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OLD SCHOOL

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To help sprinters, hurdlers, and jumpers reach their potential, coaches should revisit the Mach system in its original context.

In 40 years of coaching, I have seen the number and the complexity of sprint drills grow. In observing this phenomenon, I have questioned whether athletes are just doing drills for drills' sake or if the drills actually transfer to improvements in running technique or specific strength.

I feel strongly that most drills done today are just filler—fluff, ineffective at improving either technique or specific strength. They look good, but what do they do? What is the purpose of these drills? Are we teaching sprinters to drill or teaching them to sprint?

Early in my career, I was profoundly influenced by Mach drills, which are part of a comprehensive system that is largely missing today. Over the years, as Mach drills reached greater acceptance, they have often been used out of context.

I am not sure current coaches know the origin of the drills and how they were intended to be used. The purpose of this article is to lend a historical perspective to Mach drills and clarify their application as part of a system.

A PERSONAL PERSPECTIVE

In 1975, I was introduced to Mach drills by a group of Canadian athletes training in Santa Barbara, Calif. They gave me an article written by the originator of the drills, Gerard Mach, who coached sprinters and hurdlers on the Canadian national team.

At first glance, the drills did not appear to be significantly different from those used by Bud Winter, former Head Track Coach at San Jose State University. But after reading Mach's article, I saw a clear, logical sequence that was not apparent with Winter's drills. (For an excellent description of Winter's drills, find a library copy of *So You Want to Be a Sprinter,* which was originally published in 1956.)

Each drill had a specific place in Mach's system, and each drill could either be prescribed to address individual weaknesses or modified to focus on performance in specific events. I began to use the drills with my high school athletes, and quickly achieved good results.

At the time, I still thought the drills were about technique. But in fact, the improvements in technique and performance occurred because of gains in specific strength, which significantly improved posture, leg action, and ground contact.

Athletes on our team bought into the drills and were very diligent in their technical execution. This diligence is also essential: Mach drills must be executed with precision and rhythm. Because of their repetitious nature, the drills can become quite mundane, which can result in athletes just going through the motions.

By the end of my first season using Mach drills, I was still missing some key elements, especially the drills' rhythm emphasis. So I attended the Canadian training camp in Southern California, where I spent several days with Coach Mach. By watching him work with a 400-meter runner who had pulled his hamstring three days

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earlier, I gained greater insight into the system's applications for rehab. The use of the drills for rehab was aggressive and criteria-driven, and within three weeks, the runner ran a personal best.

In 1977, I met Dr. Al Biancani, who was Head Coach at Cal State Stanislaus and had apprenticed under Mach. Al was very generous in sharing his knowledge of the Mach system, which greatly helped me understand correct technique as well as the place of coaching cues in the system.

The next year, I attended a clinic where Mach spent three hours detailing the development of the Polish Sprint School, beginning with his experimentation as an athlete and continuing with the application of his system to athletes like Andzej Badenski and Irena Szewinska.

The pieces finally came together—it was an epiphany. Mach was far ahead of his time, and the concepts he articulated in the 1950's are the foundations every good sprint coach uses today.

THE FOUNDATIONS

The cornerstone of Mach's system is the A, B, and C drill series. Mach initially designed the drills to help sprinters get the repetitions they needed during the long Polish winters. In presentations, he always pointed out that he did not have the good weather American sprint coaches enjoyed, so he had to come up with alternatives to build a foundation of strength.

Mach broke the sprint stride into three component parts: knee lift, foreleg action, and push-off. Each drill was designed to work one component of the sprint stride. The A drills develop the knee lift. The B drills work on foreleg reach or pawing action. The C drills focus on push-off and extension to create vertical velocity.

According to Mach, "all exercises with leg extension and active down are special exercises to strengthen the hamstrings. The marching and skipping exercises were designed to develop the technique required for body lean, arm action, high knee lift, leg extension, and keeping the center of gravity high, but did not emphasize the strong driving forward or push forward action." (From subsequent biomechanical analysis, we know sprinters do not paw the track, but that this action works the hamstring eccentrically to decelerate the foreleg.)

My understanding, taken from discussions with Mach and Biancani as well as my own extensive use of the system over the years, is that the drills' primary benefit is for specific strengthening, not technique. They specifically strengthen the muscles in postures and actions similar to those occurring in the sprint action.

STRENGTH SPECIFIC

Strengthening specific positions occurs by repetition through a full range of motion. The result is that sprint mechanics are improved. I consider the Mach system to be a set of posture drills, specific strength drills, and functional flexibility drills. The technical benefit is ancillary.

If the drills are not taught properly and coached carefully, they can lead to incorrect execution, and repetition can ingrain bad habits. Correct execution at the precise rhythm and tempo through a full range of motion are paramount to ensure positive transfer. Posture must be emphasized constantly. Hips tall!

One of the biggest faults in the A series is its emphasis on knee lift at the expense of impulse off the ground. In the drills, the knee is not pulled off the ground to achieve high knees. Instead, the swing leg is driven *down* to create a quick strike on the ground, which results in knee lift due to ground reaction forces.

I never heard Mach or anyone who worked closely with him emphasize dorsiflexion of the foot, which has become a fixation today. If athletes put force into the ground, the foot will react and dorsiflex to the necessary degree. In the sprint stride, everything happens too fast to cognitively execute this movement.

Perhaps the biggest fault in the way the drills are currently conducted is the rate and rhythm of execution. When I observe these drills today, athletes often appear to be exercising in slow motion. Mach emphasized that the drills should be executed at three steps per meter and should use the correct arm action. Too often, athletes do the drills with very passive arm action, which is incorrect.

Each drill is subdivided into a marching (walking) action, a skipping action, and a running action, which are numbered. For example, A1 is high-knee marching, A2 is high-knee skipping, and A3 is high-knee running.


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Most of the time, drills are currently incorporated into a daily warmup. One application that has largely been forgotten is the use of the drills as actual workouts.

They can be used to emphasize either power speed or strength endurance and for rehab after hamstring pulls. For power speed workouts, drills should be executed in less than 10 repetitions, 10 meters, and 10 seconds. Mach used sandbags or weighted vests to add resistance to the exercises, which he then called "power speed mixed" drills. If the drills were done longer than 20 meters with more than 10 reps of more than 10 seconds, he designated them "strength endurance." With added resistance, Mach termed these drills "strength endurance mixed."

Szewinska was reported to have executed a series of 200-meter A2s. With developmental athletes, I have used A2 and A3 for 4 to 6 x 50 meters with a weighted vest at 10 percent of body weight. Another effective application to build specific strength and reinforce posture at the end of a race is for athletes to finish a repeat and then execute 20 meters of a particular drill.

The drills are a great lead into teaching hurdles. The lead leg is actually a B action, and the trail leg is a C action closely coupled with an A action.

Another aspect of the system I do not see applied often is its ability to link the drills to acceleration. For example, athletes can execute an A3 for 10 meters and then shift gears to accelerate over the next 30 meters. The goal is to work a particular component of the stride and then immediately place it into the context of the whole action.

Gerard Mach was a genius, and his work has stood the test of time. His drills continue to have a special place in the daily preparation of track athletes. I strongly recommend that coaches study the work of Mach, truly understand the context of the drills, and use all the system's components to help athletes reach their potential. ☆

A highly sought-after lecturer worldwide, Vern Gambetta is considered by many to be one of the pioneers in the field of functional sports training. In addition to extensive experience coaching track and field, Gambetta has worked with professional baseball, basketball, soccer, and hockey teams.