

# Patient-Centric Medical Design

To be successful in today's healthcare environment, developers of medical devices face two main challenges: They must design state-of-the-art technology that delivers diagnostic results with ease and accuracy, and use design standards that simultaneously keep a patient calm and comfortable.

*By Louisa Kasdon Sidell*

Albert Q. was nervous. He had walked into his doctor's office complaining of a headache and white spots in his field of vision. A naval architect, he assumed that both were caused by too many deadlines and late nights at his drafting table. But within the hour, Albert found himself in the hospital's radiology clinic, waiting for an MRI. He'd heard about MRIs. The banging, the tight metal capsule. Albert hated being in tight spaces. A large man, well over six feet, Albert got claustrophobic even at the idea of being in a packed

elevator. He was sorry he'd ever agreed to come into the hospital at all. When the radiology technologist came, he seriously contemplated walking out the front door instead of changing into a hospital gown. But when he entered the examination room, Albert was surprised to see a futuristic, almost pretty, pearlescent plastic halo hovering over a comfortable table, instead of the sealed, metallic capsule he had expected. Rather than standard-issue medical-institution gray, the tones of the new device were



**BUILT AROUND** the patient: MAGNETOM Espree's unique Open Bore design can accommodate more types of patients than any other 1.5T system on the market today, particularly the growing population of obese patients.

soothing and blue, and the edges were rounded. The whole device looked more like modern sculpture than a high-tech diagnostic machine. Albert let out a deep breath, expelling much of his anxiety. "It's our new one," the medical technologist said. "State-of-the-art imaging, comfortable for all patients, and very easy to use. The designers finally figured out how to make the technology catch up with people."

The speed of advances in medical technology and device design over the past decade has

been breathtaking. This progress has affected all areas of medicine – from new examination tables to gurneys that allow easier patient lifting – but nowhere is the impact more impressive than in imaging technology. With the increased sophistication of high-resolution MRIs, CT scans and PET scans, among others, medical caregivers and diagnosticians now have systems that allow them to identify and intervene at far earlier stages in a disease or injury progression, and with far greater likelihood of a successful outcome. But as



**SOMATOM SPIRIT** translates the Siemens design philosophy into computed tomography.



**SOMATOM** Sensation Open features a 82-cm-wide gantry bore to facilitate patient accessibility and positioning, and examination of bariatric patients.





**THE USER-CENTRIC** design of SONOLINE Antares offers more comfort for sonographers.



**EASING PATIENTS' ANXIETY:** the sleek and compact design of the Symbia SPECT-CT system.



**THE TABLE** of the SIRESKOP SD fluoroscopy system can carry patients up to 500 lbs.



**THE COMPACT** flat detector design of the AXIOM Artis dTA ceiling-mounted C-arm allows better system and patient access.

with most technology, sophisticated medical equipment can still fail to accomplish its technological mission if there is a poor interface between the people who use it and the product. As medical technology has advanced – especially in the area of medical diagnostics – the issues of the human factors engineering, ergonomics, and user-centered design have gained increased importance. Not only does the technology have to work well, it also has to work well with the people who operate it – technicians, nurses, and physicians – and with the people who ultimately benefit from its service – the patients. As a result, medical design specialists now focus both on developing superior devices in terms of function and on achieving ever higher standards for the psychological and physical well-being of the operator and patient.

### The Science of Ergonomics: Beauty and Functionality

Aesthetically, today's new imaging devices are worlds away from the old X-ray clunkers that dominated radiology for decades. The modern machines are colorful and sleek, and have been developed with a nod to patient comfort – including amenities such as stereo headphones and CD decks so a patient can pass the time listening to music – as well as very sophisticated diagnostic functionality. For the staff, the new medical systems offer easy-to-read control panels, so that technologists don't dread using the machine when

they come into the room for the umpteenth time each day. Modern medical device design has also become highly attuned to what is commonly known as the "pilot error problem". "Even a small design flaw in the control panel, such as a dial that turns to the left instead of the right, can cause a harried or hurried technologist to make an error that can injure the patient," says Klaus Thormann, head of Siemens' designaffairs in Erlangen, Germany.

"When MRIs first became available in the early 1980s, they were great technology, but due to technical restrictions, they were not especially patient friendly – at least from today's perspective," observes Britta Fünfstück, Head of Marketing at Siemens Medical Solutions' MRI division. In the meantime, designers and engineers have caught up with the need for patient-friendly devices and have redesigned MRIs that allow for different patient positions and reduce the overall stress on the patient and the operator.

"If the patient isn't comfortable, or can't hold still, the discomfort will affect the quality of the images," explains Fünfstück. "The new Open Bore design helps a lot. When a patient is lying feet-first in a spacious gantry and feels like taking a nap, instead of feeling claustrophobic and fidgety because he is stuffed into a long tube, the images are better and the diagnostics are optimized."

### A Growing Market in a Maturing Industry

Thormann has studied the interface between humans and machines for several decades and has published several reports, articles and commentaries on design that works with humans rather than in spite of them. He believes that awareness of patient comfort is a sign of the maturation of the medical equipment industry: "First we got the equipment to work, and that was fantastic. Now we can focus on how people fit into the equation." For Thormann, patient-centric device design is part of a general realization that well-designed medical equipment can be a marketing tool for both manufacturers and hospitals. Not only does each one of the

"Making people feel at ease  
with technology has always been  
the greatest challenge."

Klaus Thormann, Product Designer, designaffairs,  
Erlangen, Germany

major vendors operate in an extremely competitive market; their clients do, too. “Hospitals and clinics now recognize that patients do have a choice,” says Thormann. “And if a patient who is already under stress from an illness or a trauma certainly would prefer to undergo tests in an environment that is attractive, modern and airy, clinics and hospitals are going to have to adjust to these preferences. Human factors don’t just matter to the patient – they also affect the bottom line,” he adds. “The new medical systems, accept a far greater range of patients, especially the increasing number of patients who weigh more than the 350-pound maximum for most traditional devices.”

“Before the redesign of many high-tech imaging systems, oversized patients – whose numbers are growing in the industrialized world – were unable to take advantage of improved diagnostic techniques and patient-handling systems, and as a result, were unable to profit from medical advances at the same rate as average-sized patients,” says Cynthia McCollough, Ph.D., physicist at the department of radiology at Mayo Clinic Rochester, MN. “It was unfortunate. We had to substitute imaging studies that gave us less useful information simply because a patient either couldn’t fit in the system or was too large to move easily.” Dr. McCollough applauds the new systems that serve a far wider range of body types.

## Government Acknowledges the Human Factor

Aesthetics and efficiency are not, however, the only reasons that human factors engineering has made major inroads into medical instrumentation. The government has an even more serious agenda. In 1996, the United States Food and Drug Administration (FDA) adopted the Quality System Regulation that require human factors to be part of proper design control. As a prerequisite for approving new medical devices, the FDA document lays out precise design requirements intended to make sure that the design addresses “the intended use of the device, the needs of the user, and the needs of the patient”. The FDA

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Britta Fünfstück, Head of MRI Marketing,  
Siemens Medical Solutions

acknowledges that medical devices are often used under stressful conditions, and that users may think or behave differently under stress than device designers expect.

“The U.S. government has spurred real advances and has shown true leadership on this issue,” says Michael Andrews, Ph.D., Manager Submissions, Siemens Medical Solutions. “And the engineers have gotten the message.”

The landscape for medical device design is changing very quickly. In this climate, innovative medical manufacturers have an obligation as well as a huge opportunity. The next wave of growth in medical diagnostics will belong to companies that can creatively blend state-of-the-art technology with aesthetics and ergonomics. The new trend toward patient-centric, user-centric medical design means that patients – even anxious ones like Albert Q. – can look forward to a medical experience that is as nurturing as it is necessary.

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