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Coto Research Center: Athletics Goes Digital

This article discusses the innovative use of biomechanics and computer technology in sports at the Coto Research Center. The center, located in Orange County, California, is a \$1.2-million project started by Dr. Gideon Ariel, a former Olympian, and Vic Braden, a renowned tennis teacher. The center uses advanced technology to analyze and improve athletes' performance.

A typical program at the center involves filming an athlete performing their specialty, then analyzing the footage using a process known as "digitizing". This involves tracing the athlete's movement frame by frame and feeding the information into a computer. The computer then produces a printout comparing the athlete's performance to the theoretically perfect way to perform that movement.

The center also features the Wilson Ariel 4000, a computer-controlled exercise machine that monitors an individual's physical status, ability, and progress while exercising. The machine can provide instant feedback on the user's performance, including a list of required exercises and the degree of effort put forth during each repetition.

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Below find a reprint of the 1 relevant pages of the article "Coto Research Center: Athletics goes Digital" in "PSA":

SPORTS

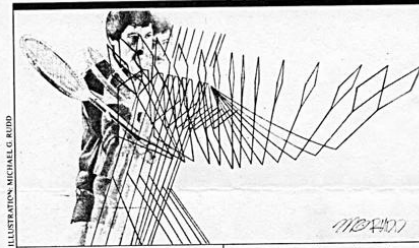


ILLUSTRATION: MICHAEL G. RUIB

COTO RESEARCH CENTER: ATHLETICS GOES DIGITAL

By Steve Bisheff—You make your way off the frantic San Diego Freeway and travel along a busy, traffic-strewn street located some seventy miles south of Los Angeles, until, finally, you turn onto a lonely road that is part of the rich, rural real estate of Orange County. It is quiet, green and picturesque, and as you go over one final hill, there is no hint that you are about to enter a brave, new world.

What you see, instead, is an exclusive resort community known as Coto de Caza. It has swimming pools, tennis courts, a new modern clubhouse and everything you'd expect at a posh vacation spa. It is not until you further inspect the premises—until you are led around the side where a building known as the Coto Research Center resides—that you begin to realize there is more going on here than just fun, sun and relaxation.

Suddenly, you are jolted by the sights and sounds of what seems to be a dazzling Futureworld of sports technology. You find a maze of cameras and computers and remarkably refined machinery, all designed to maximize the potential of the human body. Coto is the most advanced sports research center in the world, a \$1.2-million project started by Dr. Gideon Ariel, a Ph.D. and former Olympian, and Vic Braden, one of

America's premier tennis teachers.

What is happening here, in essence, is that the scientific tools of biomechanics and computer technology are being applied to human and animal physical motion. The combination of biomechanics—the study of motion in humans and other living organisms—and the speed and memory of the computer has created a new field of research. A field that, as Ariel puts it, is "science serving industry, sports and human performance."

This is the way a typical experimental program might work at the Coto Research Center: An athlete goes out on one of Coto's plush tennis courts or carefully plotted running tracks and performs his or her specialty. Meanwhile, Ariel and his technicians film the action for an analytical process known as "digitizing." In a series of carefully coordinated steps, slow-motion cinematography records an individual's movement at up to 10,000 frames per second. After the film is developed, each frame is taken separately and the subject is traced from joint to joint by a special sonic pen which feeds the information to 20,000 microphones lining the two sides of the digitizing screen. Coordinates are registered and simultaneously fed into the computer. Onto the screen flashes a continuous series of stick figures representing the actual position of the body and its limbs during each critical phase of action. The computer performs a complete analysis of this data, producing a

printout that compares the subject's performance to the "theoretically perfect" way to perform that particular movement. The athlete then sits down with Ariel and members of his staff in an attempt to discover what must be done to perform consistently at the athlete's full potential.

"Human beings are creative, but we have terrible memories," says Ariel, a stocky Israeli who competed as a discus thrower and shot putter in the 1960 and 1964 Olympics. "Computers are ignorant, but their memories are infinite. You have to guide them step by step and channel your creativity through the computer software—which is a program created by human ingenuity."

Ariel moves over to a twelve-foot contraption that looks like something you might see at any neighborhood weight-reducing gym, except that this one has a small computer screen blinking out information on top of it. It is called the Wilson Ariel 4000, and its proud inventor, Ariel, notes, "It is the only one like this in the world." What it does is offer computer-controlled exercise. "For the first time, there is an intelligent exercise machine that has the capability of monitoring an individual's present physical status, ability and daily progress while exercising," Ariel explains. The Wilson Ariel 4000 can, for example, build up a postoperative knee by presenting it with the most appropriate amount of pressure each day. At the same time, it can prevent the other leg from weakening by challenging it with the full weight.

Ariel is convinced that the computer's applications in athletics and rehabilitation will be far-reaching because of the machine's instant feedback ability. During the exercise process, the user can refer to the display screen for information concerning the history, progress and immediate status of physical performance. Some of the available information includes:

- A list and amount of required exercises.
- The degree of maximum and average effort put forth by the exerciser during each repetition.