



White Paper

*How to Buy an Office Chair:
A Primer from Applied Ergonomics*

With so many choices, how do you choose the right chairs?
Let's start with a primer on the different features of desk and task chairs.

First, the adjustment mechanism

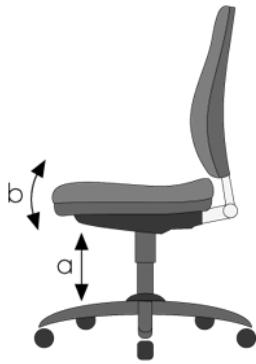


Fig. 1 Swivel-tilt mechanism

Swivel Tilt

The most basic chairs feature a gas lift with a **simple swivel tilt mechanism with tilt lock**. This means that the chair has a center pivot point for rocking and a lever that can be lifted to activate the pneumatic gas lift to raise or lower the seat height. The mechanism's lever is pushed in prevent the chair from rocking and locks the seat in a flat horizontal position. The seat and back move together as a unit. These mechanisms are very common on chairs from big box stores, but we only recommend them for conference chair applications. A definite drawback of chairs with this type of mechanism is that you can't vary the angle between your legs and back, and when you recline the front of the seat raises, adding pressure to the underside of your thighs and potentially restricting your circulation. These chairs are often sold as executive chairs in high back faux leather with deep loop arm supports. They are really terrible for your posture. The deep arms keep you from pulling up to your desk, so you have to lean forward to reach your keyboard, and when you are leaning back the padded upper back often wraps around your shoulders, forcing a hunched posture. Stay away from these, even if you are tempted by the price!

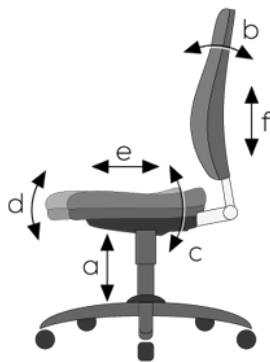


Fig. 2 Multi-function mechanism

Multi-function

The first innovation that kicked off the category of ergonomic seating was the development of the **multi-function mechanism**. This allows the user to adjust literally every dimension and angle of the chair. Most often, the center paddle activates the gas lift to raise and lower the height. The rear paddle allows you to change the back angle relative to the seat, gaining a variable open hip angle. The front paddle locks and unlocks the seat angle. There is either a far back paddle or a knob that allows for back height adjustment. Some versions of the multi-function mechanism feature a forward tilt lockout option. We're big fans of forward tilt on the seat pan, as it offers real benefits. Having the seat at a slight forward tilt takes pressure off the thighs and makes it easier for shorter people to place their feet firmly on the floor, both enhancing circulation. It also helps to roll the pelvis forward, making it easier to achieve an "S" curve in the spine, rather than the common "C" slouch. The challenge with most multi-function mechanisms is that the tension on the spring needs to be set to the individual's weight, and if it's too tight you are thrown forward beyond a comfortable angle. While you mostly likely won't actually slide out of your chair, this sensation doesn't feel very good. It takes fine tuning of the tension control, located most often on the underside of the seat, to get this right. Some newer mechanisms offer a **forward tilt lockout** which spins to set the exact forward angle of the seat, alleviating the issue while giving the benefit.

Who should consider a multi-function mechanism? Most experts, including us, advocate movement throughout the day, and the multi-function mechanism is intended to precisely dial in an upright, supportive posture. Having said that, many people want to get their movement by getting up and walking or working part of the day standing, and while they are seated they just want to be in one position and perhaps change an angle or two as the day goes on. The multi-function mechanism is ideal for these people with one caveat: they must understand how it works, so education and ongoing access to usage guides is critical.

Common to many types of chair mechanisms is the **variable seat depth** setting, or "seat slide" (Figure 2e). It adjusts the depth of the seat relative to the back. Almost everyone benefits from this feature, and it's a critical consideration when buying for a group or organization. Some chairs with a fixed seat depth will feel just right to some individuals, and some chairs can be ordered with multiple size seats in depth and width, but unless the seat feels just right, varying the depth will allow you to sit back in the chair, gaining back support, and ensure proper circulation by not adding pressure under the front of the thighs. A general rule of thumb is that the front edge of the seat should be 4 fingers behind the back of the knee, and the reality is that most seats are too deep for most people. Generally, people who have long legs, are short-waisted or are large-bottomed benefit from extending the seat pan forward. Some seat slides are set to only go forward from the otherwise fixed position, while others go both deeper and shallower.

Knee Tilt

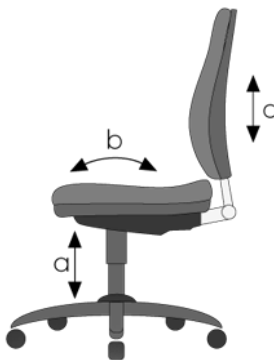


Fig. 3 Knee-tilt mechanism

The next step in the evolution of ergonomic seating was the **knee-tilt mechanism**. Intended for use by people who spend part of the workday in a reclined position, perhaps on the phone or deep in thought, the knee-tilt mechanism moves the fulcrum forward so that when the seat is reclined, the front raises up less so than on a center pivot point. This lessens the pressure on the thighs while reclined, producing a very comfortable rocking motion. Most other features from the multi-function are available with knee-tilts except usually seat slide, as it impacts the center of gravity and counteracts the mechanism. A personalized seat pan size is thus recommended for task chair use. The wonderful rocking motion would seem to be ideal for conference use, and it *can* be with a caveat: it must be set for conference room use at the tightest tension because if a large person sits in a knee-tilt chair with the tension loose, they can literally fall backwards.

Synchro-tilt

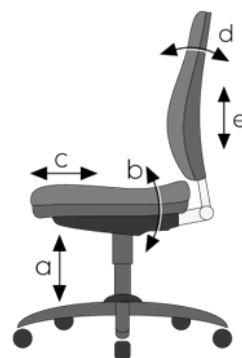


Fig 4. Synchro-tilt mechanism

Unfortunately, Cornell University has now documented what we've all known anecdotally: a vast majority of people have never adjusted their chairs and don't know how or what they would want to achieve when doing so. This understanding by chair designers has led to more simplified mechanisms. The first of these was the **synchro-tilt**, which is now very commonly used for general task seating. It moves the seat and back in a ratio, most often 2:1. The synchro-tilt mechanism makes reclining easy and healthy with reduced lift on the front of the seat as the back reclines deeply and is almost always compatible with seat depth adjustment. Most synchro-tilts have two drawbacks though: 1. The range of movement is limited, so for some people they don't go far enough forward or backward, and 2. the starting angle between seat and back before they adjust upon recline is preset, so for some people the upright posture is not sufficiently upright and not adjustable. There are some notable exceptions to this limit, and the **Soma E mechanism** stands out with its separate adjustment paddle for back angle. For conference applications there is also a good but less common variant of these called the synchro knee-tilt.

Niels Diffrient, who invented the knee-tilt mechanism, later tried to design a radically simplified chair and this became the iconic [Humanscale Freedom](#) chair. It allows seat slide and backrest height adjustments to conform to the individual's needs when they first sit down. Otherwise, the frame of the chair acts as the mechanism and uses the weight of the person to determine the resistance of the recline ratio. Diffrient continued by designing the Liberty and Diffrient Smart chairs based on the same principle, incorporating purposely tailored mesh into the back for body-hugging back support. His innovations were adopted by many in the furniture industry and resulted in production of many chairs featuring weight-balanced mechanisms on the market, including the 4U from Via and the Icon from Neutral Posture.

There are many other unique mechanisms in the market. One example is [Hag](#), a fine Norwegian chair manufacturer and maker of one of our favorite chairs, the [Capisco](#). While the Capisco features a very simple mechanism, the firm's other chairs, the H04, H05 and [H09](#), are designed with very sophisticated non-locking mechanisms that encourage continual movement and core muscle engagement. Another European company that makes great movement chairs is Aeris, distributed in the US by Via. The well-known Swopper and the new 3Dee feature a spring coil and rotating shaft for the seat post which allows for continual movement and core muscle use while rotating the pelvis. Other creative new chairs designed with these same goals include the Backapp and the Core Chair.

What else makes a chair great (or not)?

ARMS. We're fanatical about chair arms.

Let's face it, most chairs have **terrible** arms.

This is what we look for when we evaluate arms:

- Do they go low enough? Almost all arms go high enough but the issue is that they don't go low enough and they push the arms up, forcing your shoulders into an unnatural shrug posture. That causes pain over time. We look for arms that can get low relative to the seat.
- Do they come in close enough to the body? Many arms are fixed width and many others are width-adjustable to fit wider people. The issue is that you want your elbows to be comfortably close to your torso, and if the arms force you to extend your arms outward to get support, that's bad for your back and wrists. Some of our chairs offer arm caps that either rotate or slide in close to the body, leaving the posts wide for comfortable hip room but still giving plenty of close-in arm support.
- Are the arm pads hard or soft? The ulnar nerve (funny bone) runs around the outside of the elbow and resting your arms on a hard arm pad can, over time, inflame the nerve.
- Do they extend too far forward? Have you ever had the experience of not being able to pull up to your desk or keyboard tray because the arms are hitting first? Then you know what we're talking about. The arm caps should support your forearms near the elbows, not the wrists.
- Can they get out of the way when you don't want them? Some arms can go down almost as low as the seat, others can swing down, still others can swing behind the back and others still can be easily pulled off the chair.
- Can they move to various positions for different tasks? With handheld tablet use increasing at desks, this has become a nice feature.

How about NO arms?

Some people simply aren't comfortable without arms, they need the support. For most though, arms are most useful for resting and not for actual computer use. If you have a palm support on a keyboard tray or desktop, it's likely that you are taking enough load off your shoulders to make the arms unnecessary.

What about back support?

This is key for so many people and involves multiple aspects of the chair's design, starting with whether the back is upholstered over foam or if it is mesh. Chair designers create lower back support with the shape of the foam, back height adjustment and adjustable additions to the back, whether mechanical or inflatable, to customize the firmness of the lower back. Some chairs feel like the hug your sides and that's fine as long as they also help support the lower section of your spine, rolling the hips forward and firming up the lumbar area. A small number of seating manufacturers understand how critical open shoulders are to good posture and offer narrow upper backs or sculpted backs with distinct thoracic support. These manufacturers are again some of our favorites and include Soma, Keilhauer, Hag, Neutral Posture, Bodybilt and RFM.

Back support gets a little trickier with mesh backs. Humanscale has created seams in the mesh to create side support. Allseating has created a flexed frame in its You chair to vary the depth of the support, and used an elastomeric material in the mesh to make it more responsive. ChairX, an updated design from the creator of the Ergohuman, has a flexible lumbar support section of the back. RFM will soon introduce a new mesh back chair with a pair of air bladders for lower and thoracic support. Most other manufacturers have a variation on an adjustable strap the can slide up and down and / or tighten to create a firmer lumbar experience.

What else matters on chairs? A lot.

The quality and type of **foam** used makes a huge difference to the comfort and longevity. Foam varies in density and how it is shaped. Denser foam tends to last longer and be more supportive, but this really is an oversimplification. Many high-end seating manufacturers use multiple densities of foam in different parts of the seat to distribute pressure. Others use memory foam, which molds to your body over time and returns to its original shape. Foam can be cut from blocks or it can be injection molded. When it is molded, it not only takes a specific shape that helps support the body, but it also gets a skin that adds to its durability.

Standard **casters** are designed for use on carpet. Casters for hard floors are made to be softer and thus slower rolling. Stools often have braking or reverse braking casters. Braking casters are made for safety so that the stool doesn't roll out from under you while you are getting up on it. Reverse braking casters are made for stability while seated, so that if you are using a microscope or doing other fine motor skills, the stool won't tend to move while in use. Most domestic chairs and stools are also offered with glides.

Fabric manufacturing and treatments have become so sophisticated that they deserve a chapter rather than a paragraph. The most important aspects for our purposes are durability, cleanability, sustainability and treatments. Durability is measured by abrasion testing, done by placing the fabric into a frame and mechanically rubbed with a wire brush. The test measures how many double passes occur before the fabric breaks. We look for at least 100,000 double rubs for task seating. It's worth noting just how abrasive denim is, so if your chair users commonly wear it, you need a strong fabric. Fabrics can be cleaned with either or both water-based or solvent-based cleaners. Fabrics are noted as W, S or SW, and you risk ruining the fabric if the wrong cleaner is used. More and more fabrics are manufactured with recycled content without sacrificing any other factors. The mills have been brilliant innovators in this regard. Fabric treatments include Teflon and similar stain resistance, but a slew of newer technologies are available including Crypton, which has stain resistance together with a moisture barrier, Nanotex which makes liquids bead up like mercury, and others. Crypton now owns Nanotex.

We're proud to work in an industry that has led the way in sustainability progress. Our manufacturers have almost all undertaken initiatives to become more efficient in their energy usage and material waste and are using more recycled content to manufacture products that can themselves be recycled at the end of their use. We try to encourage our customers to buy products that are long lasting and recyclable, thus putting less material into landfills.

Where do standing support chairs fit into this?

Standing supports are a relatively new category for the office, though they have been in use for decades in industrial settings. The idea is that they give you support in an upright posture that is neither sitting nor standing, and they encourage a rolling of the pelvis to create a curve in the spine and naturally good posture. Since you're upright, but not fully standing, they work perfectly with height adjustable desks that can go from sitting to standing and any spot in between. We carry great options in this category, including the [Focal Upright Mobis II](#), the [Varier Move](#), the [Via Muvman](#) and while it's not technically a standing support, we love the [Capisco](#) for multiple height use with sit-stand desks.

So, with all this education, what should you buy? It depends on who you are buying for and what your budget is.

Who are you buying chairs for? Just one individual, a department or group, or a large organization?

When we're consulting one-on-one, we sharply focus on the person's body type, discomforts and tasks. If you are buying a chair for yourself and you are living with discomfort, just call us at 847-679-5148 or fill out our [request form](#). We can drill down with you to identify a chair that will be best, and if you are in the Chicago area or an area that has a partner we can work with, we'll do our best to get you a sample chair to try. As well as we know chairs and the bodies that sit in them, getting them together is still an art that requires testing.

If you are buying for a group of people, it's best to use a chair that fits a wide range of people and is simple to use. Of course budgets need to be considered, but here's what we look for: a synchro-tilt with back angle adjustment or a weight activated mechanism, a seat slide, adjustable back height or lumbar support and (low) height and width adjustable arms with relatively soft arm caps that move forward and backward. Ideally, the chair will be somewhat modular and offer different sizes for the seat. Optionally, you can choose two or three different chairs for the group. Have them available for people to try for a few days and let people choose. We'll help you decide which should be your standard chairs, and if you are local you can come in to train your staff on the how's and why's of adjusting them. We can film this training and keep it available for both new hires and those who need a refresher course.

If buying for a large organization, there are multiple things to consider beyond the chairs themselves. Warranty and service are top priorities as chairs sometimes break. It may be advantageous to work with the same manufacturer for multiple types of chairs, again for service but also complementing aesthetics and greater discounting. When buying for a large organization, though, it's likely that you will want to offer a selection of chair options as there simply is no one chair that fits everyone, even if it comes in multiple sizes. Creating an ergo lab / lending library with chairs and ergonomic products that employees can try at their own desks for a few days is an investment that will pay for itself many times over.

The best lesson is to bring in a real expert to help you avoid all of these and many other common mistakes on your project. Call or email the author, Jeff Meltzer, founder and President of Applied Ergonomics, for a free consultation TODAY to help ensure that YOUR project is a success.

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