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July 2004

MACHINES FOR SITTING

The complex job of making
your office chair simple



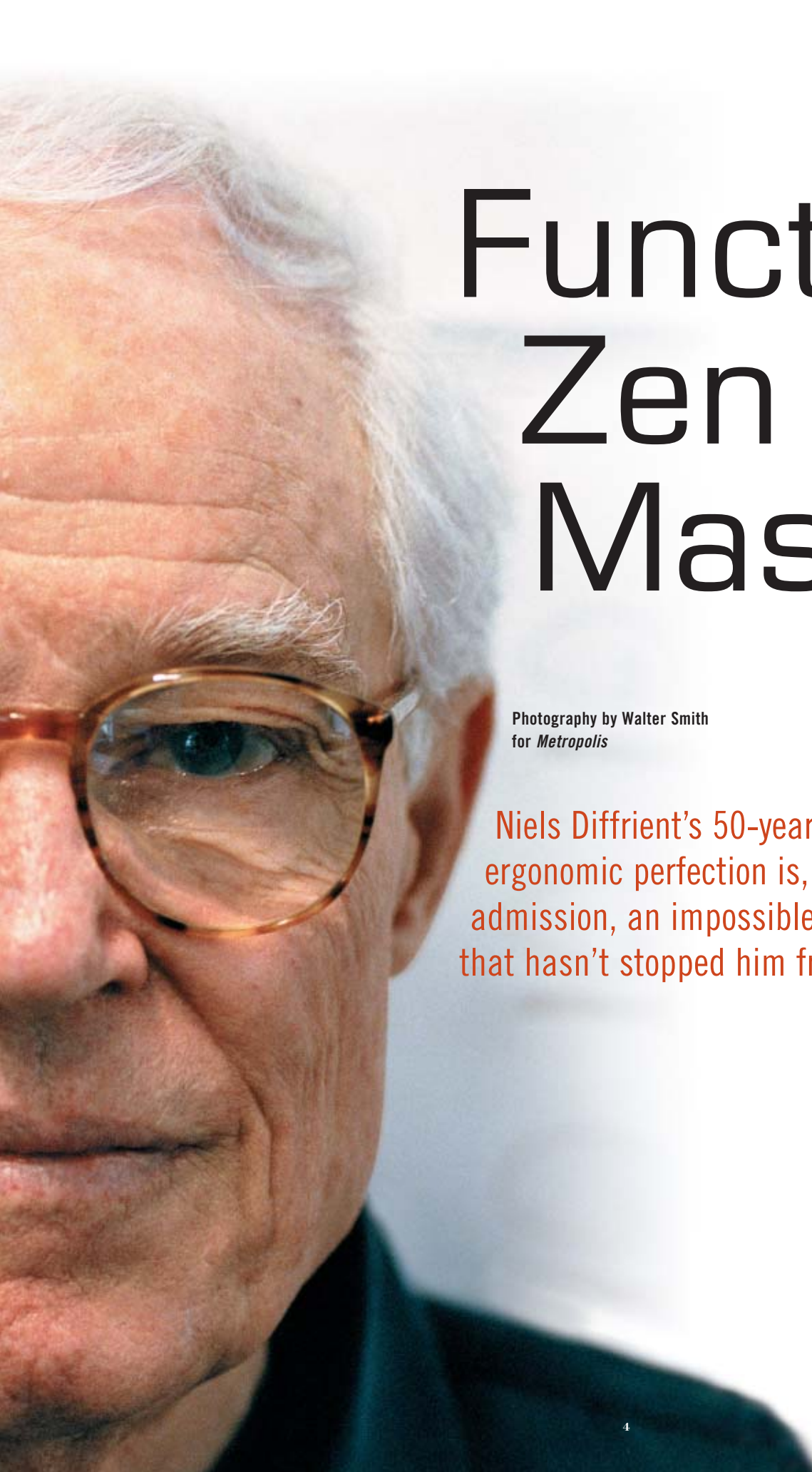
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Features July 2004

Continuing his life-long quest toward an impossible goal—ergonomic perfection—Niels Diffrient is designing a second task chair for Humanscale, a company named after the booklets he co-wrote in the 1970s, a guide to designing for the human body that quickly became the industry standard.

Photography by Walter Smith
for *Metropolis*



Function's Zen Master

Photography by Walter Smith
for *Metropolis*

Niels Diffrient's 50-year quest for ergonomic perfection is, by his own admission, an impossible task, but that hasn't stopped him from trying.



By Peter Hall

Up in the barnlike studio he built for himself and his wife on the site of a former farm in Connecticut, Niels Diffrient is demonstrating one of his inventions. For his wife, tapestry weaver Helena Hernmarck, he has designed a rather peculiar-looking fan, which is suspended by thin low-voltage wires below the 30-foot-high ceiling. At the flick of a switch, a propeller containing the fan motor whirs around in circles, pulling a larger wing blade and moving the air around with quiet effectiveness. Diffrient figured out he could avoid installing a large central ceiling motor by having the motor fly in circles under its own momentum. "It was a simple way to move it," he says. "I realized if I could put a smaller motor out farther on the arm it would not only act as a counterbalance but would use the energy more efficiently." As with many of Diffrient's inventions, the effect is a kind of incidental beauty, as if aesthetic appeal were entirely the by-product of functional requirements.

Diffrient, who is 75, has also just completed a new lightweight task and conference chair for Humanscale, a New York-based manufac-

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Seams

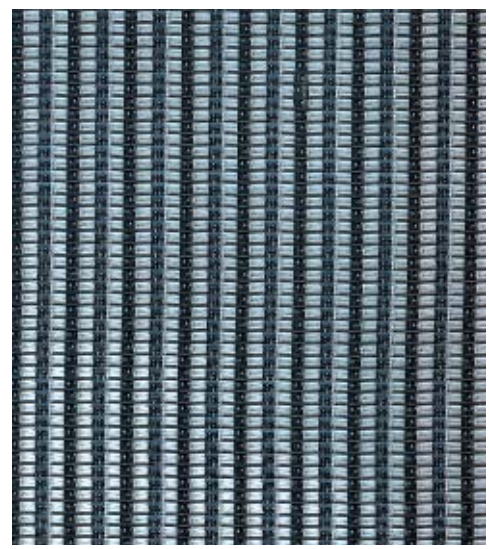
The new Liberty task chair designed by Niels Diffrient for Humanscale is made with a limited-stretch mesh that is pieced together like a shirt. The translucent backrest joins along curves that focus support on the lower back, while the counterbalanced recline responds to the force of an individual user's weight.





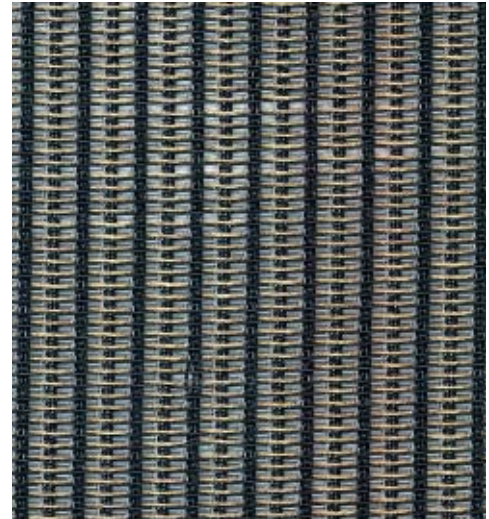
Early Prototype

“The key to developing a good design is to make many prototypes,” explains Diffrient. “The process allows you to establish and test comfort standards and refine the final appearance.” The rough prototype (shown above) allowed him to test the relative angles of the seat and backrest.



Experimental Mesh

Textile designer Elizabeth Whelan developed a variety of technical weaves that meet both Diffrient's structural requirements and Humanscale's aesthetic requests. Among the final options (shown above and below) are three weaves that support the body while still adapting to it. Each one provides a different degree of transparency and breathability.



Initial Sketch

Though Diffrient allows the process to dictate the final shape, initial hand-drawn sketches such as this one (right) give an early indication of how a chair might be assembled and look.

turer of ergonomic office equipment. The chair, called Liberty, was launched at NeoCon in June. As with his Freedom chair, which debuted in 1999 and turned the little-known Humanscale into a contender among the big office-chair makers almost overnight, it is the product of Diffrient's quest to invent a self-adjusting seat that anyone of any body size can be comfortable in.

The perfectly comfortable chair, of course, is hypothetical. "Chairs are inherently imperfect," Diffrient says. "There are always huge compromises." Having studied the way the human body moves in the workplace for the better part of 50 years, he knows that sitting still for hours at a time in any chair isn't good for you. "A straight back is more natural in the standing or lying-down position. Sitting tends to lose this natural effect," he writes in his notes on the Liberty chair and its back-support principles. But since we persist in spending our days and nights hunched into chairs in front of computer screens, Diffrient has set aside nine hours a day, seven days a week to pursue the hypothesis of the universally comfortable chair. Some might call it an obsession. "Most of my work demands a level of creative output that doesn't come as easily as when I was a teenager," he says wryly. "I don't have the energy to pull all-nighters anymore."

Diffrient's impact on the field of ergonomic seating has been "overwhelmingly unappreciated," according to Bobby Cadwallader, who led the furniture manufacturer SunarHauserman in the early 1980s and, as president of Knoll in the 1970s, first hired Diffrient to design a task chair. "From my point of view he's the best ergonomic-seating expert in our field. I don't think many people appreciate that." Cadwallader argues that this



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low profile reflects a general level of ignorance about design among the public. "Most people who buy so-called ergonomic seating today don't give a shit who makes it." But Michael McCoy, who codesigned Knoll's Bulldog chair a few years after Diffrient completed his seating system for Knoll, also identifies a reclusive aspect to Diffrient's career: "In an era of overhyped design personalities, Niels just quietly does his work and regularly introduces new breakthroughs."

After cashing out of Henry Dreyfuss Associates in 1980, where he had worked for 25 years as a designer and partner, Diffrient shed all his management responsibilities and established a small studio in Ridgefield, Connecticut, with one assistant, outsourcing everything he couldn't do himself and funding research with the help of design grants from the National Endowment for the Arts. The house he built for himself and Helena is as unobtrusive as a New England home could



Prototypes

Built in his shop, Diffrient's earliest and most clunky prototype (top) allows him to angle the backrest and adjust the seat height to proper positions. The second prototype (lower left), which is mounted on the base of the Freedom chair, lets him experience the proper recline and locate the correct armrest position. The third and most advanced prototype (lower right) fixes metal brackets onto a contoured backrest so that Diffrient can fine-tune the chair's back and arm supports.



When Diffrient unveils a new chair, his peers take note. Donald Chadwick, co-designer of Herman Miller's Aeron, says of the new chair, "Niels might be onto something. If anybody knows about the human body, he should."



Live/Work

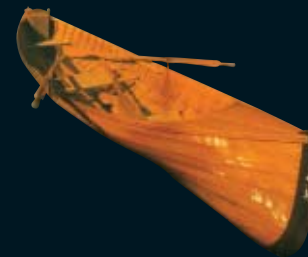
At home in his studio (opposite), Diffrient keeps several of the chairs he's designed over the years, including the first commercial chair he made for Knoll International in 1979 (in the foreground) and two pre-production prototypes of his recent project, the Liberty chair (to his left). His studio, which he shares with his wife Helena Hernmarck, a textile designer, is built on the foundations of an old barn (top). Inside, a model airplane he once constructed hovers near a window (center). "I built it 21 years ago. It was the last free moment I had," says Diffrient. And behind his drafting table on the far wall (bottom) hang some of his 40 commercial patents and awards.

Diffrient's career is a singular example of how after World War II a second wave of industrial designers followed a philosophy and practice based on human need rather than the marketing goals that had spawned the profession during the Depression.

be; the only indicator to an observer that Diffrient had something to do with it are the generous concessions to function: a port-cochere for disembarking from a car on a stormy night and a large screened deck on the second floor for outdoor dining in mosquito season. The studio is similarly designed from the inside out. Diffrient's side has two drafting tables next to a large window with a painterly view of the garden pond and grassy verge beyond. The space is perfectly composed, and furnished with evidence of Diffrient's livelihood: a wall of books, framed certificates from the patents and trademarks office, and a flat file of precomputer-era mechanical drawings, and miscellanea from past projects (a large cardboard cutout man in an eighties suit emerges when a drawer is opened). His furniture is quietly confident rather than ostentatious—there is his 1979 Diffrient chair for Knoll, the 1982 Helena chair for SunarHauserman, the 1999 Freedom chair, and the 2004 Liberty for Humanscale. The last two reflect what is perhaps Diffrient's most significant achievement, reducing the number of levers and knobs on a task chair to a bare minimum, so that using the chair doesn't require a training session—their clean curving lines and minimal controls (for the Liberty there is one, for seat height) belie the fact that the chairs use an intelligent counterbalance system that automatically senses the weight of the sitter and adjusts the recline tension accordingly.

Inspiration

Below are examples of what Diffrient calls "anonymous designs," objects that everyone uses but no one ever thinks of as being designed. "I refer to them as designs without designers," says Diffrient. "When an object is well done, it's beautiful but it's not self-consciously designed to be beautiful."



"The canoe is essentially formed by the properties of water. To be effective it has to meet certain functional demands regarding weight, strength, and the ability to move efficiently under the power of one person."



"The violin follows the dictates of sound-making from bowed strings. Its form is familiar but it is really quite striking."



"The umbrella is a ubiquitous device that we all take for granted, but look at it: just think how effective it is with a minimum amount of material and cost."



"No one would ever call a wine bottle ugly. Its shape has been determined by its use, and many of them have handsome graphics."



"An English saddle is as fine an object as the best designed chair."

The Liberty chair is perhaps Diffrient's most literal interpretation of a fitted suit. The project began with a marketing demand for a chair with a mesh fabric, which in the office-seating world is the new black.

When Diffrient unveils a new chair, his peers take note. Donald Chadwick, co-designer of Herman Miller's Aeron, says of the new chair, "Niels might be onto something. If anybody knows about the human body, he should." Before he turned his attention to task chairs, Diffrient had earned a place in design history for his work in anthropometrics, the variations in human body shapes and sizes, and how they adapt to the workplace. In the mid-1950s he and a team at Dreyfuss took a vast impenetrable array of anthropometric data and turned it into a series of accessible graphic brochures titled "Human Scale," which became the industry standard. Douglas Ball, a seating and systems furniture designer based in Montreal, recalls how in the 1980s when he was working with Sunar, "Human Scale" was the "Bible." He adds, "It was the most comprehensive study that had been made, but easy to digest and extremely well designed. Before that there was a lot of information out there, but it was in different forms, and often contradictory and difficult to access."

Diffrient's career is a singular example of how after World War II a second wave of industrial designers followed a philosophy and practice based on human need rather than the marketing goals that had spawned the profession during the Depression. While studying at Cranbrook Academy and Wayne State University between 1948 and 1953, he worked part time in Eero Saarinen's office, followed by a design and architecture Fulbright scholarship to work for Milan-based architect Marco Zanuso, where he found himself happily designing a sewing machine. Industrial design was then part of a buzz akin to interactive media in the 1990s. "As a student I felt architecture was rather retrograde, all sticks and stones, and I was fascinated by automobiles," Diffrient says. Returning to the United States to join Henry Dreyfuss's California office in 1955, he was exposed to the firm's emphasis on the burgeoning field of human factors. Thereafter he began applying increasing emphasis on user comfort and safety in design projects—which included everything from tractor and airline seats to cutlery to, from the early 1970s, office seating. "At the time, a lot of chairs on the market were pretty poor," he says. "So in my spare time I started trying to overcome the problem of a recline that lifted your feet off the floor."

He took his research to Cadwallader at Knoll, who remembers Diffrient travelling for more than two years on a chair with an articulated recline that pivoted at the knee, leaving the sitter's feet on the ground (in much the same way as the Aeron chair does today). When a prototype was built, Cadwallader concluded that to manufacture the chair would raise the retail price to double the amount any customer would be willing to pay. "I said, 'Niels, no one will buy this son of a bitch—you have to go back and make the thing much simpler.' He said

he didn't think he could do that," Cadwallader recalls. But Diffrient left for California that night and by the next day had redesigned the chair to bring down the price point. "He's not a prima donna at all," Cadwallader says. After leaving Knoll, he hired Diffrient again to work on a "next generation" office system for SunarHauserman that included a motorized height-adjustment desk to allow shorter people to find a comfortable table height without having to position their chair too high for their leg height. Cadwallader introduced the system in a brochure at the time by recalling a poignant question Diffrient had asked him in the early 1960s: "Why can't furniture fit like a suit?"

The Liberty chair is perhaps Diffrient's most literal interpretation of a fitted suit. The project began with a marketing demand for a chair with a mesh fabric, which in the office-seating world is the new black. Ever since Herman Miller defined the quintessential 1990s office chair with the mesh Aeron in 1994, everything has gone mesh, even bicycle seats. "We have a lot of requests, from the design community in particular, for a mesh chair that looks translucent," Humanscale CEO Robert King says. But when King first asked Diffrient to think mesh, he got a blunt response. "Niels felt very strongly that it was not a good material to use in a chair," King says. "He believed that it's not a good material to support your body because it can't be shaped three-dimensionally like a foam cushion. I kept bugging Niels about it, and eventually gave up."

The issue for Diffrient boiled down to one particular problem area of the human body: the lumbar, or lower-back, region. An elastic mesh stretched over a horizontal frame might comfortably displace the loads of the human backside, and, if the frame is large enough, provide pleasantly springy support for the moving upper back, but it will only accommodate the shape the lower back chooses to take—good or bad. "It's the part of the back where most people suffer, and it's the first one to go into a slump condition, or kyphosis," Diffrient says. "Kyphosis puts pressure on the disks, which for a young healthy back is not a problem, but for us oldies or people who sit at a computer for hours under work-related stress, it can aggravate a bad back—if not cause one." For Diffrient the Aeron's mesh was only capable of following a simple curve—it could not also cradle the lower back to provide support to its full contours.

Despite his initial reluctance, however, Diffrient became intrigued by King's challenge and mesh's popularity, and began to think that instead of stretching a single piece of the material over a frame, it might be possible to sew together pieces of mesh to the kind of compound curves possible in foam. Early last year he called King, who recalls that, "Niels said, 'Bob, come on up to the studio. I want to show you something.' He had a mesh chair up there. He had been thinking about the problem for quite some time. It wasn't an elegant form at that time, but he had taken three pieces of mesh and stitched them together."

Diffrient's inspiration came from a quotidian source: the shirt pattern. "Your clothes fit the contours of your body by being pieced together," he says. "I sat down and drew a pattern that I thought was workable: the cross contours were deepest through the lumbar region with a relatively flat area up at the shoulders—for the sitter to move around and twist." By changing the distances between three pieces of fabric at various

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points in a chair-back frame, Diffrient found he could optimize the three-dimensional form of the fabric to provide lumbar support for a variety of back shapes. He also found that a less stretchy mesh than Aeron's "pellicle" was able to provide the kind of firm support he was hoping for, with the additional benefit of displacing loads so the back would mold to fit variations in the position of the lumbar quite comfortably. King, who is 6'4", argues that it is more supportive for a wide variety of people than the Freedom chair. "Mesh wraps around you, whereas foam, as carefully as you mold it, doesn't take on anyone's form." And unlike Aeron's stretch mesh, he argues, the Liberty's fabric "displaces like gel materials. That's the exciting thing about this material—you don't have to adjust the height of a lumbar support."

In King, Diffrient has found an opportunity to have his ideas realized without the compromises of a large producer, focus groups, and firmly entrenched procedures. In Diffrient, King has found a unique blend of aesthete, engineer, and ergonomist who doesn't quite subscribe to any particular school. Diffrient distinguishes himself from ergonomists (who do not invent forms) and what he calls "art-based" designers ("who find the form they like and squeeze function into it") as well as engineers. To develop a pivoting and height-adjustable arm for the Liberty chair, for example, that moved in a way that mirrored the natural side-to-side movement of the arm, Diffrient came up with a patented mechanism. Unlike an engineer, he says, "I didn't start with the mechanism; I started with a need. I'm uncompromising in that respect."

It was a meeting waiting to happen. King had built his company, initially called Neutral by Design, on the back of an ergonomic and easy-to-adjust keyboard tray, and had just begun to investigate the idea of branching out to chairs. He knew from a human-factors study of 1995 that operating task chairs was more than most people could fathom. "It was clear that no one knew how to adjust them—even salesmen got it wrong," King says. "I interviewed designers about this, and they suggested putting a CD-ROM into the chair. I knew that wasn't the issue. Then someone told me the greatest chair designer in the world was living in Connecticut. I went out to meet Niels, and we had a long talk

about my philosophy of making things easy to use. Niels felt the same way. Then he led me upstairs to a room where he had a prototype of what became the Freedom chair. I remember driving back and telling someone on the phone that I had just seen the future of task seating." King promptly bought the name Humanscale from Dreyfuss and renamed his company.

Out in the bucolic calm of Diffrient's studio, where the only distracting noise is the sound of ladybugs falling from a window blind, it is not easy to imagine that this sprightly gray-haired man drinking tea and discussing the winter habits of insects is a key player in the future of a multimillion-dollar business. The calm contrasts frenzied activity elsewhere: Liberty was designed with the help of a diverse team of trusted specialists including a 3-D software operator in Portugal and a machine shop in California. Diffrient leads the remote team with the aplomb of experience. New York-based textile designer Elizabeth Whelan—who designed Liberty's mesh using material from a Swiss manufacturer that makes protective mesh for BMW motorcycle gear—reflects that working with Diffrient is a unique lesson. "His kindness, laserlike concentration, and intense pace have profoundly affected me."

One is still left wondering, however, what drives Diffrient to focus so intensely on comfortable seating when he could be inventing new ceiling-fan designs, or just playing golf with all the other septuagenarians. He describes the chair as a "psychological challenge: all architects and designers of note have chosen the chair as their ultimate note. It's gotten to be hallowed ground." Yet as Diffrient is quick to point out, most of the icons of chair-design history are simple mechanism-free objects. The modern task chair is a complex piece of equipment required to satisfy increasingly demanding criteria. It's not really even furniture. As Diffrient sees it, the task seat is "the most used piece of professional equipment."

Noted writer and design consultant Kenneth Gaulin noted in the 1984 edition of *Contemporary Designers* a "keen, almost evangelical design philosophy" in Diffrient, "which places human comfort above other criteria." But one also suspects that Diffrient's expertise in issues of the human body and the craft of making a chair make the challenge an extremely satisfying one. As Diffrient drove me from his house to the Metro North Railroad station at Purdeys, New York, he remarked that it had been a rare pleasure to talk at length on the subject of seating ergonomics. At cocktail parties the question, "What do you do?" is often a nonstarter. Diffrient has the consolation, though, of never having suffered back problems. "I'd like the implication to be that I've only sat in my own chairs, but I might have a hard time proving that," he laughs. ■ www.metropolismag.com



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