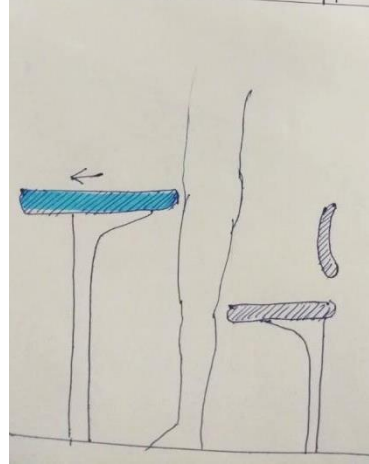
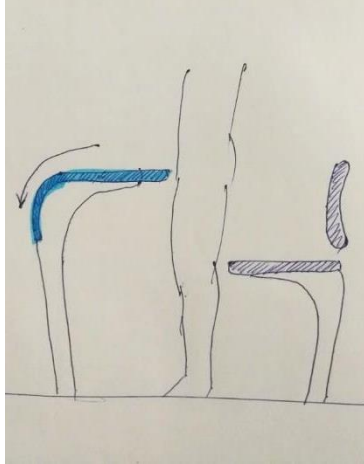
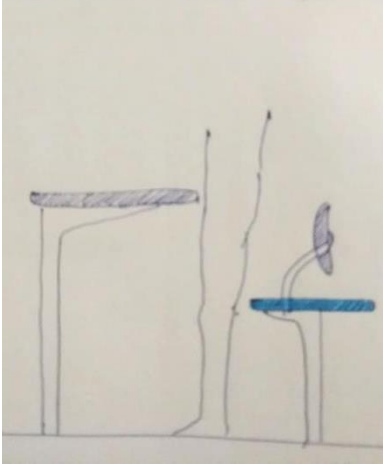
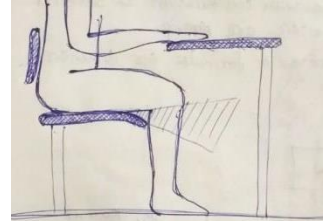
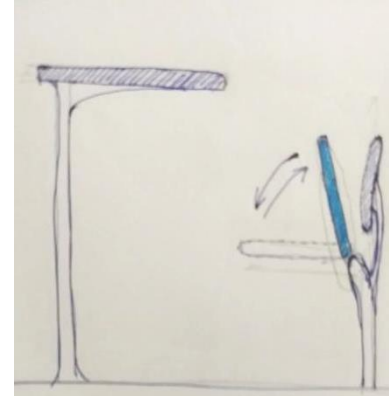
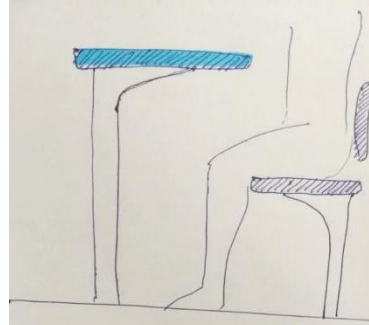
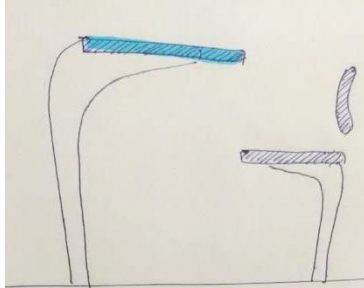
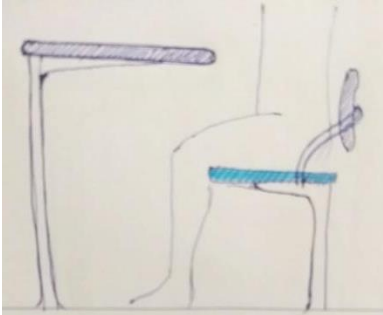
Basic elevation

## **%ile value considered for the final design:**

- Table top height 95<sup>th</sup> %ile.
- Table top width 95<sup>th</sup> %ile.
- Table top depth 95<sup>th</sup> %ile.
- Table top angle 3 degree.
- Knee height clearance 95<sup>th</sup> %ile.
- Distance between table and chair 95<sup>th</sup> %ile.
- Seat height 5<sup>th</sup> %ile.

- Seat width 95<sup>th</sup> %ile.
- Seat depth 5<sup>th</sup> %ile.
- Seat angle 3 degree.
- Back rest bottom line height 95<sup>th</sup> %ile.
- Back rest upper line height 5<sup>th</sup> %ile.
- Back rest width 95<sup>th</sup> %ile.
- Back rest angle 100 – 105 degree.

## Concepts sketches :



Sliding seat

Sliding table top

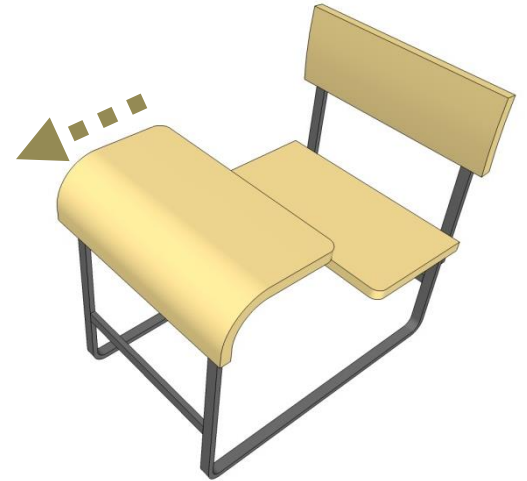
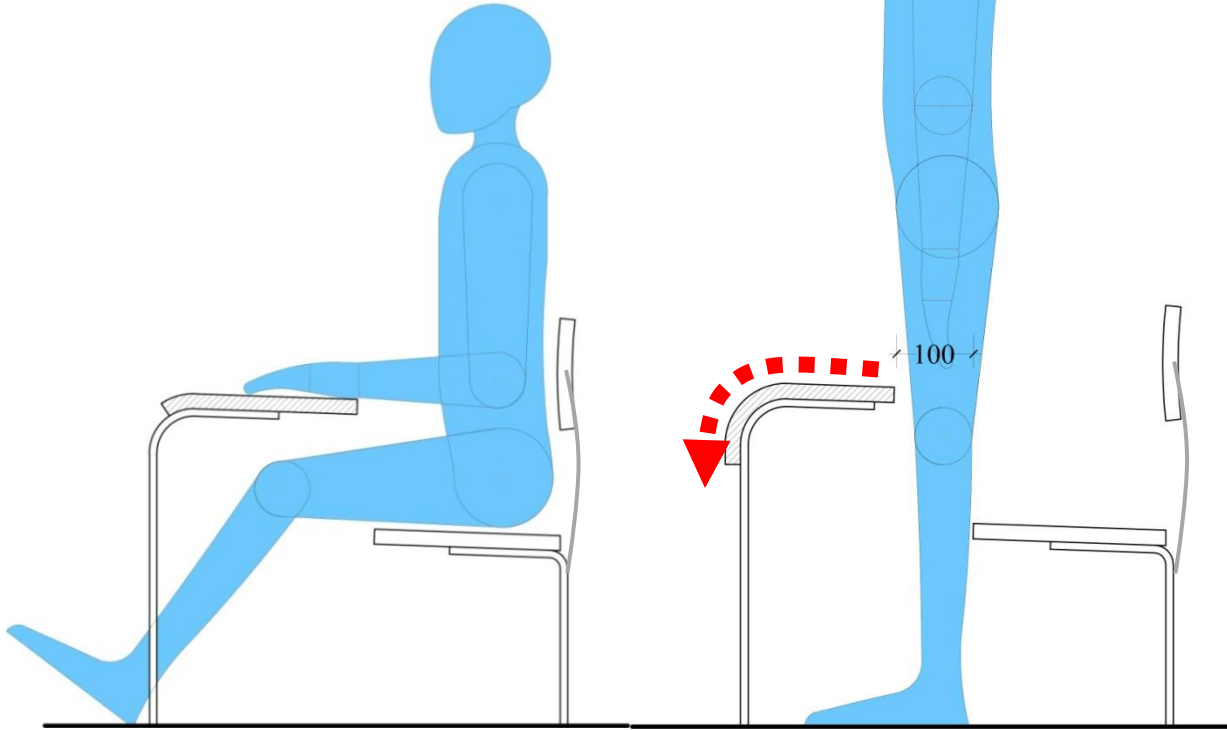
Sliding table top

folding seat

rotating seat

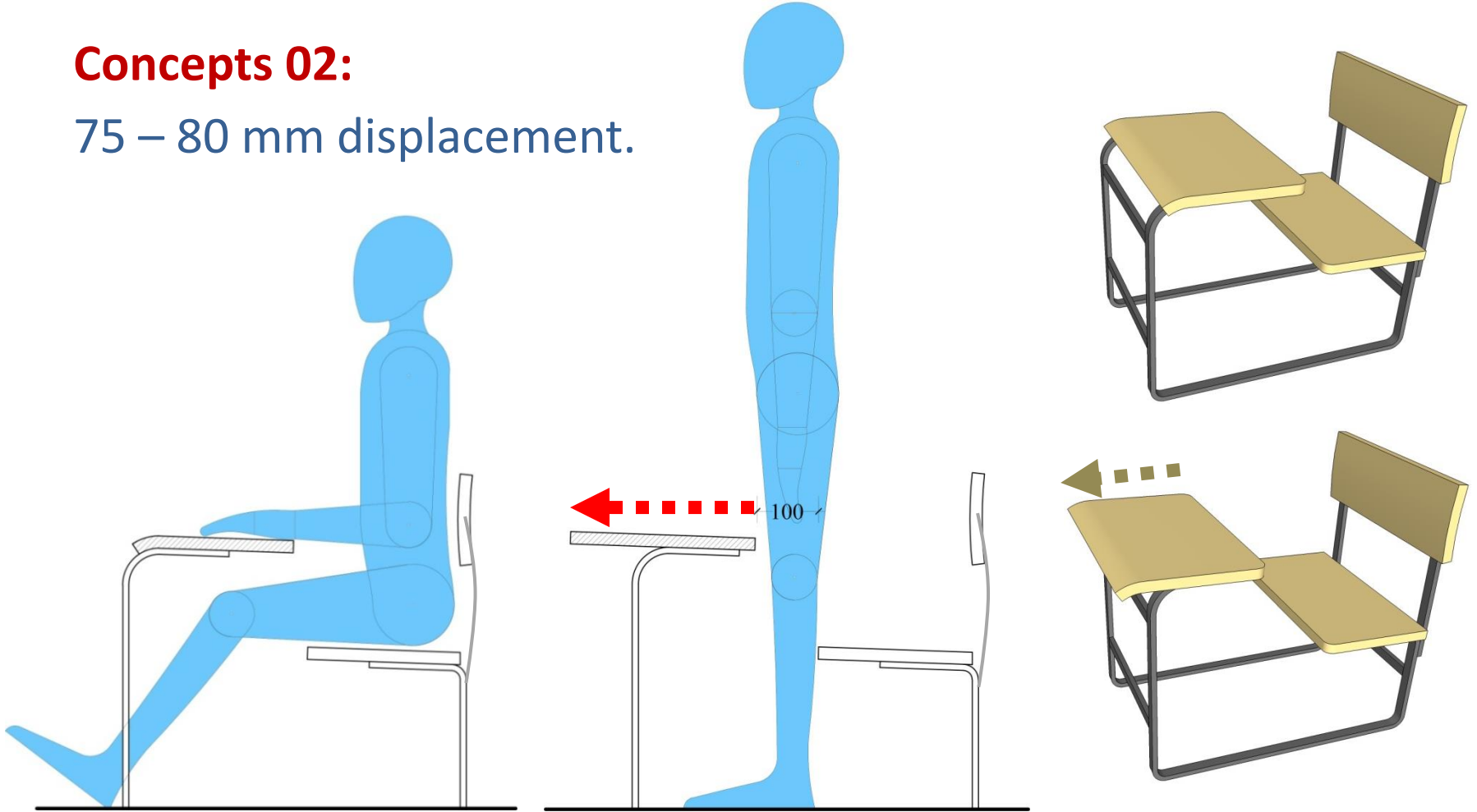
## Concepts 01:

75 – 80 mm displacement.



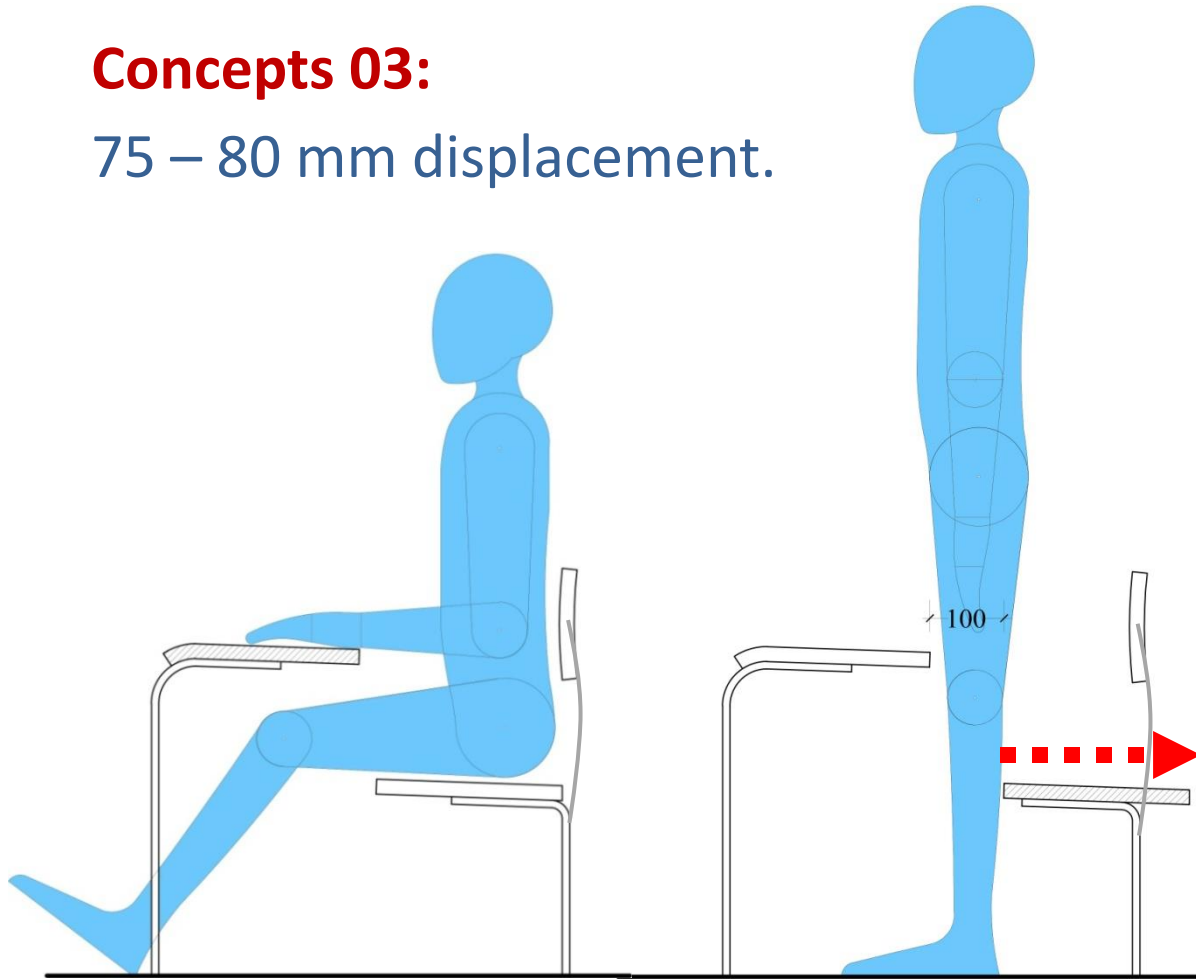
## Concepts 02:

75 – 80 mm displacement.

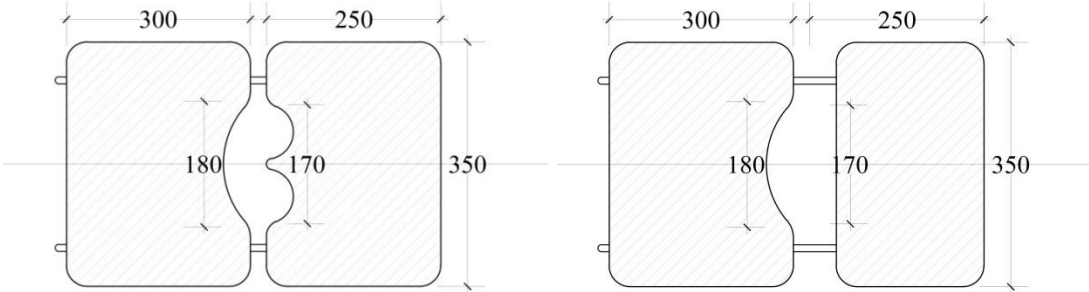
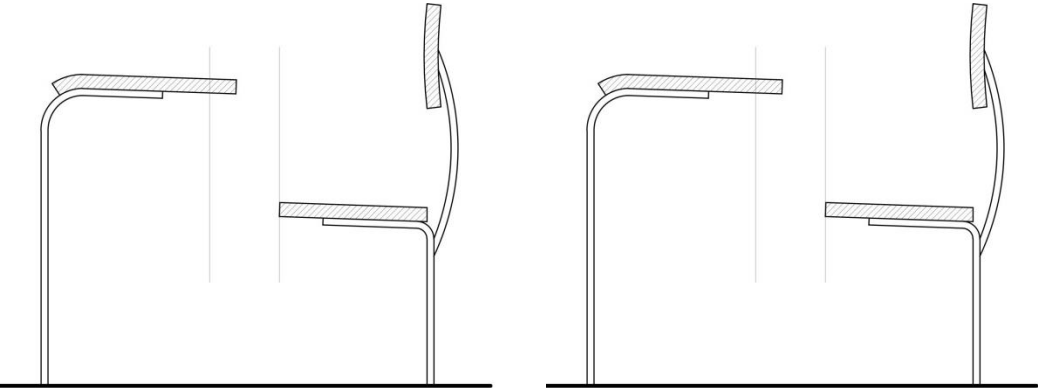


### Concepts 03:

75 – 80 mm displacement.



# Concepts 04:



## Acknowledgement :

Firstly, I would like to express my thanks and gratitude to my project guide Prof. **G. G. Ray**, without whom this project would not have been possible.

I also would like to thank **Dhanashree sindhe** and **Amar kundu** from ergonomics lab for helping out with my project to understand the technicalities.

Lastly, I would also like to specially thank that studio staff for helping me out with prototypes

## Reference :

- “Anthropometry of indian school children” by G G Ray and N Sadhu.
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**Thank you**