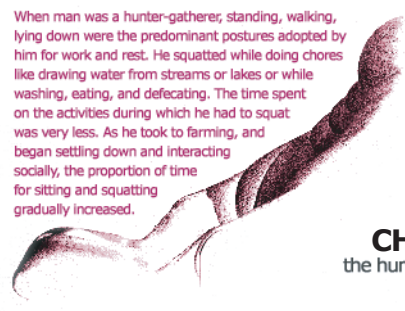


graphics by Ramiya,IDC, IIT Bombay.

CHAIRS
the human factor

©
K.Munshi
Professor of Design
Indian Institute of Technology, Bombay
Powai, Mumbai - 400 076
email : **munshi@idc.iitb.ernet.in**

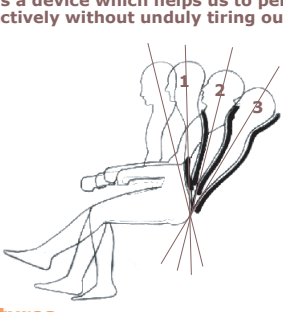
why do we sit?

When we stand, many muscle groups contract, that is, they work hard to keep our joints of the foot, knee, hip and the spine locked to maintain the posture. Blood and fluids tend to accumulate in the lower limbs. The heart has to work harder to pump blood over a greater vertical distance from the toes. A standing person, therefore, spends a lot of energy even without doing any work. This higher energy consumption and accumulation of certain chemical products (lactic acid) in the contracted muscle groups causes fatigue and pain. To relieve this fatigue we sit.

Sitting takes the pressure off our feet, legs and excess workload off the heart. The back support and armrests of a chair keep the back and the shoulder muscles relaxed. The result is that the body spends much less energy. Though this could be achieved by lying down, we cannot lie down anywhere; so an **intermediate posture - sitting on a chair.**

Certain tasks necessitate a sitting posture. These tasks are essentially compulsions of modern society. Reading. writing, having extended conferences, watching television, driving cars, flying aeroplanes, or those tasks which require free and precise body movements, like watch repairing and diamond polishing, are some of them. Such tasks cannot be performed effectively in any posture except sitting.

Sitting is good for operating foot controls because the sitting posture gives stability to the body. **We can conclude that a seat or a chair is a device which helps us to perform many tasks more effectively without unduly tiring ourselves.**



sitting postures

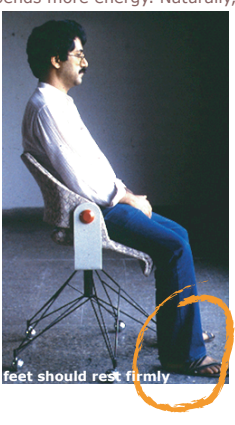
1. **Sitting to work at a surface**, like writing, cutting vegetables or assembling electronic parts, driving a vehicle, repairing a watch or eating at a dining table.
2. **Sitting to work without a work surface**, as while knitting, reading a book, sitting to monitor (watching things happen) like watching television, or games in a stadium, or a concert in a theatre, in a tourist bus; sitting in front of a display panel to monitor various functions of an industrial plant.
3. **Sitting to relax**, like leaning back in a chair at home after a day's work or in a park.

In each of the above categories, the posture is different. So, there should be different types of seats for each. As we move from category 1 to 3, the angle of the backrest increases with respect to the vertical; the level of comfort increases because we move towards a supine posture from an upright position.

a good seat

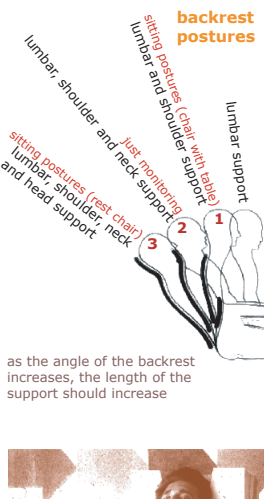
An all purpose chair does not exist but one can have a **good chair to suit individual tasks**. One must definitely avoid using chairs that force us to adopt the wrong posture.

The first criterion of a good chair is that it should support the pelvis, spine, legs and arms. It should neither be too high nor too low. In a high chair, the feet and legs dangle, the pressure under the thighs increases, hampering the blood flow to the legs and making them numb. In a low chair, the thighs are not adequately supported. This causes fatigue. To get up from a low chair, one spends more energy. Naturally, if done often, it makes one tired.



While sitting on a good chair, the **feet should rest firmly on the ground**. There should not be a gap between the seat surface and the knee end of the thighs. This part of the seat should be well rounded and soft so that it does not dig into the knee cap). The depth of the seat should be such that while keeping the feet firmly on the ground, one should be able to lean right back against the backrest at the lumbar region (the small of the back).

The **seat should be cushioned** with a soft but firm material so that pressure on the buttocks is fairly evenly distributed. If the cushion is very soft and thick then one sinks into it. This makes it difficult to get out from. If the cushion is soft and thin, the buttocks touch the hard surface underneath, thereby losing the effect of such cushioning. The upholstery should be textured to prevent slipping and should preferably be made of woven materials like cottons and hand looms so that it breathes and ventilates. The backrest should also be cushioned for full support, but the cushioning material should be softer than that used for the seat. the lack of support at this region is either due to improper seat depth or wrong contours of the backrest - the cause of many back pain and slipped disc.



The height and the angle (with respect to the vertical) of the backrest should increase as we go from category 1 sitting postures (chair with table) to category 3 sitting postures (rest chair). Where the person works at a table, the lumbar region should be well supported, where he just monitors (category 2) the backrest should also support the upper part of the back and shoulders. Armrests should be provided, as the unsupported weight of the arms causes fatigue in the shoulder muscles. The backrest angles in this kind of chair can vary from 5 degrees to 15 degrees.

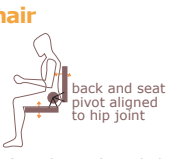
For the **relaxing posture** (category 3) the backrest should be high enough to support the neck as well as the head. The angle from the vertical could be as much as 60 degrees. A negative or recessed head support where the back of the head rests in a wedge-shaped recess, prevents the head from dropping sideways if the sitter dozes off. This type of head support is also useful for bus and aeroplane seating as it firmly holds the head and stops head wobble, caused by sharp turnings or vibrations. it also prevents nausea.

"**articulated footrest**"

A chair should also allow for changes of posture and for flexing the trunk, legs feet and arms. This can be achieved by providing "**articulated footrest**" with the chair or work table (a good example is a railway room chair where the leg support can be swiveled out of the armrests whenever needed). Independent footrests or foot stools or ottomans also allow the lifting and lowering of the feet.

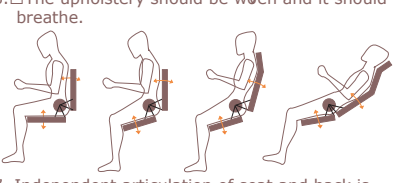
Another way to cater for postural changes is to provide spring loaded and/or pivoted backrests. Pivoted and forward inclinable seats help in stretching the body and changing the posture periodically. The pivot of the seat should ideally align with the hip joint of the person seated.

choosing a chair



1. Define the task and choose the chair for the specified task.
2. The body and feet should get firm support.
3. The backbone should retain the natural curve while sitting.
4. The back should be supported well, particularly at the lumbar region.

5. The cushions should be adequate - firmer on the seat pan and softer on the back.
6. The upholstery should be woven and it should breathe.



7. Independent articulation of seat and back is desirable.
8. The chair should allow you to adopt variations in postures.
9. Dispense with the armrest only if the task demands it.
10. Footrests should be looked for.
11. For relaxing and lounging chairs, see that the head rest, neck rest is provided.
12. An appearance of comfort or thicker cushions do not always mean comfortable chairs. Sit in it, feel it, try it and then use it.
13. Irritants should be looked for. In a good chair you should find none and you should be able to forget yourself when you sit on it.

A good chair should be interactive - responding to the body movements and facilitating correct posture, particularly during work. The seat as well as backrest should independently move about a point which corresponds to the hip joint of the body.
It should allow the feet to rest firmly.