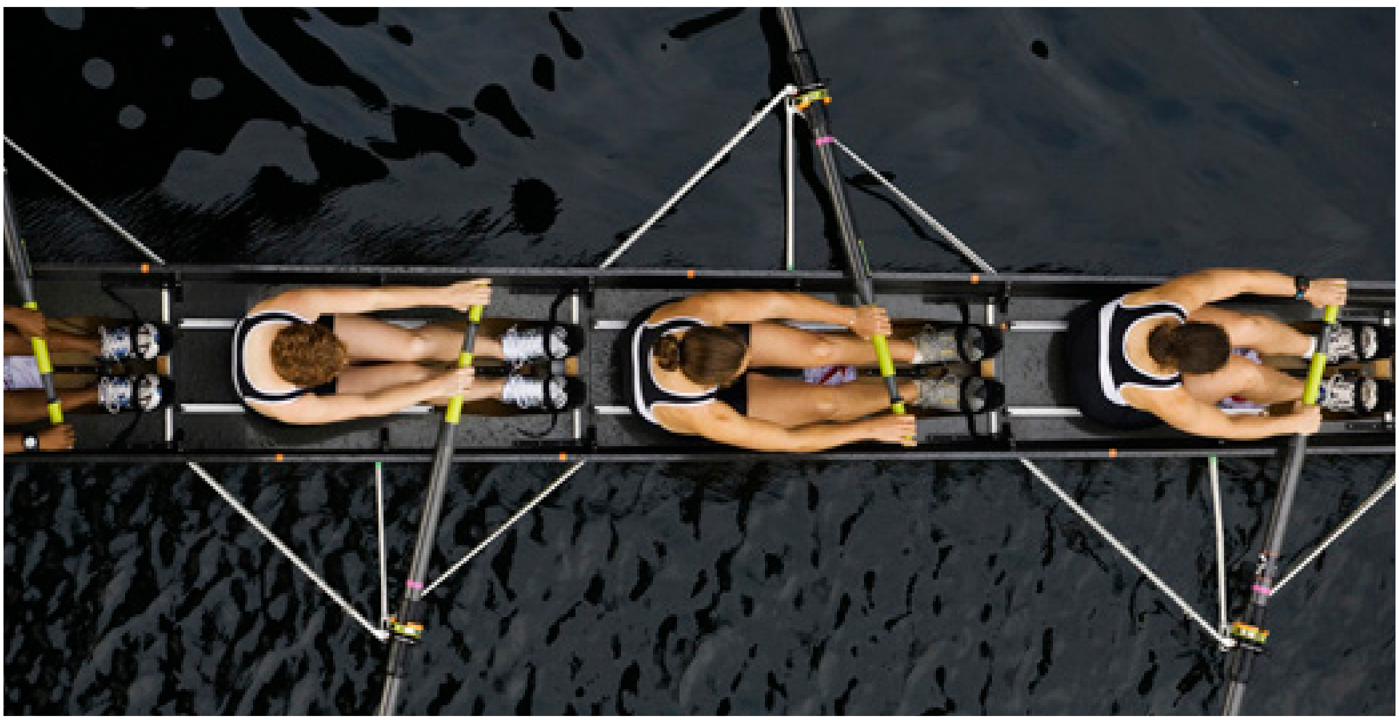
Maintaining Concordance as Seated Postures Change

HOW THE ENVELOP® DESK UNITES THE TWO HEMISPHERES OF WORK



People doing technology-intensive work may have several elements that provide proper support for their wrists, backs, and eyes. However, these elements lack concordance. They don't work in concert, so changing postures requires the person to adjust each one separately. This is further complicated by ergonomic guidelines that base the design of work areas on an upright seated posture. If the person wants to work in a reclined posture—which has been shown to offer health benefits—moving puts everything out of alignment. What is needed is an easy, coordinated way for a person, his or her chair, desk surface, and technology to remain in alignment as the person moves through a range of postures.

What We Know

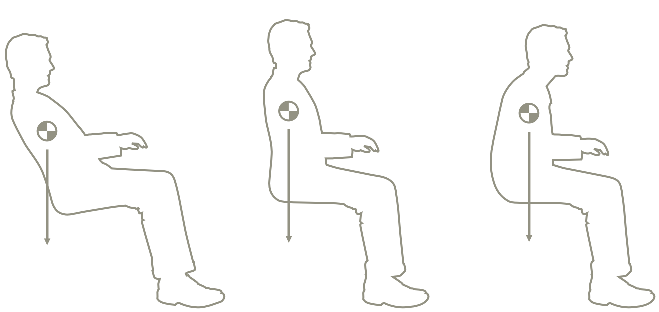
The computer is a wonderful thing. So much so, that people—whether working hard or playing intently, at the office or at home—are mesmerized by it. Focused use over a long period of time isn't the problem so much as the inactivity it fosters. That's because the human body is made to move.

Research has clearly established the health benefits of postural change when seated:

- Muscle movement serves as a pump to improve blood circulation (Schoberth, 1978).
- Movement of the spine nourishes the intervertebral discs through hydration (Holm and Nachemson, 1983).
- Continuous movement of joints is therapeutic for joints and ligaments (Reinecke, 1994).

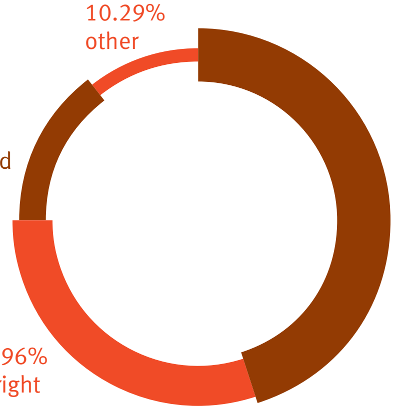
By contrast, at the workstation level, computers and computer furniture are largely static. As Dr. James Sheedy, Director of Optometric Research for Pacific University's Vision Performance Institute notes, "The main problem with the computer display is that it's fixed in space, and you've got to adapt to it visually and posturally."

For the purposes of studying the seated human body at work, ergonomists have identified three postures based on the location of the body's center of mass: reclining, upright, and forward leaning.
/ See Figure 1 /



/ Figure 1 / Typical seated postures: reclining, upright, forward leaning

Field observations indicate that people tend to sit in a way that makes their posture conform to the fixed nature of display and furniture. The Office Seating Behaviors study conducted by researchers at Herman Miller found that people performing computer-related tasks exhibited upright or forward-leaning postures nearly 75% of the time (Dowell, Green, and Yuan, 2001).
/ See Figure 2 /



/ Figure 2 / Seated torso postures as recorded through visual observation.

The dominance of forward/upright postures when computing is dictated by the practical need to view the computer screen. Physical therapist Eileen Vollowitz describes this tendency as "the eyes always win." That is, the sitter commonly—and often instinctively—sacrifices good postures and the associated proper support in order to see his or her computer screen, even if the resulting posture puts stress on the body.

Constraining movement and sitting in a posture with no support strains neck, back, shoulders, and arms. As a result, prolonged interaction with computers is contributing to higher costs associated with time lost and workers' compensation claims. To combat the pain of sitting awkwardly—as well as the tendency to sit too long in static postures—people add support elements. These range from keyboard trays to highly adjustable chairs to work surfaces that adjust vertically to movable monitor arms. As good as each of these is in promoting healthy postural change, a problem persists: They lack concordance because they do not work in concert.

Changing postures requires the person to adjust each element independently. That seldom happens. This is further complicated by ergonomic guidelines that base the design of work areas on an upright seated posture. If the person wants to work in a reclined posture—which has been shown to offer health benefits—moving puts everything out of alignment.

As research has shown, reclining reduces the load on the lumbar spine and paraspinal musculature (e.g., Andersson et al., 1974) and pumps nutrients to the intervertebral discs—the soft cushions between the spinal vertebrae (Andersson, 1981). Compared to upright postures where the effects of gravity on the spine are most pronounced, reclining effectively reduces compression of the discs. This, in turn, reduces the rate of fluid dissipation.

Assuming a reclined, or what might be called a working-reclined, posture is not only healthy, it is preferred. Researchers found that when the only task constraint is forward-directed to a visual target across the room, such as viewing a projection screen, subjects chose a reclined-torso posture (Gscheidle and Reed, 2004).

Therefore

A disparity remains between the preference for a working-reclined posture and the upright or forward-leaning posture people assume while working at computers. Further, the fact that support elements do not move in concert means they are out of alignment as soon as a person changes postures. Together, these reduce the benefits gained through the adjustability and healthful support these elements offer individually, placing undue stress on the body.

Design Problem

Design a solution that allows the individual to work in a range of postures, from upright to working recline, with the ability to position the technology at the appropriate distances and have them remain in proper alignment as the person moves from one posture to another.

Ensure that the solution allows all elements—chair, desk surface, computer display, input and pointing devices, and other work tools—to move in concert with the person so that reach and vision requirements are always comfortably supported.

Design Solution

Herman Miller is a recognized leader in the field of ergonomic seating design. Achievements in this arena, most notably the recent introduction of the Embody® chair, have improved the support given to the body as it engages with technology. However, many, including the Embody chair's co-designer Jeff Weber, acknowledge that even a highly ergonomic chair cannot deliver proper support and comfort if the interface between person and technology is out of alignment.

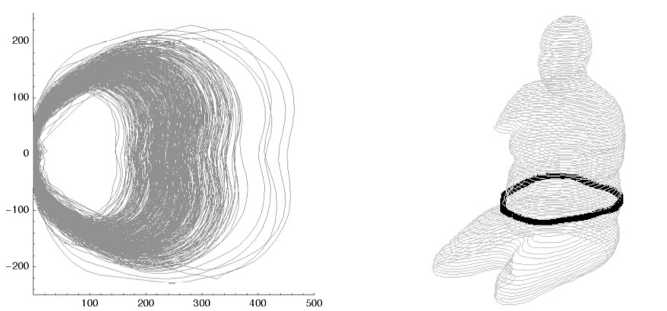
Addressing this disconnection became a priority for Weber as he worked with the late Bill Stumpf and the Herman Miller research and development teams on the Embody chair. The two pursued a global approach, addressing the "two hemispheres" of work—the person and the technology. The solution, known as the Envelop desk, is designed to relate the desk surface a person is sitting at with the chair he or she is sitting in, allowing him or her to maintain a proper distance to technology while exercising postural freedom.

/ Figure 3 / A person can move the Envelop desk's articulating surfaces fore and aft as he or she reclines or returns to an upright posture.

As Weber puts it, "Humans are designed to move." That fact, as he colorfully states it, sums up two tenets of recent research: That people don't sit still in their chairs and that moving around is good for them when they sit. The Envelop desk makes moving possible even when a person is focused intently on a computer screen.

Its design is deceptively simple. Articulating surfaces are supported by a height-adjustable base. The front, or "infield," surface is soft and resilient to reduce localized pressure on the wrists. The back, or "outfield," surface can hold up to 35 pounds of equipment. While seated, a person can move the surfaces fore and aft as he or she reclines or returns to an upright posture. / See Figure 3 / The maximum extension is seven inches, with a seven-degree decline, a ratio of one inch of decline for every inch of extension.

The infield surface nearest the person has the form of a "body pocket." Designed to accommodate a wide range of body sizes and shapes, the pocket shape is derived from three-dimensional scans of human torso models. Planar slices estimated at the mid-lumbar level were taken of 380 seated subjects from the CAESAR anthropometric survey. / See Figure 4 /



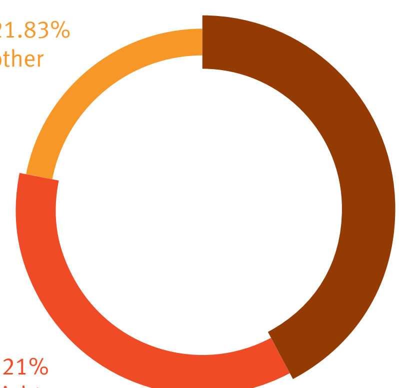
/ Figure 4 / The Envelop desk's "body pocket" dimensions are based on a wide sampling of mid-section torso "slices."

Further, on either side of the pocket, the infield surface provides continuous arm support in any position. The advantages of supporting the forearm during typing tasks have been validated by leading medical researchers. Specifically, a field-based, one year long randomized controlled intervention study with 182 subjects found that forearm support reduced neck, shoulder, and arm pain among computer users who used a computer for more than 20 hours per week (Rempel et al., 2006). Additional studies have noted that supporting users' forearms decreases trapezius muscle load (Aaras and Ro, 1997). And because a desk surface can accommodate multiple upper arm postures, it is better to support the forearms on a desk surface rather than on a chair's armrests (Delisle et al., 2006).

Further, as the desk surface moves toward the person as he or she reclines, it brings keyboard, pointing device, and computer display with it to accommodate reach and vision requirements. This is the case whether the display is part of a notebook computer, a freestanding flat screen, or a screen mounted on a monitor arm.

The concordance Envelop provides adds a new level of convenience for people. Now when they move, their technology tools move with them, eliminating the need to adjust each element separately. That convenience encourages postural freedom that is good for people's bodies. It also makes it much more likely that they'll get the support they need when they assume the slightly reclined posture that many prefer.

In the study cited earlier, (Dowell, Green, and Yuan, 2001) researchers found that three-quarters of those studied assumed an upright or forward-leaning posture while performing computer-related tasks. A recent investigation recreated this research with 33 subjects. With a conventional surface that provided no movement, the results were the same as the earlier study—75 percent of the time the chair's tilt was not engaged.



/ Figure 5 / Chair recline position as recorded through instrumented measurement of the tilt position.

However, when the Envelop desk was introduced along with a highly ergonomic chair that provided upper back (thoracic) support, the number dropped to 43. / See Figure 5 / The chairs were in reclined positions more often. Assuming the sitters' torso postures matched the position of the chair's backrest, the sitters would have experienced the health benefits the reclined posture affords.

Another study substantiated the neutral effect Envelop has on the wrists, an area of widespread focus given medical conditions such as Carpal Tunnel Syndrome that can result from extreme wrist postures. Twenty-one subjects performed keying and mousing tasks in a controlled, supervised study conducted at a leading university ergonomics laboratory. Subjects rotated through six work conditions at three different work surfaces—Envelop, Envelop with supplemental palm rest, and conventional work surface—in a random sequence. Their wrist postures were measured via an optoelectric position measuring system.

Use of the Envelop desk, either alone or in conjunction with the supplemental palm rest, was "associated with more neutral wrist extension/flexion postures when compared to the conventional table" and well within the target wrist posture range desired for such repetitive tasks (UC-Berkeley, 2009). In this same study, Envelop was also associated with less elbow flexion, another significant advantage over the conventional table conditions.

The promise of the Envelop desk is in its ability to solve a key problem that until now has not been addressed. As Matthew P. Reed, Ph. D., a noted biomechanics expert on seated postures says, "The chair and the work surface need to be considered together as a system that minimizes musculoskeletal stress while accommodating the users' preferred patterns of work and movement through a minimally complex interface."

Technology will be with us, whether at work or at play. The Envelop desk provides an easy, coordinated way for chair, desk surface, and technology to remain in alignment as a person moves through a range of postures. That alignment—and the proper support and correct distances between person and technology tools that it maintains—will positively affect the health of people as they intensively use computers.

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Credits

Championing research and creativity in the earliest phases of Herman Miller’s product development efforts, Gretchen Gscheidle leads the team that explores unmet customer needs and responds to strategic questions identified by various organizational leaders. As the research link in all of the company’s seating introductions beginning with the Aeron® chair in 1994, Gretchen has a strong record of participation and contribution in product development at Herman Miller. She is a member of the Human Factors and Ergonomics Society and represents Herman Miller on the Office Ergonomics Research Committee. Her research has been published in peer-reviewed journals. Gretchen earned a BFA in Industrial Design from the University of Illinois at Urbana-Champaign and graduated from Northwestern University’s McCormick School of Engineering with a Master’s of Science in Product Design and Development.

The late Bill Stumpf studied behavioral and physiological aspects of sitting at work for more than 30 years. A specialist in the design of ergonomic seating, his designs include the Ergon® chair, introduced by Herman Miller in 1976 and, with Don Chadwick, the equally innovative Equa® and Aeron chairs. He contributed significantly to the design of the Embody chair and the Envelop Desk prior to his death in 2006. In that same year, he posthumously received the National Design Award in Product Design presented by the Smithsonian’s Cooper-Hewitt, National Design Museum.

Jeff Weber credits his love of furniture design to working with Bill Stumpf, who designed for Herman Miller for 30 years. Weber joined forces with Stumpf’s Minneapolis firm in 1989. That led him to his association with Herman Miller. Weber worked with Stumpf on the Embody chair and, after Stumpf died in 2006, Weber evolved the design at his Minneapolis-based Studio Weber + Associates. He also developed a concept that emerged during his work on Embody: the need to unite the two hemispheres of work. This concept eventually took shape in the Envelop Desk. In addition to the Embody chair, Weber’s designs for Herman Miller include the Intersect® portfolio, Caper® seating, and the Avive® table collection.

For more information about our products and services or to see a list of dealers, please visit us at www.HermanMiller.com or call (888) 443 4357 (USA or Canada).