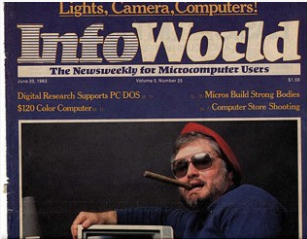




# High-tech workout aids athletes and convalescents

Imagine a computerized exercise machine that uses a micro to "maximize" your weight-training workouts?



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## High-tech workout aids athletes and convalescents

In 1983, Gordon Ariel, a former Olympic discus thrower and shot-putter with a Ph.D. in exercise science, created the Computerized Exercise Machine (CEM). The CEM uses a microcomputer to maximize weight-training workouts, providing a more efficient workout with fewer injuries for athletes and all types of people who work out with weights. The machine is also beneficial for handicapped and injured users. Ariel's controlled experiments showed that computerized workouts were more effective than regular weight-training and running methods. The CEM is controlled by advanced software and a special design based on the Motorola 68000 microprocessor. The machine costs \$15,000 and has been mostly sold to rehabilitation centers and physical therapy departments of hospitals.

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Below find a reprint of the 7 relevant pages of the article "High-tech workout aids athletes and convalescents" in "InfoWorld":

# Lights, Camera, Computers!

# InfoWorld

The Newsweekly for Microcomputer Users

June 20, 1983 Volume 5, Number 25 \$1.50

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## Special Feature

### High-tech workout aids athletes and convalescents

By Tom Shea, IW Staff

Some athletic coaches have been labeled cold, heartless and unfeeling. But can you imagine a computerized exercise machine that uses a micro to "maximize" your weight-training workouts?

Despite the Frankenstein-type possibilities, the actual machine is quite humane for hands-off and injured users, and supposedly it allows for more efficient workouts with fewer injuries for athletes and all types of people who work out with weights.

"Activating" it is easier, Gordon Ariet, the Computerized Exercise Machine (CEM) is probably more efficient for increasing muscle strength, wind (cardiovascular aerobic) endurance and limb speed than the usual methods of weight lifting and running.

Ariet, a former Olympic discus thrower and shot putter who has a Ph.D. in exercise science, has done controlled experiments testing the view against regular weight-training and running methods. His results show computerized workouts to be more effective by a statistically significant margin.

There are actually two different types of computerized exercise stations. One is a multipoint station for bench presses and bench pulls, squats and siting presses. To use this one, you sit on a padded bench, grasp the handbars of a big hinged lever and push and pull the bar up and down. At the other end of the bar, where you'd expect to see weights and pulleys, is a video display sitting atop a metal cabinet. On a table to one side are the computer keyboard, disk drive and electronics.

The other unit is a single joint station for leg and arm extension/flexion, sit-ups and unilateral motion exercises. This machine looks like an industrial-strength high chair with various contraptions hanging off it. It, too, is connected to a computer.

The working element of both machines is a hydraulic cylinder with a computer-controlled valve to vary the resistance the machines give to the exerciser. Both devices are controlled by advanced software. The computer is a special design, based on the Motorola 68000 microprocessor.

The mechanical system is simple, but the scope of what can be accomplished by someone with special needs or by someone who's interested in the fine points of athletics is great. The efforts to keep the machine simple to use, even for a jock who's afraid of computers, have paid off in a simple user interface. The user commands the exercise by small movements of the handbars and by occasionally keying in requested values.

The computer counts the repetitions of each exercise; it keeps and a horizontal line sprouts multiple bar graphs for each push and pull of the

## Announcing the Eagle PC. From \$1995, simply a better PC.

A video display is attached to the computerized exercise station.

In fact, the computer performs an

back machine and other electronics. The computer controls and monitors the weight training by DACs (digital-to-analog converters) and ADCs (analog-to-digital converters). Signals from the computer create a voltage that drives a stepper motor controlling the hydraulic valve on the exercise cylinder. This motor re-actuates the stepper motor 16,000 times a second, giving it very close control of the force the user strains against. Strain gauges, accelerometers and transducers allow the computer to measure an exerciser's activity and keep track of forces and angles.

Let's take a high-tech workout to get a feel for this smart weight-lifting device. Dery Saar, the director of fitness systems and research, explains some of the machine's abilities.

First, you put your personal data in the drive and look over the menu. It's all menu-driven," Saar says. "We

Ariet's Coto Research Center includes more than \$2 million worth of computers, biofeedback equipment and other electronic devices that comprise a high-tech gymnasium.

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First, you put your personal data in the drive and look over the menu. It's all menu-driven," Saar says. "We

can't really take any computer knowledge for granted. Most people from the exercise world are not computer-oriented.

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## Special Feature

### Exerciser

continued from preceding page

Saar said that the researchers included a video interface that could enable people to watch an instructional video tape about how to use the machine.

Staff members of the Coto Research Center in Southern California quantify and analyze human and animal motion to a degree never done before.

but the user would have to supply his own tape player, and the instructional tape has not been produced yet. On the other hand, users could simply watch TV to stave off boredom while they're building muscles or burning off fat.

To help you use up calories with precision, there's a "work training" option driving swing. That takes about an hour.

Then it takes two weeks for the staffers to digitize the information, draw stick figures for analysis, have the computer analyze the displacements, velocities and accelerations.

Finally, the staff can use the information to build an evaluation of performance, including specific recommendations to the athlete or his coach.

It costs \$2000 to have your golf swing (or whatever) analyzed by computer. The Coto Research staff also evaluates horses to see if they have what it takes to be champions and to provide useful information to the animal jockeys and trainers; analyzing a horse costs \$500.

This computerized exercise station at the Coto Research Center is for unilateral-motion exercises.

# IBM UNLEASHED

corona Personal Hard Disk 10

Volume 5, Number 25 InfoWorld 17



Dany Saar, director of fitness systems and research, finds his "sticking point," the point in the arc of travel at which the computer-controlled machine strongly resists his upward push.

tion" that lets you set yourself so much work to do. You can specify the amount of work in all sorts of measures: calories, ergs, foot-pounds. After you've chosen the amount of work you can do it at any rate you want. The machine counts it down until you're done.

Another option tells the machine to stop your routine when you've reached a certain fatigue level.

The Ariel Computerized Exercise Machine is the latest version of a product that has been a long time coming. It came out of Ariel's work in biomechanics and his determination to "take the witchcraft out of coaching" originally and later to do the same thing with weight training.

"We quantify motion," explains Ann Penny, an exercise physiologist who works with Ariel. Penny and others quantify and analyze human and animal motion to a degree that no one ever has before. In the Southern California research center, the staff rec-

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