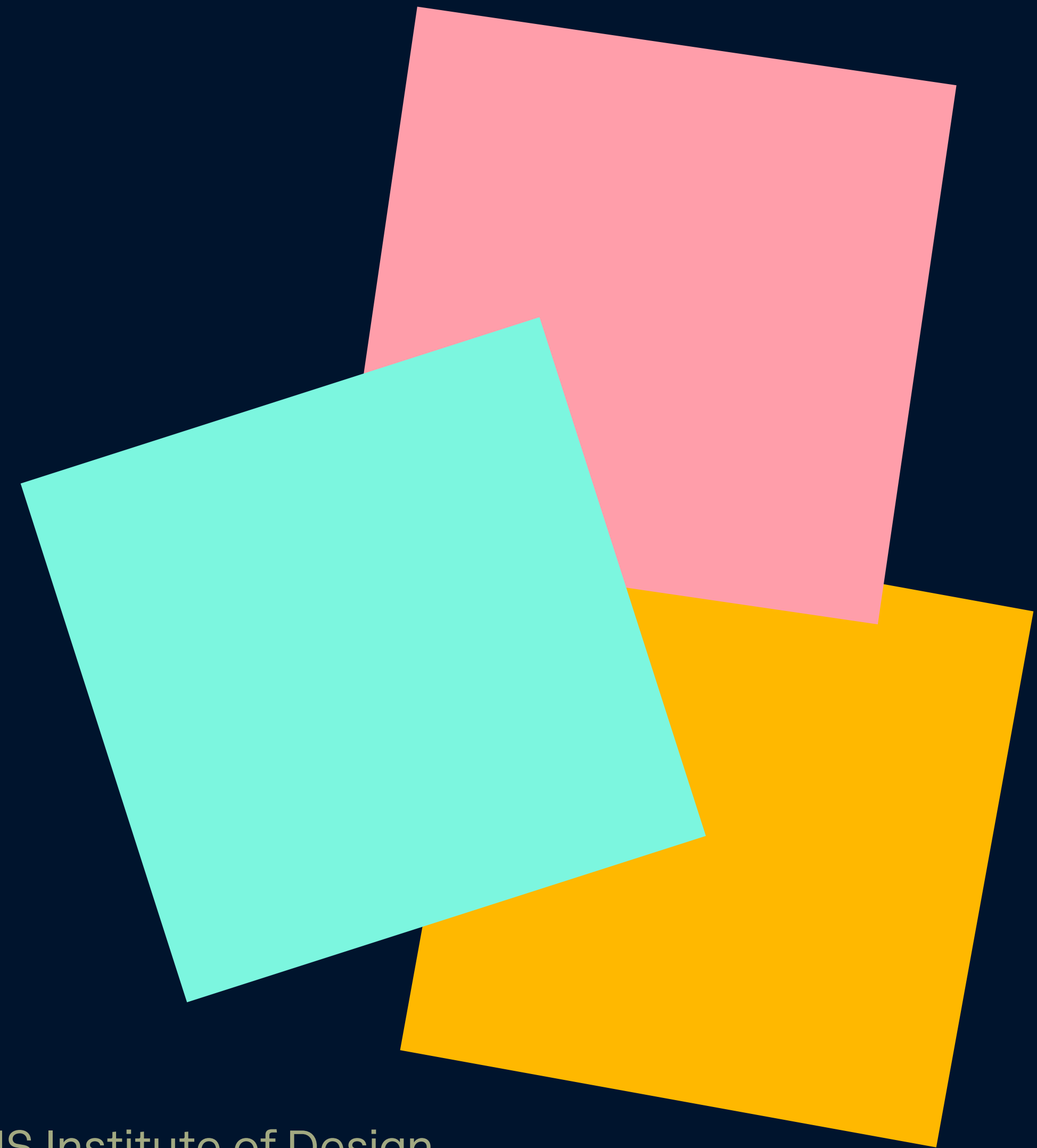


Lecture 2

Ergonomics - Physical and Cognitive

Physical Ergonomics

29 August 2025 · Gyan Lakhwani · gyanlakhwani@gmail.com · JS Institute of Design



RECAP

LECTURE 1

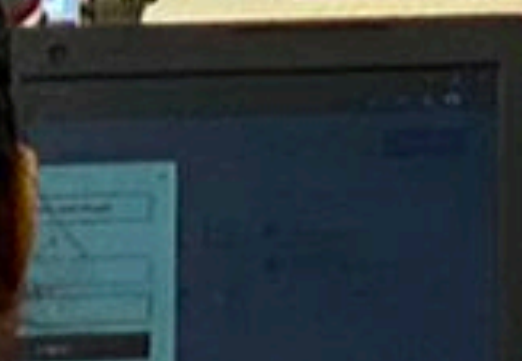
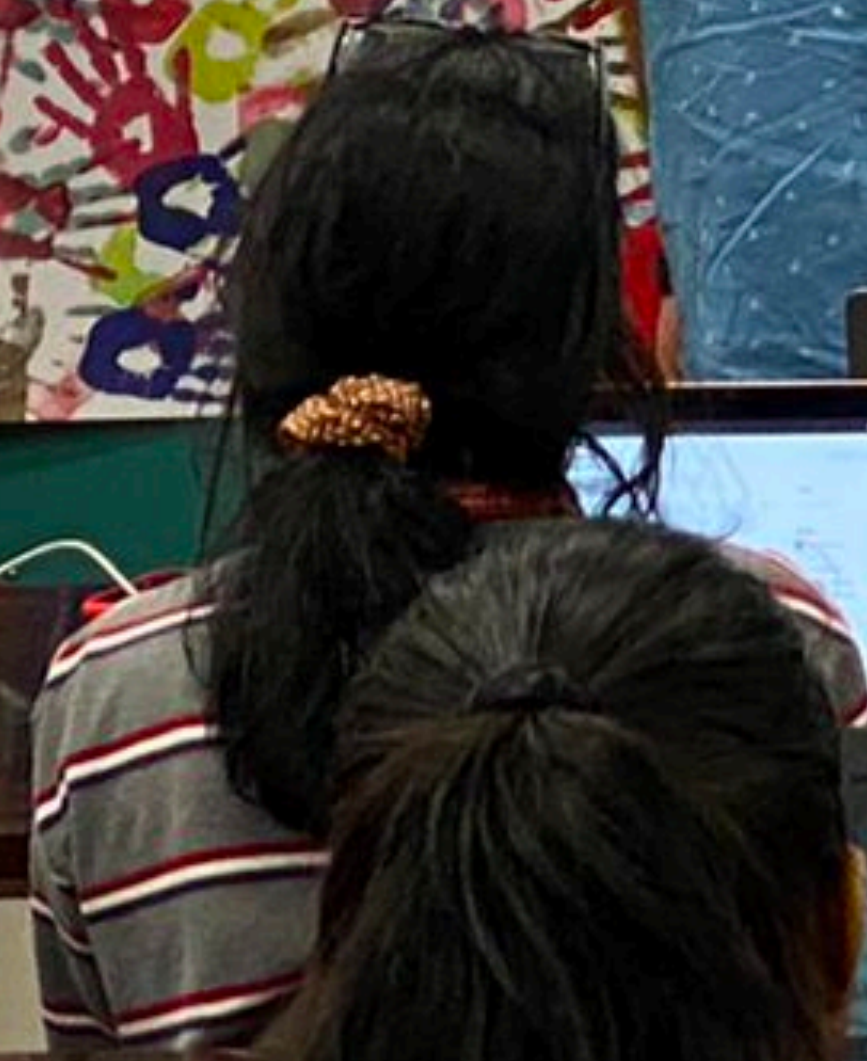
22 August 2025 · Gyan Lakhwani · gyanlakhwani@gmail.com · JS Institute of Design

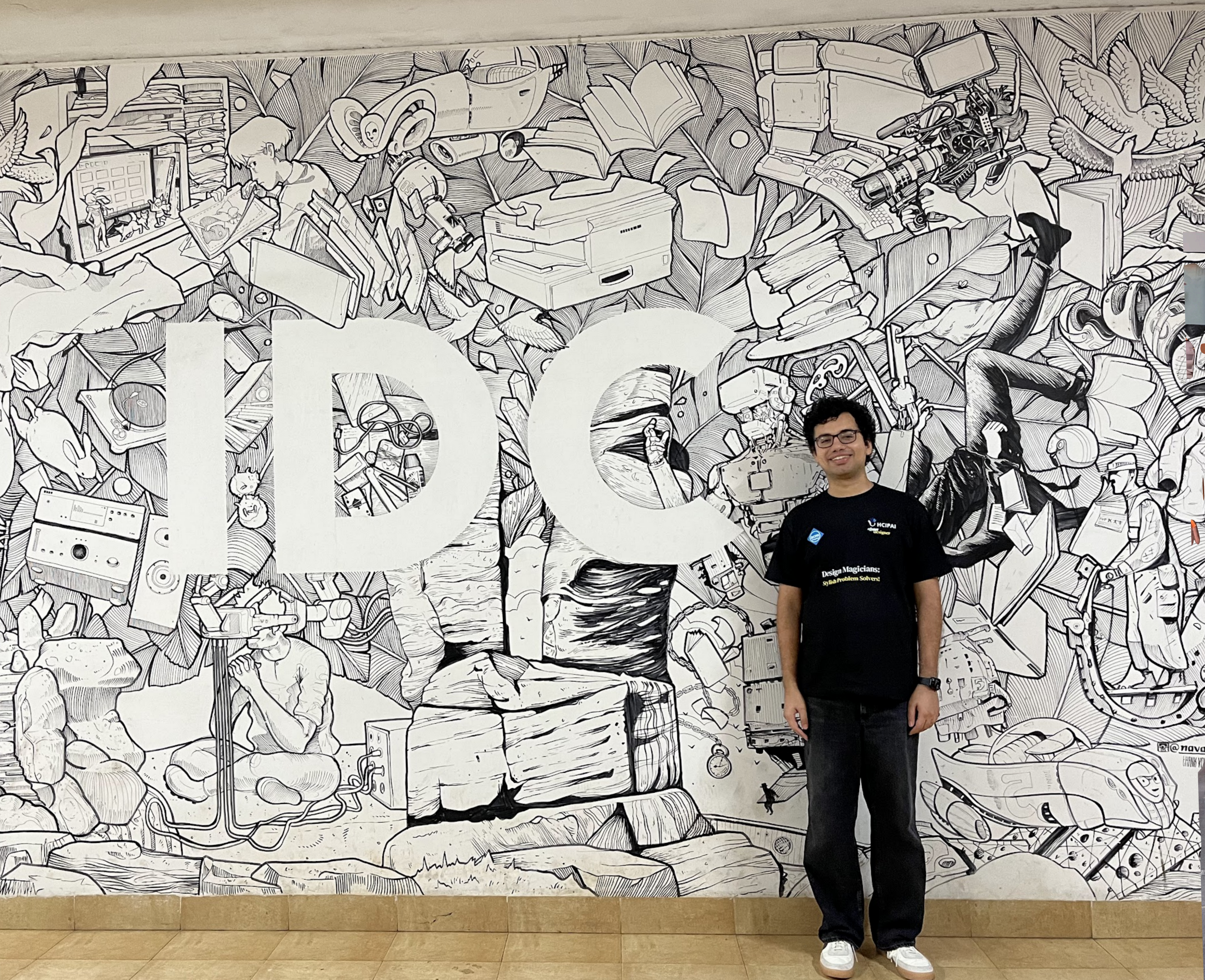
About me

- *Designer*
- *Nerd*
- *Likes bullet points*
- *Masters in Interaction Design from IDC School of Design*
- *UX Designer at Microsoft*
- *Uses Figma (almost) every day*

About me

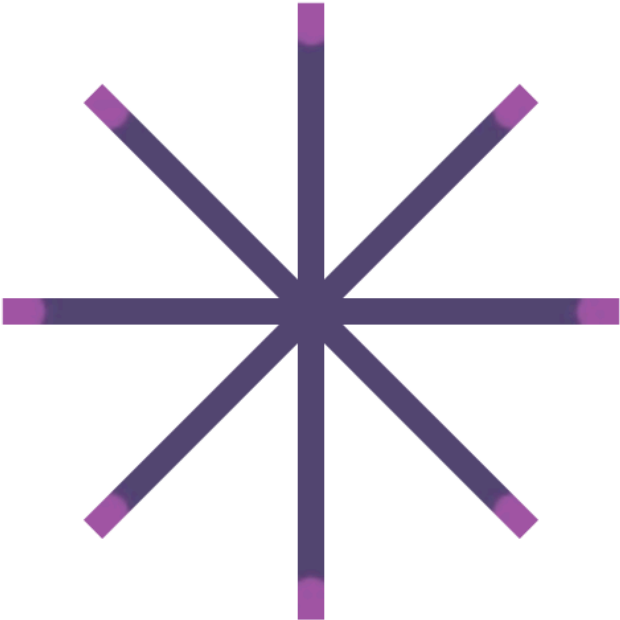
- *Designer*
- *Nerd*
- *Likes bullet points*
- *Masters in Interaction Design from IDC School of Design*
- *UX Designer at Microsoft*
- *Uses Figma (almost) every day*







studio*
/ public
knowledge

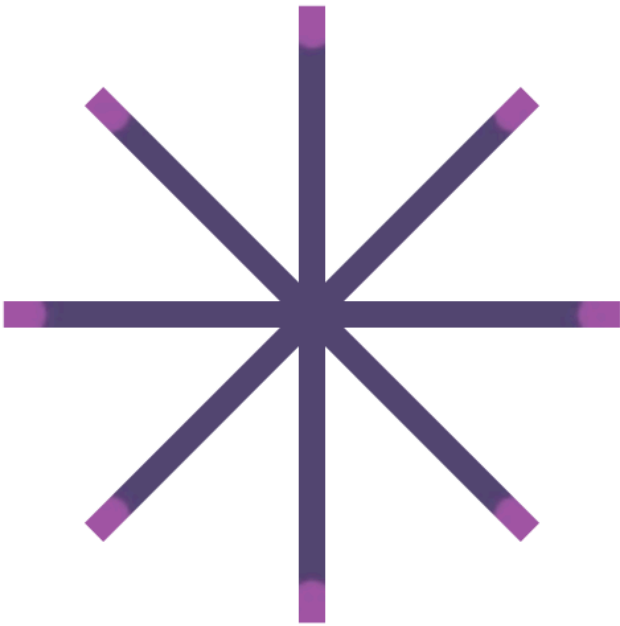


[SCROLL TO START]

studio*
/ public
knowledge

Public Knowledge Studio is an India-based design studio focused on crafting technology with care. We build interfaces and experiences with precision, personality, and purpose.

Talk to us about your project
2 Slots left for Oct 2025!



[SCROLL TO START]

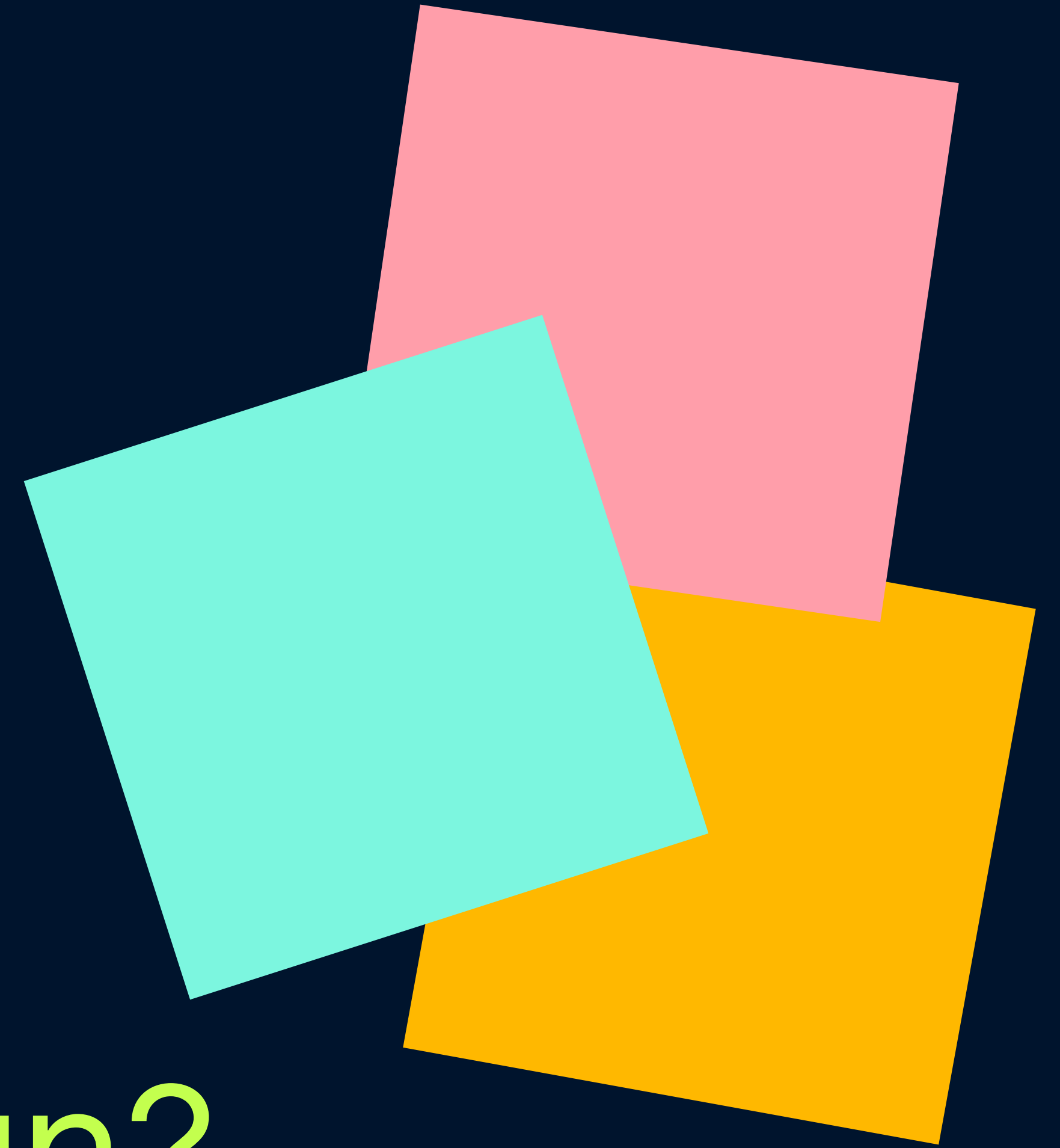


Lecture 1

Ergonomics - Physical and Cognitive

Introduction:
What is Good design?

22 August 2025 · Gyan Lakhwani · gyanlakhwani@gmail.com · JS Institute of Design



Airbus A380 Cockpit 2010s





**TV Remote
“Improved”**

Herman Miller Aeron
1994



**Monobloc
1970s**



“Don’t make something unless
it is both **necessary** and **useful**;
but if it is both, don’t hesitate
to make it **beautiful**.”

Need

A use case

+

Function

What it does

+

Form

How it looks

Signifiers

Cues or signals that communicate where and how an action should be performed.

- A chair's flat seat surface invites you to sit on it
- A blinking cursor in a text box signals you can type.
- An underline on a hyperlink indicates that you can click it

Affordances

The action possibilities of an object — what the object allows you to do.

- A chair affords sitting.
- A button affords pressing.
- A text field affords typing.

Affordances + Signifiers

Together

- **Affordance:** What can be done.
- **Signifier:** How you know what can be done.











What is Ergonomics?

Ergonomics is a scientific discipline that addresses the effective design of products, work environments and more.

What is Ergonomics?

Ergonomics is a scientific discipline that addresses the effective design of products, work environments and more.

In user experience (UX) design, it refers to how designers streamline digital products to minimize effort, movement and cognitive loads for users, so lessening their fatigue while improving productivity and—by association—a product's desirability.

What is Ergonomics?

The study of people's efficiency in their working environment.

Ergon: work

Economos: economics

Good ergonomics reduces user fatigue, errors, and injuries, and improves efficiency and satisfaction.

Why bother studying Ergonomics?

Why bother studying Ergonomics?

Fitting machines to human perception and reaction time in times of war

Cockpits, air traffic control work stations, maintenance, passengers, other crew stations

What would I need to know to design the Aeron chair so that it is comfortable for everyone?







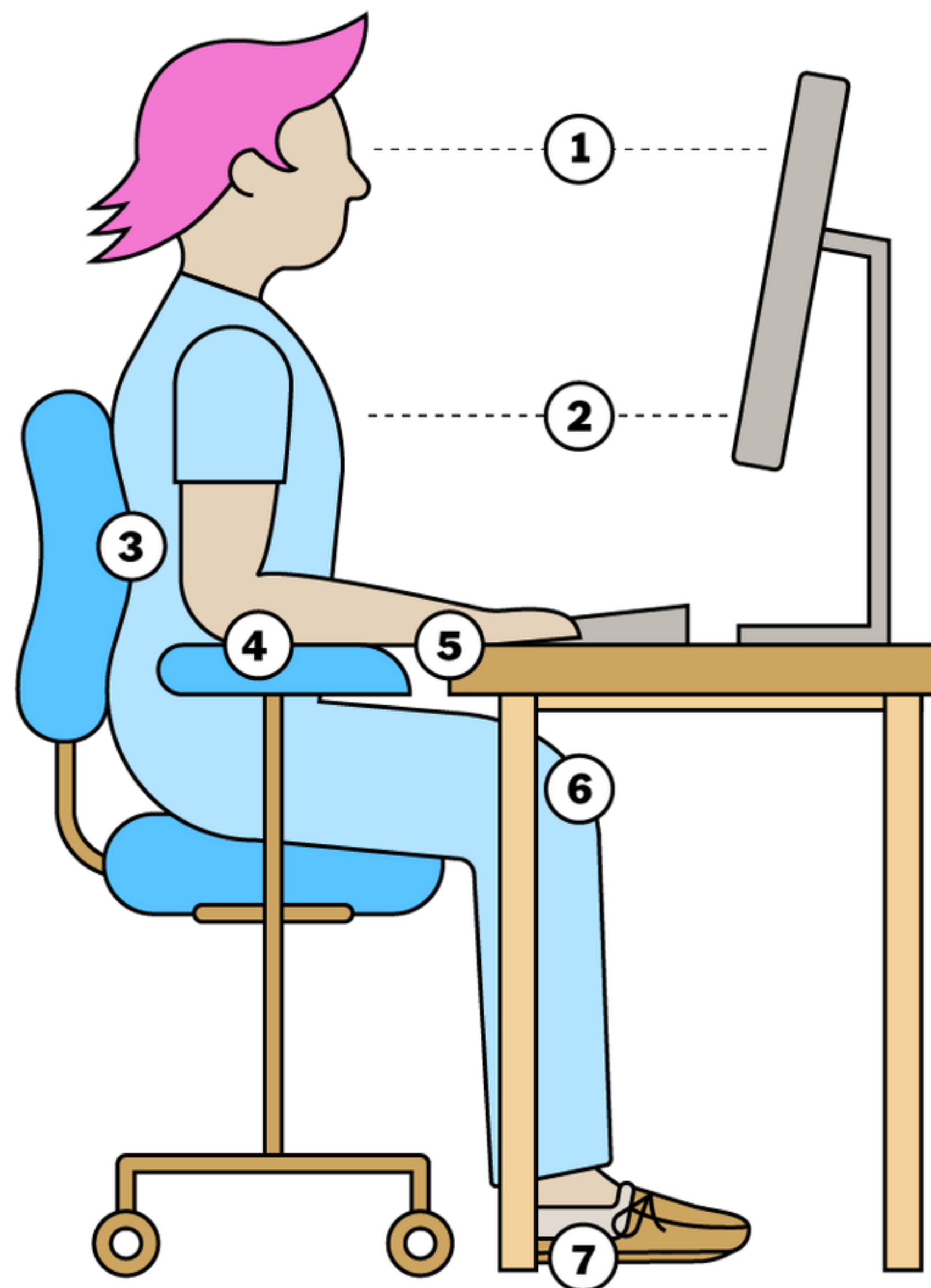




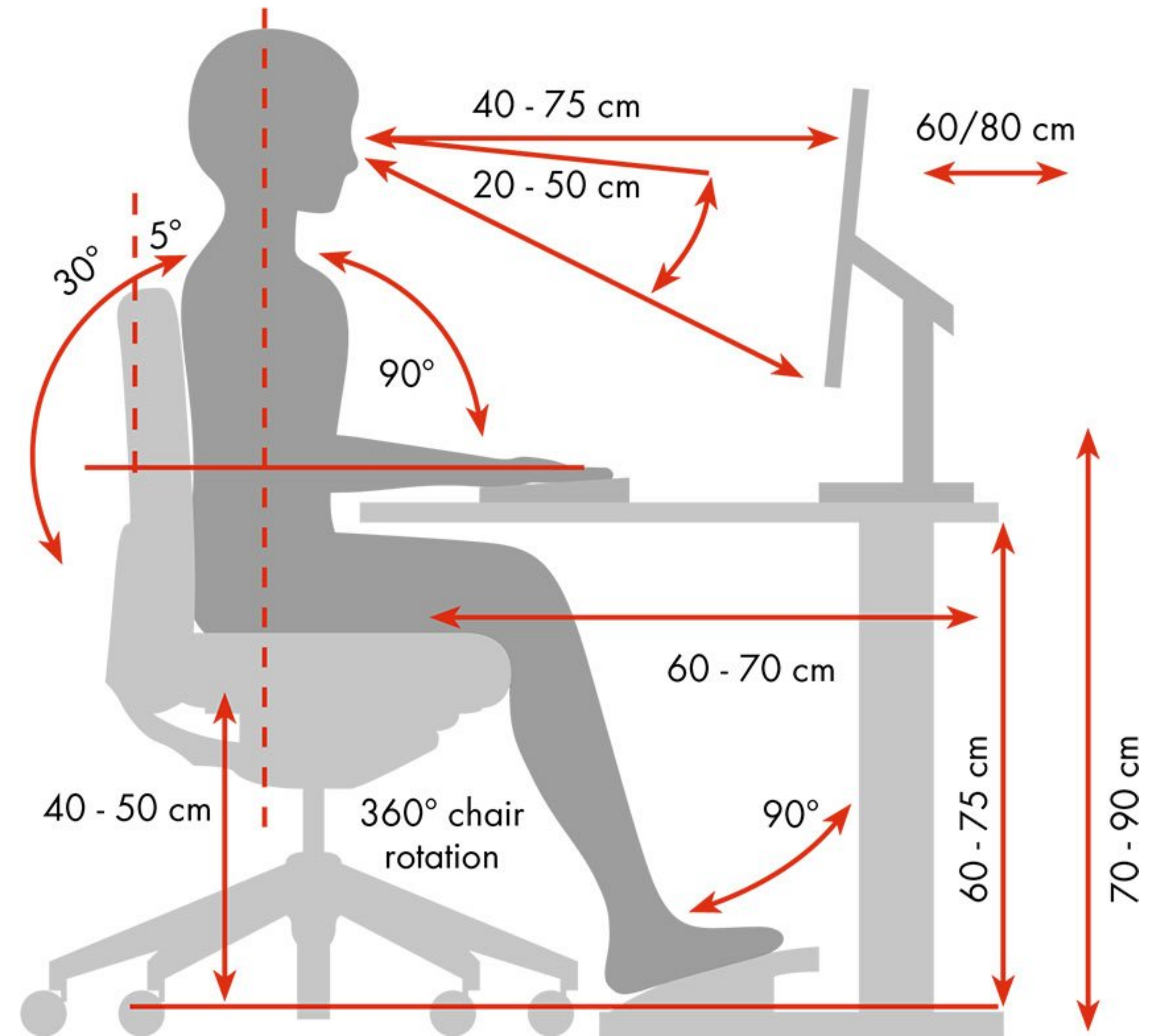
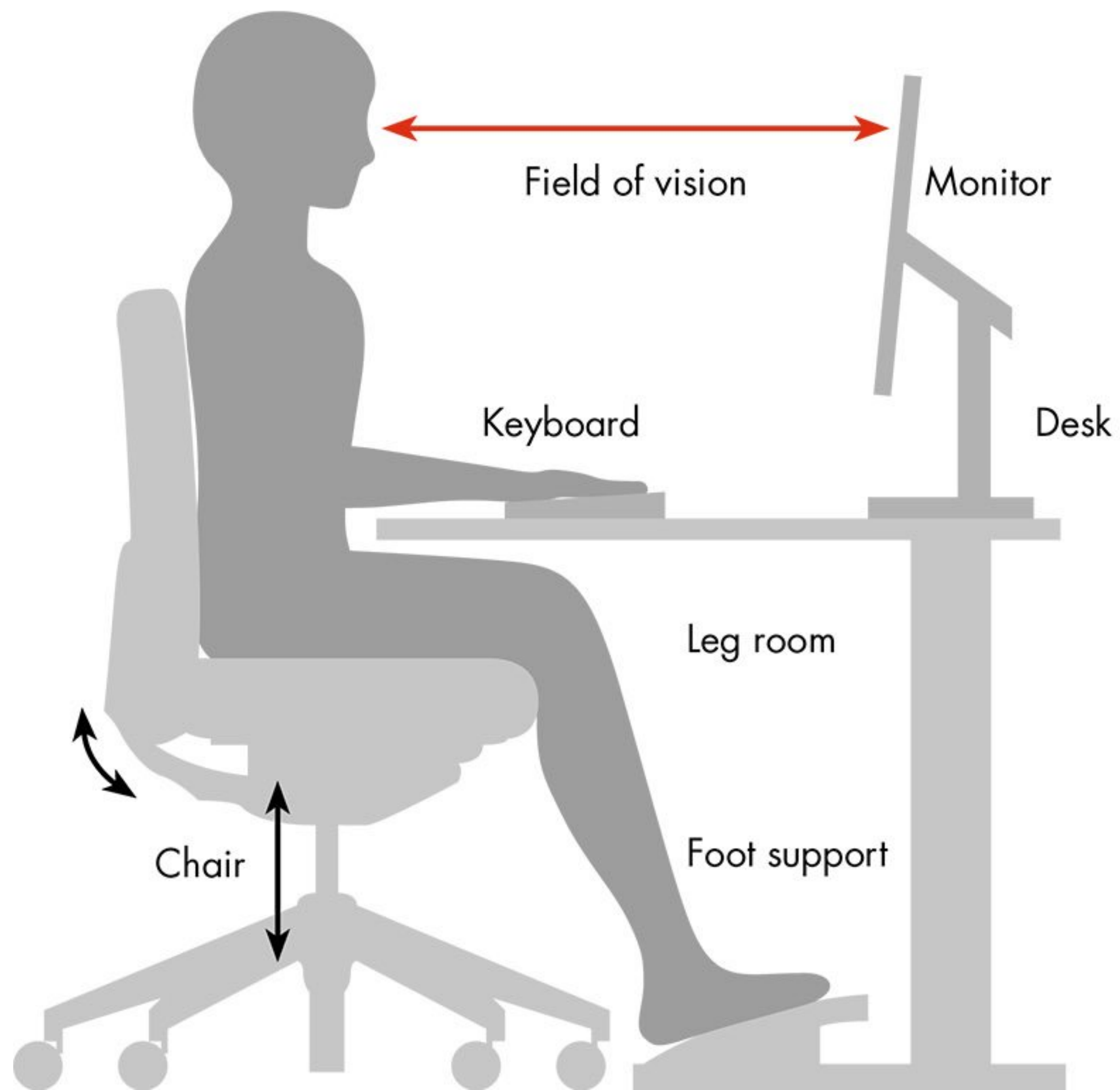
Nobody:
Absolutely no one:

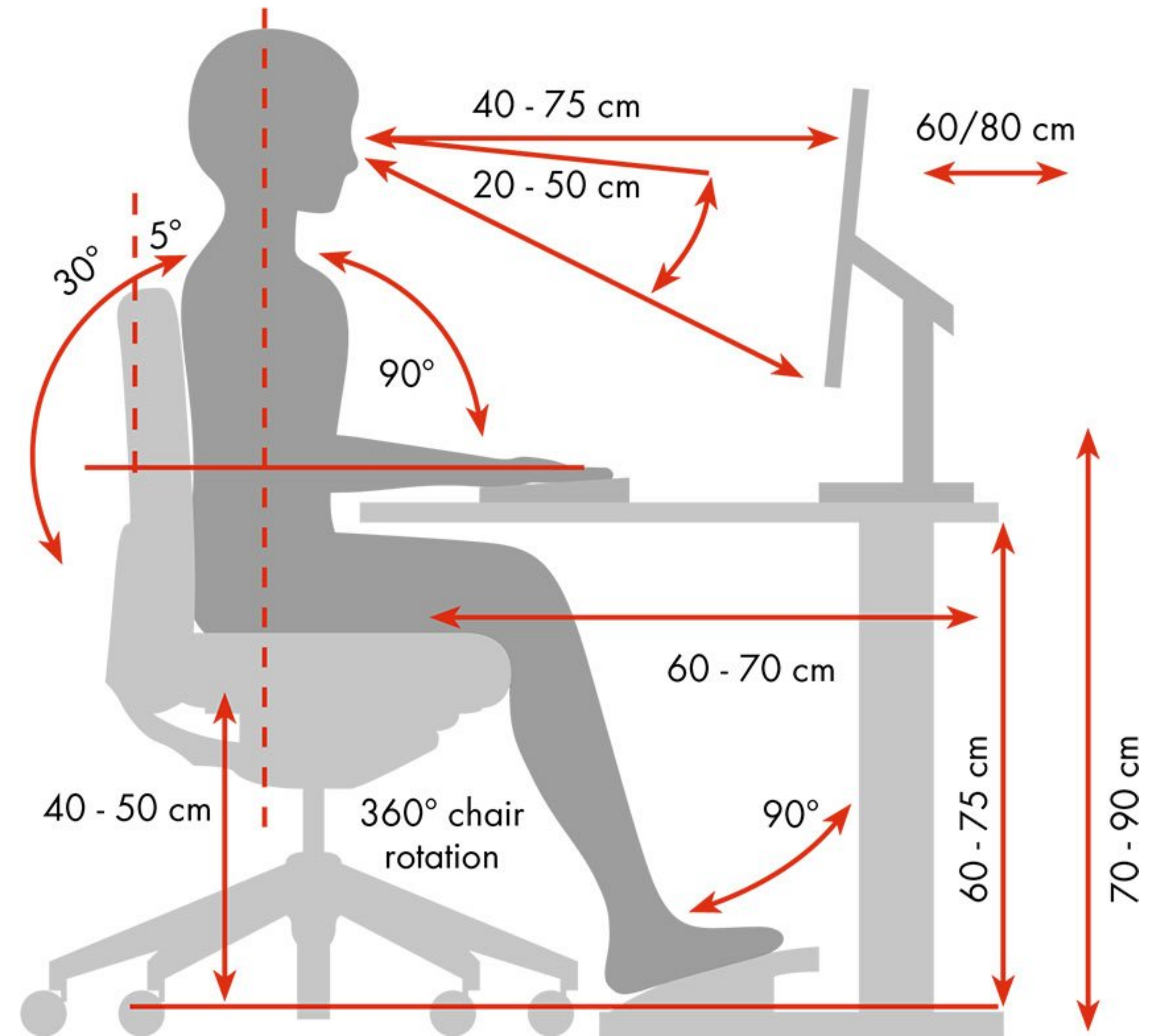
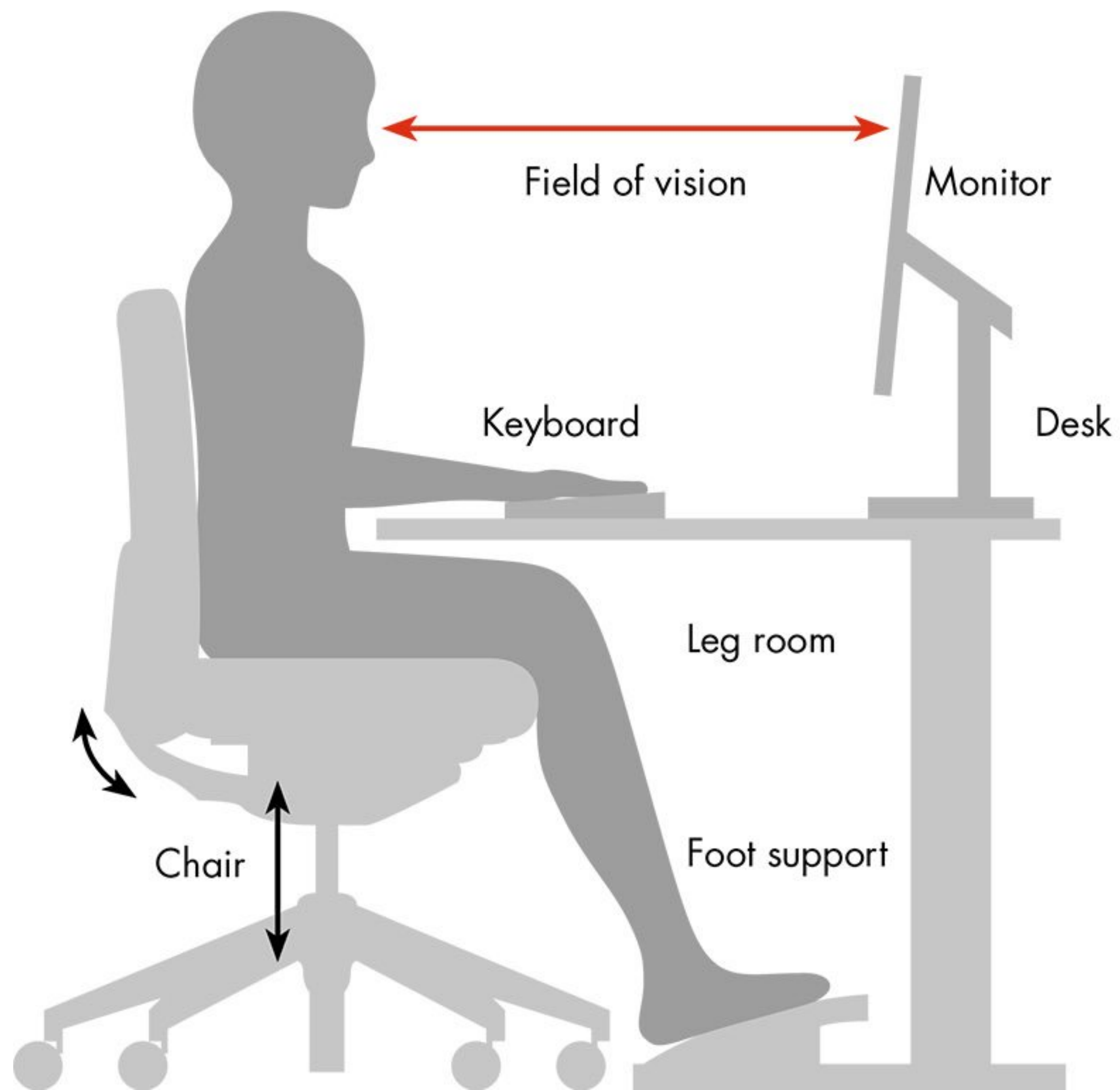
Us: Let's create the perfect
"uncomfortable" desk setup!





-
- 1** eye level at the top of the screen or 1 to 2 inches below
 - 2** monitor roughly an arm's length away
 - 3** chair with lumbar support, reclined at 100 to 110 degrees
 - 4** elbows bent at 90 degrees or more
 - 5** wrists flat at the keyboard
 - 6** knees level with hips or slightly below
 - 7** feet flat on ground or footrest





Anthropometry

Refers to the measurement of human individuals

- ✦ ánthrōpos: 'human'
- ✦ métron: 'measure'

Anthropometry

Refers to the measurement of human individuals

- ✦ ánthrōpos: 'human'
- ✦ métron: 'measure'

Q: What are the fields where Anthropometry might be useful?

Anthropometry

Refers to the measurement of human individuals

- ✦ ánthrōpos: 'human'
- ✦ métron: 'measure'

Relevant for industrial design, clothing design, ergonomics and architecture where statistical data about the distribution of body dimensions in the population are used to optimize products.

Biomechanics

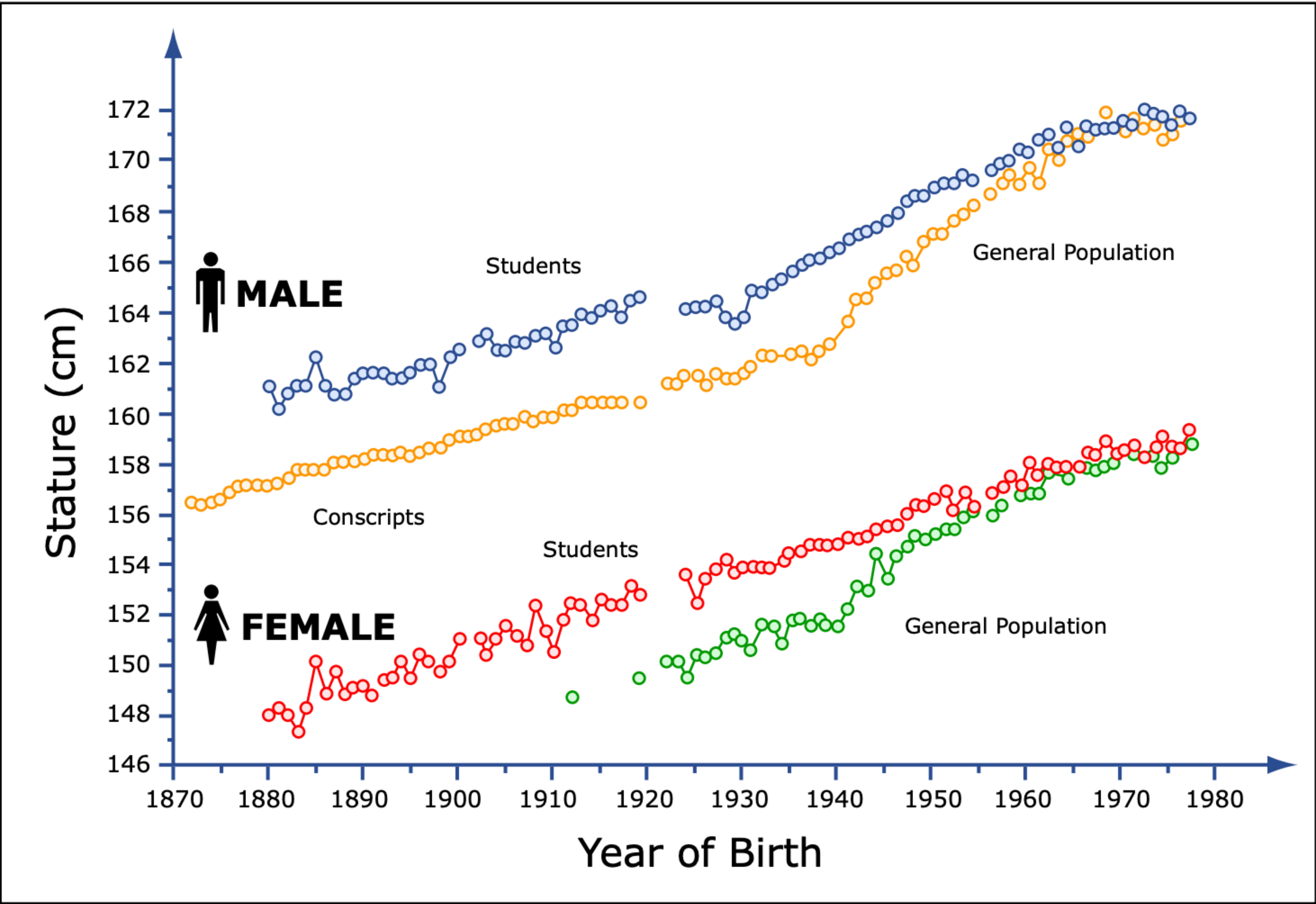
Study of motion, forces, posture

Factors affecting body measurements?

- ◆ Age
- ◆ Gender
- ◆ Country
- ◆ Racial and ethnic group
- ◆ Occupation

Height Growth in Japan

◆ Body measurements can also vary over time.

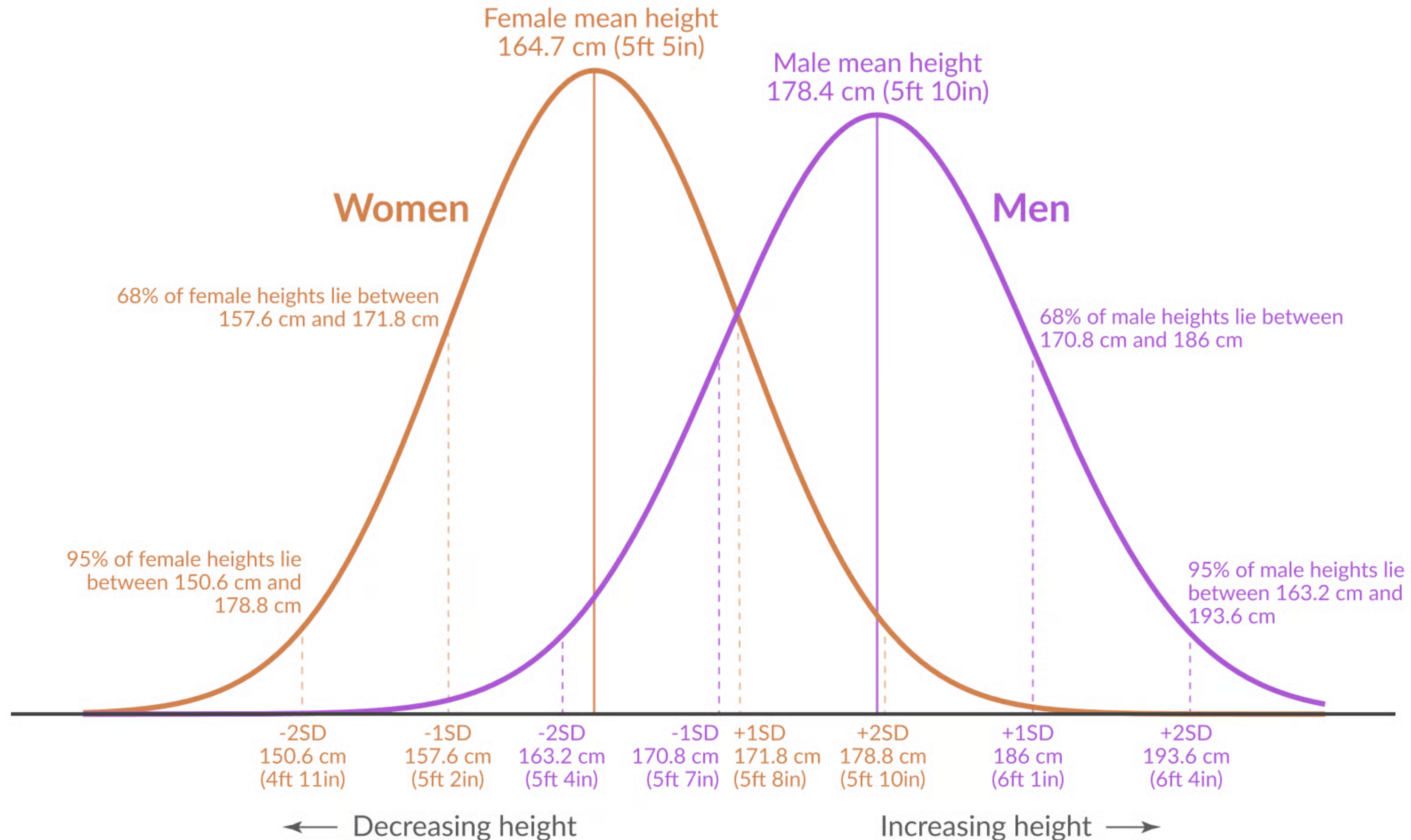


**What would I need to
know to design the
Aeron chair so that it
is comfortable for
everyone?**



The distribution of male and female heights

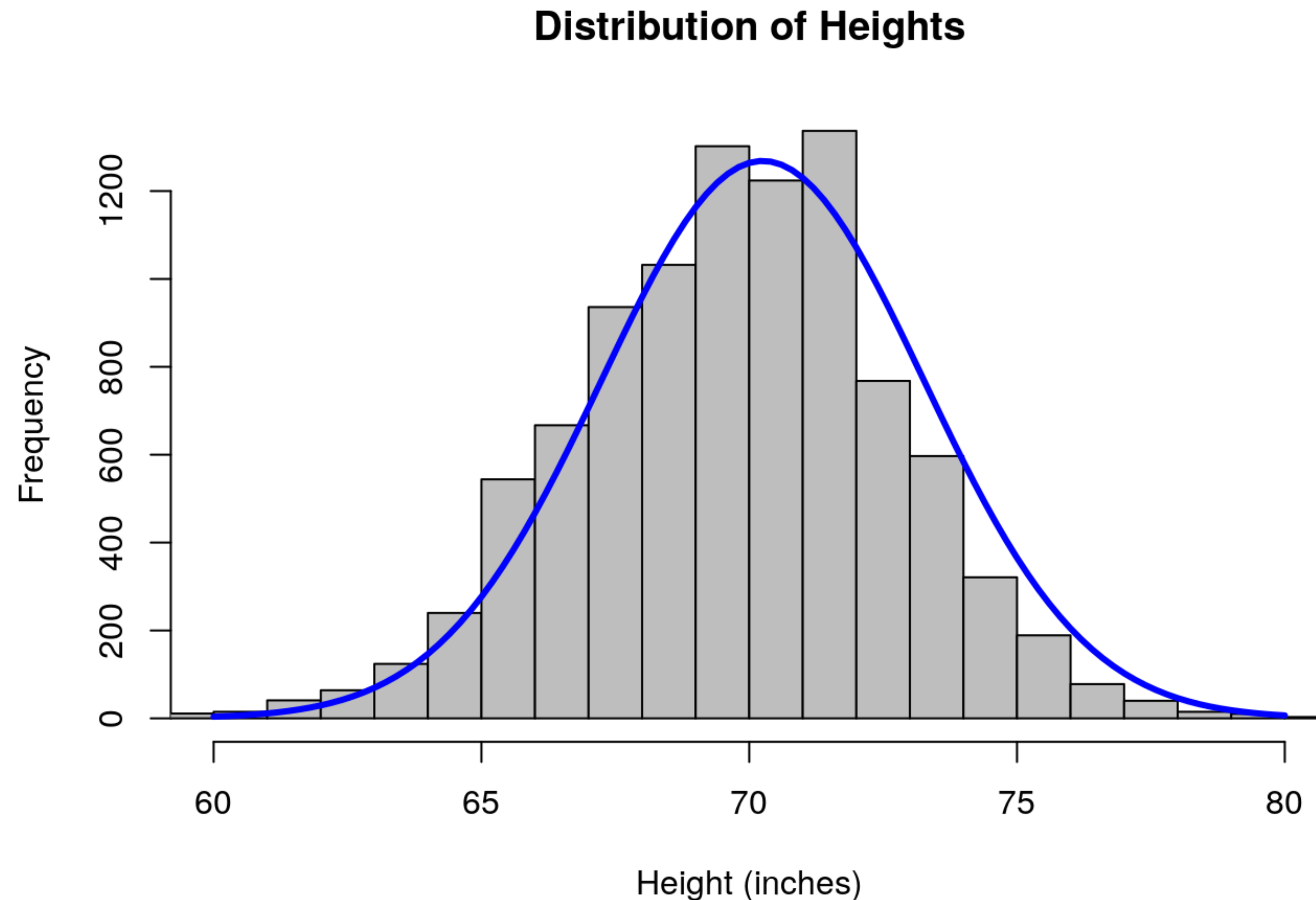
The distribution of adult heights based on large cohort studies across 20 countries in North America, Europe, East Asia, and Australia. Shown is the sample-weighted distribution across all cohorts born between 1980 and 1994 (so reaching the age of 18 between 1998 and 2012).



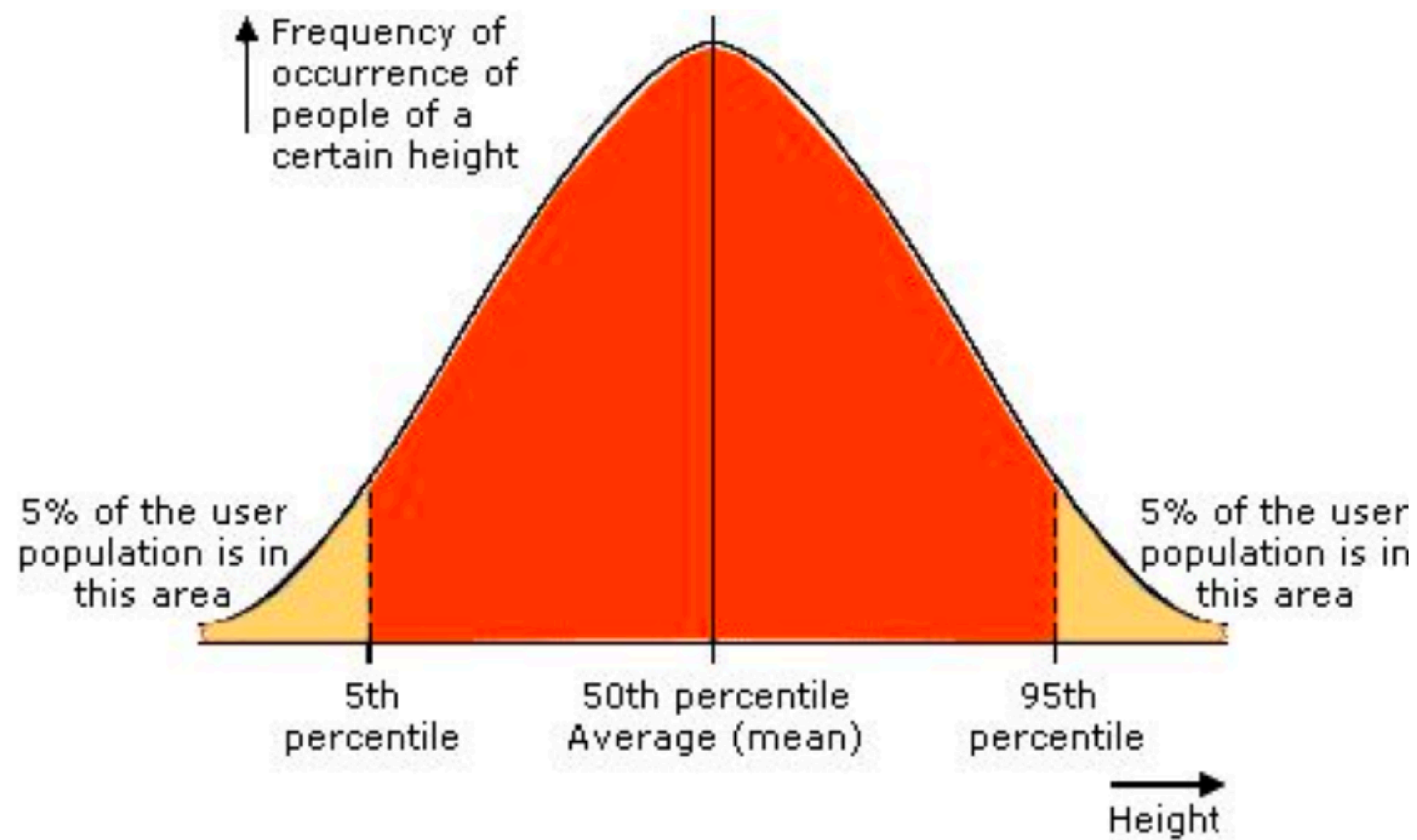
Data source: Jelenkovic et al. (2016). Genetic and environmental influences on adult human height across birth cohorts from 1886 to 1994.

Distribution of Heights of Men in USA

Below is a histogram showing the distribution of heights from a sample of 9569 randomly selected men who participated in a CDC study. The superimposed blue curve is a normal distribution that models the histogram.



The distributions of body sizes are known to be normal or similar to normal.







Populations

Everyone who could possibly use the product.

Sampling

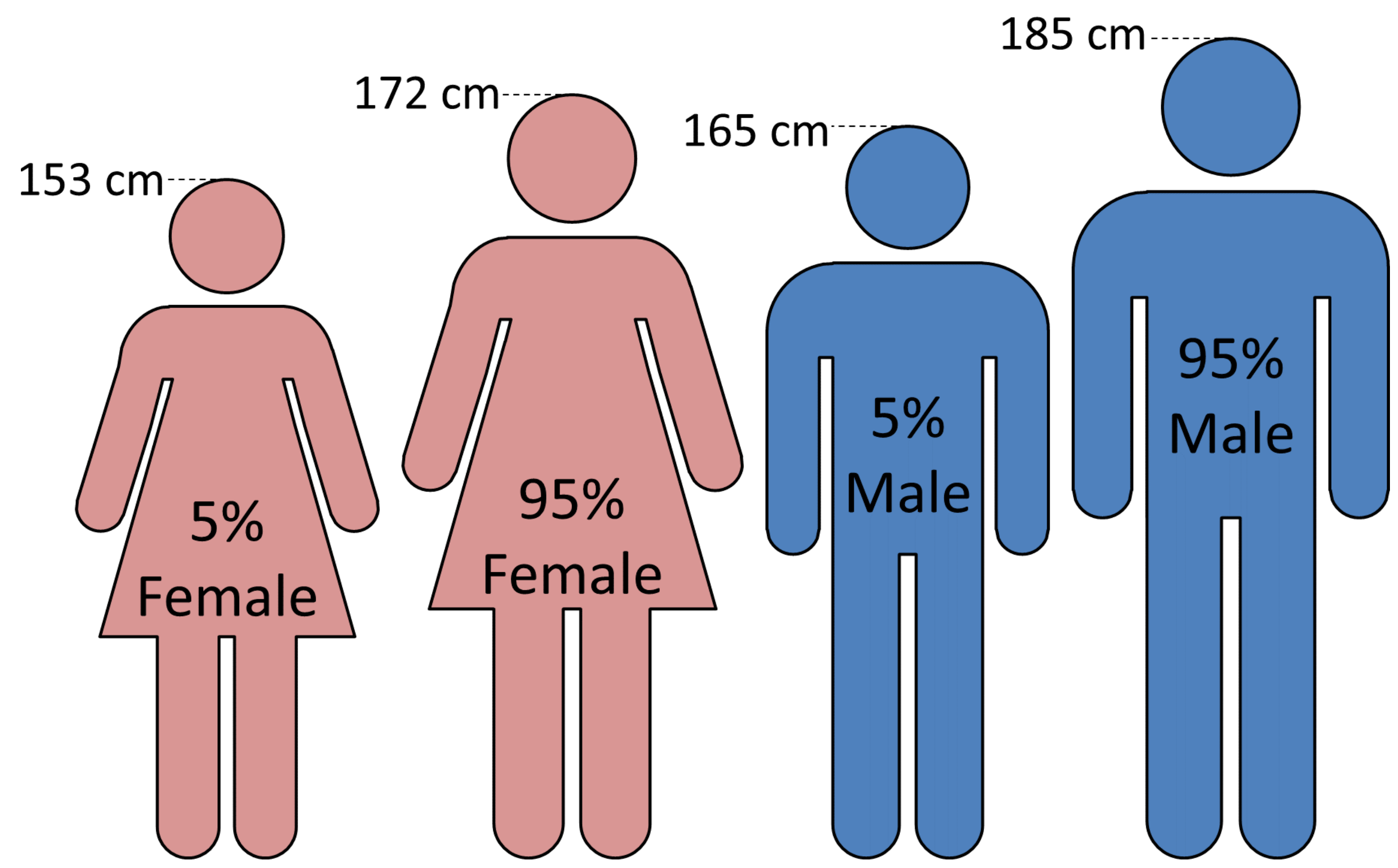
It may not be possible to get data for every person, so we use some people as a representation of the population.

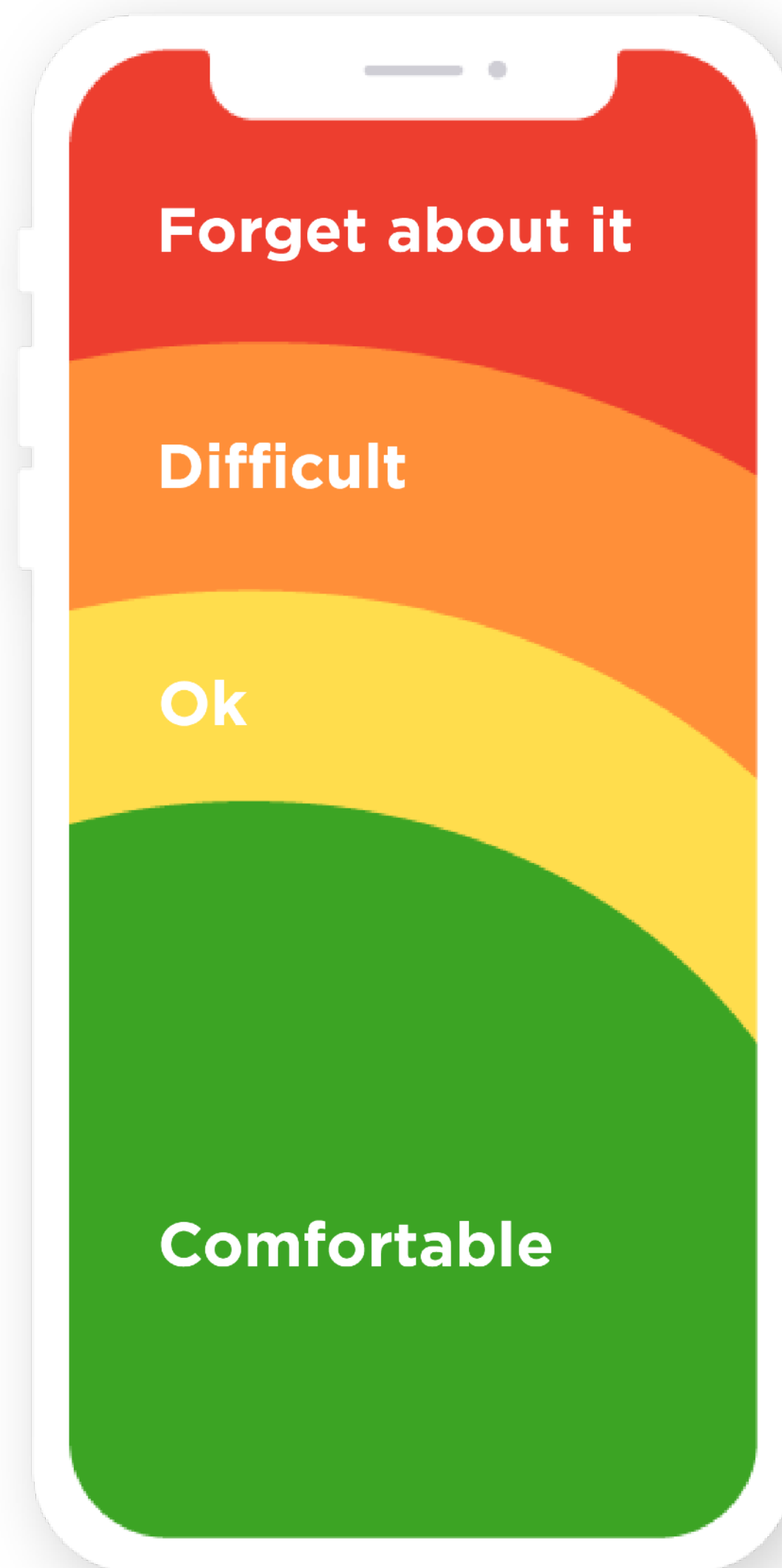
Percentiles

- ✦ That proportion of a population with a dimension at or less than a given value.
- ✦ For example, designing for the 95th percentile would be designing for the largest size that is greater than or equal to 95% of all possible sizes.

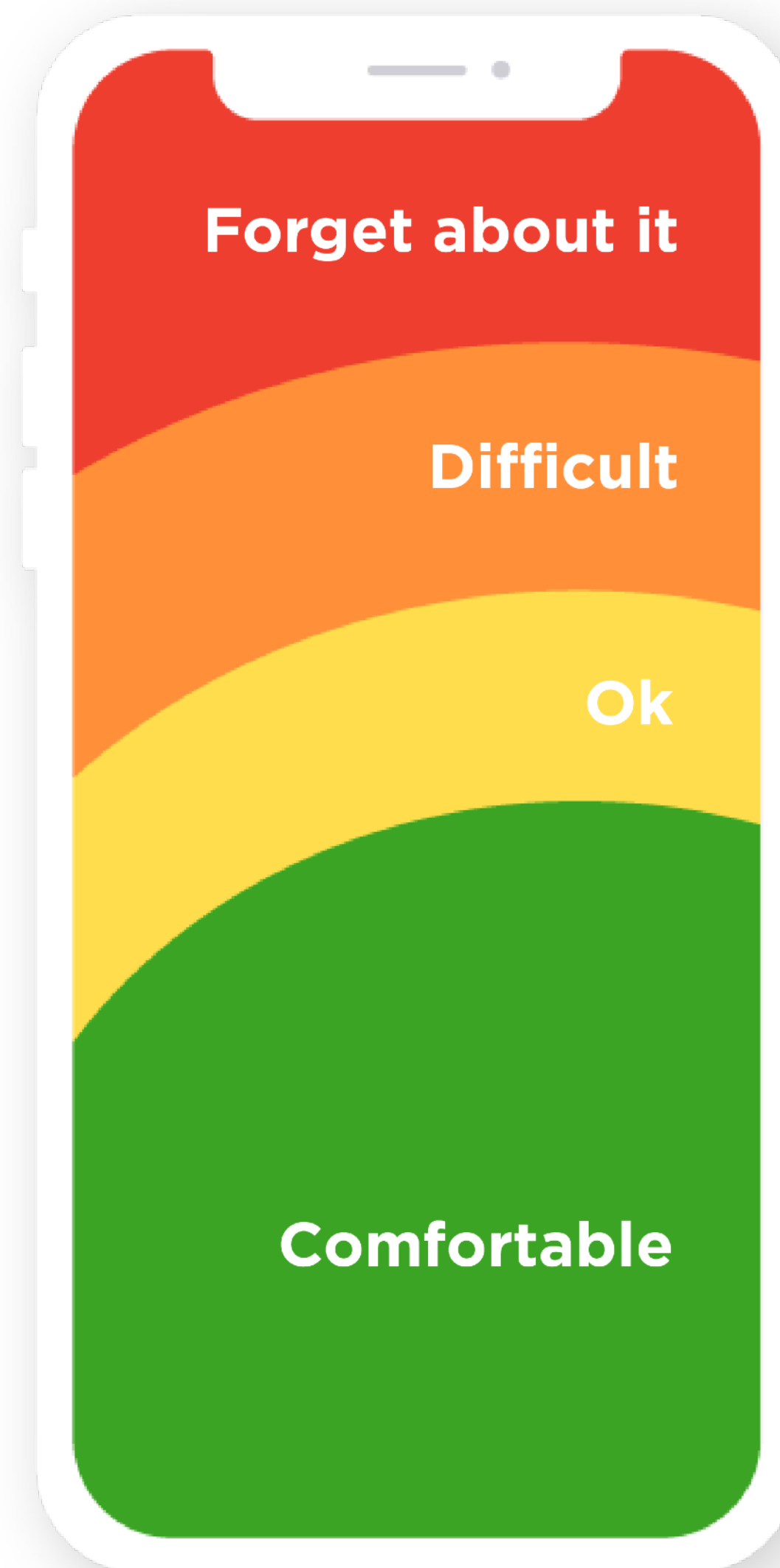
Percentiles are shown in anthropometry tables and they tell you whether the measurement given in the tables relates to the 'average' person, or someone who is above or below average in a certain dimension.

Dimension	Male			Female		
	Percentile					
	5th	50th	95th	5th	50th	95th
Stature	1560	1655	1750	1450	1530	1610
Eye height	1445	1540	1635	1350	1425	1500
Shoulder height	1250	1340	1430	1075	1145	1215
Elbow height	965	1035	1105	895	955	1015
Hip height	765	830	895	700	755	810
Sitting height	850	900	950	800	845	890
Sitting eye height	735	785	835	690	735	780
Sitting elbow height	220	260	300	215	250	285
Thigh thickness	110	135	160	105	130	155
Buttock-knee length	500	550	600	485	530	575
Buttock-popliteal	410	470	510	405	450	495
Knee height	450	490	530	420	450	480
Popliteal height	360	400	440	325	360	395
Shoulder breadth	405	440	475	365	395	425
Hip breadth	280	305	330	270	305	340
Elbow span	790	870	950	715	780	845
Vertical reach (stand)	1805	1940	2075	1680	1795	1910
Vertical reach (sit)	1105	1185	1265	1030	1095	1160





Left hand



Right hand

Percentiles

Which measurements and which percentile would you use for:

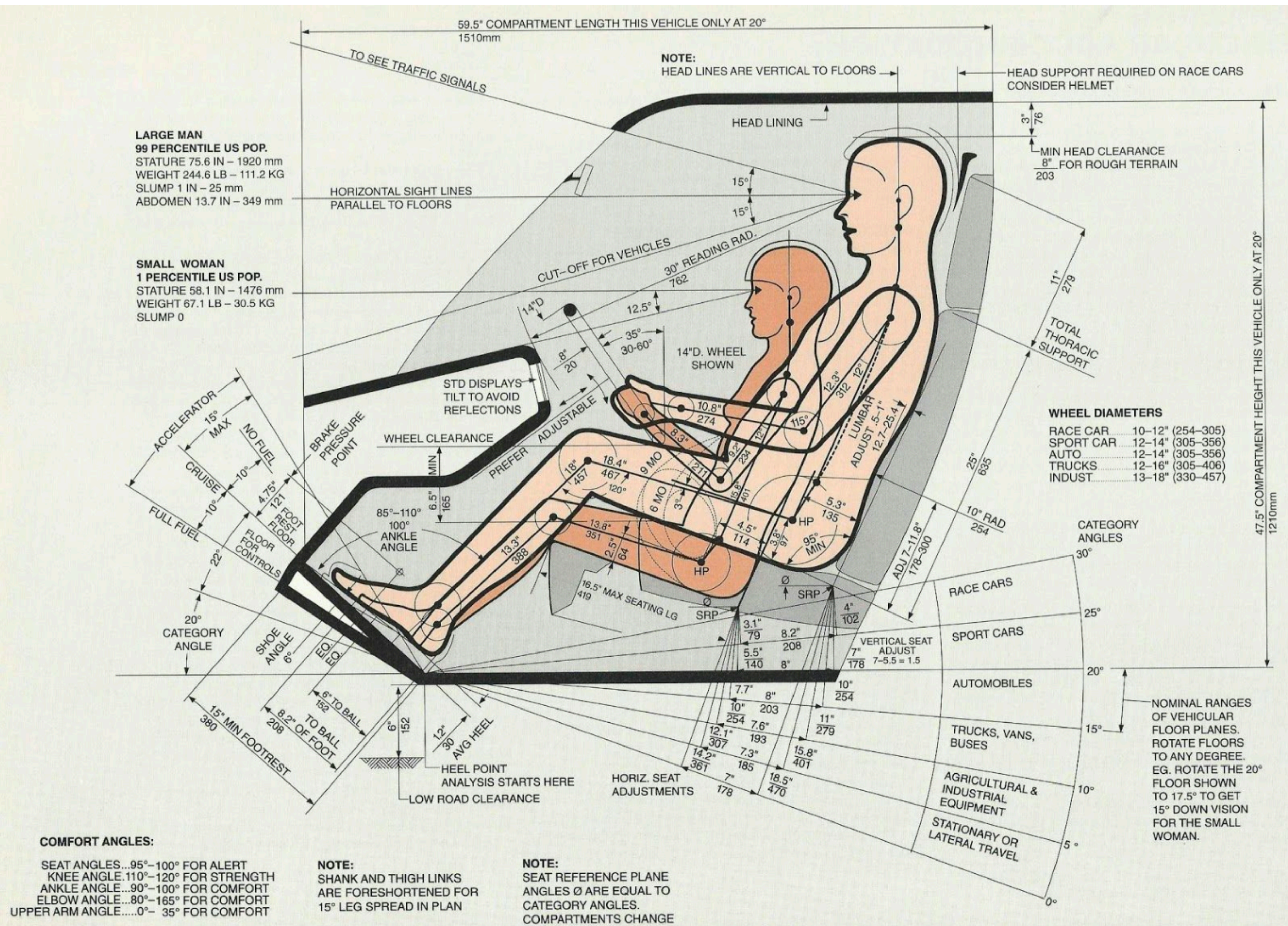
- ✦ A door?
- ✦ A cockpit where all instruments need to be reachable?

Percentiles

Which measurements and which percentile would you use for:

- ✦ A door?
- ✦ A cockpit where all instruments need to be reachable?

A common approach is to use the 5th percentile female for the lower limit, 95th percentile male for the upper limit.



Representative Human Models

A small group of people representing a designated percentage (e.g., 90%) of the target population for product design based on anthropometric data

- ◆ Efficient ergonomic design and evaluation
- ◆ Good fit between products and the target users.

**What happens if things
are not designed
ergonomically?**

Repetitive Strain Injuries

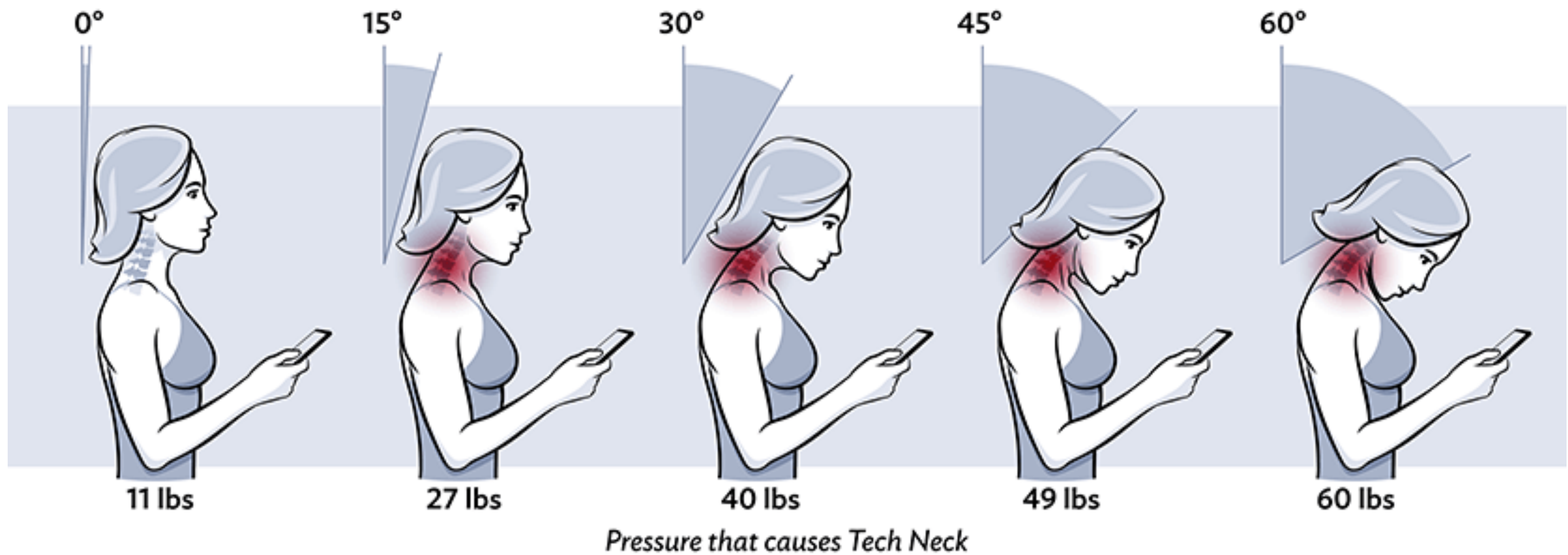
Carpal Tunnel Syndrome

- Force over 1kg
- Time < 10 sec
- Repetitive operations
- Lack of regular breaks



Mobile phone rest
on little finger

Technology's Pain In The Neck



SOURCE: kesslerrehabilitationcenter.com/why-choose-us/blog/physical-therapy-exercises-for-tech-neck-treatment/

Class Activity- Drawing Chairs

Ergonomics is a scientific discipline that addresses the effective design of products, work environments and more. Exercise - Drawing Chairs

gyani.com/ergo

Ergonomics

About [↗](#) Syllabus [↗](#) 

Ergonomics - Physical & Cognitive

Search notes..

LECTURES

Lecture 2

14 January 2025

[Link to Slides](#) Physical Ergonomics Ergonomics vs. human factors vs. human–system interaction