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NFL HOPEFULS' MOVEMENT ANALYSIS DATA OFFERS 'A BLUEPRINT FOR MOTION'

Data has transformed the personnel side of coaching in football, with GPS tracking and machine learning being used to anticipate player success from college through to the NFL, but there are still significant gains left to be had. Elite coach Pete Bommarito and sports scientist Dr. Monique Mokha are taking football analytics to a new level using motion capture.

"The game today isn't just 'I'm injured, I had surgery, I go to physical therapy, now I'm returning to train and I'm returning to play'," explains Pete Bommarito. "No, sports itself is stress, and quantifying the magnitude of what sports does to the body helps the overall game."

Bommarito has a background in sports and clinical biomechanics, but has built his career as a practitioner offering elite-level coaching to athletes through his company, Bommarito Performance Systems. He's discussing a study of would-be NFL players that he and Dr. Mokha, a Professor of Health and Human Performance at Nova Southeastern University in Florida, USA, are undertaking.

The pair met at a conference in 2017 and got talking. "We were just sketching ideas, like two battery sparks popping back and forth. And then as

our lab at Nova started developing, we started asking, 'What's possible?'" says Dr. Mokha.

Bommarito and Dr. Mokha have established an annual project that uses motion capture and other technologies to quantify the performance of NFL hopefuls ahead of the Scouting Combine and Pro Day, which gives talent assessors an opportunity to see players undergo a battery of physical and mental tests.

They worked out a system that involves Bommarito's athletes being tested in Dr. Mokha's lab ahead of his pre-Combine training camp, with data on each player being fed to Bommarito before training starts. Following the six to eight week camp, players return to the lab, which has 10 Vicon T-Series cameras and a Bertec treadmill, to be tested again so that the research team can analyze changes in the athletes' performance.

QUANTIFYING ACCELERATION

"It's not just draft prep and having people run fast," explains Bommarito. "It's a blueprint for motion, period. Anytime you're moving in sport, you are accelerating. People talk about multidirectional sports, and how you've got to be able to change direction. Well, that's great, but the challenge of changing direction is accelerating out of the change of direction. That is a stride that needs to be quantified."

Bommarito says that the study is proving his theory that speed and injury prevention are related. "If you're striving towards symmetry, you will not only be more efficient in terms of your speed, you're going to be more efficient in terms of injury prevention," he says.

"That's a theory I've had for years, but we've had to look at symmetry using all the medical disciplines: look at that holy grail of maximizing the splits, maximizing your time, and finding that when the medical team says we're symmetrical, and we're running better. But it's got to be quantified. And now we're actually proving my theory to be accurate, that symmetry equals not only injury prevention, but performance."

Because the study is focused on training for the speed- and strength-focused Combine and Pro Days, rather than football-specific skills, its applications aren't limited to football. "We're able to document the movement strategies that change when you're trying to get someone faster," says Dr. Mokha.

REMOVING GUESSWORK WITH OBJECTIVE DATA

The NFL hopefuls offer a perfect subject group for this type of work. "This is going beyond the NFL draft," says Bommarito. "The reason why we like to study these individuals is that you're eliminating the independent variables that plague research studies. These players are with me 8-10 hours a day. We control every single thing that they do from the moment they wake up until the moment they go home for dinner. We're controlling everything: recovery, regeneration, all their training, all their nutrition, all their supplementation."

"We're not just trying to prove how NFL players get faster in the 40-yard dash. We are proving the ultimate question of how do you maximize acceleration related to any sport motion? And how are you limiting injuries? We're solving that question, and we're taking this



baseline data and redirecting it back into the research community to go into a million different directions.

Digging into the specifics of the data her team is capturing, Dr. Mokha says that they are gathering "motion capture integrated with our Bertec force treadmill. We are looking at contact time, average peak forces and we're looking at symmetry. In terms of kinematics, we have the 3D hip, knee and ankle motion, and because we know the role of hip internal rotation, we also look at transverse plane hip motion."

Dr. Mokha has a history of using Vicon technology dating back to the late 90s, having initially worked with Peak Performance Technologies, which was bought by Vicon in 2005. It wasn't familiarity that kept her working with Vicon solutions, however. "It's because of their superior cameras," she says. "And the tech support people are outstanding." Taking deep dives into motion analysis and force plate data enables researchers to pick up issues that are visible when an athlete is sprinting but might be hidden from a therapist working with a stationary patient.

"This is where the industry is going," says Bommarito. "We're so good at neuromuscular therapy, but it's guesswork. We look at an asymmetry, we treat it, we look at the splits, we look at the motion, it gets better. It's great, but it's still guesswork."



"This 3D motion analysis, that's not guesswork. Now we're actually giving more data to the therapist to treat things that they might not see because they can't evaluate hip internalization at 20 miles an hour. It can only be evaluated through devices like this. That is where this industry needs to go. And we're the first people to actually produce research detailing this type of data."

The data are already changing the way Dr. Mokha looks at different types of athletes. "The magnitude of how much better the biomechanical metrics get in the heavy players, like your offensive and defensive linemen, is huge," she says. "It makes sense from a practical standpoint but that's data that has surprised me: how much better they can get at applying the force to accelerate, and accelerating the thighs at just the right time. They're over 300 pounds!"

She hopes to further deepen her dataset by using Blue Trident IMUs out on the field at some point in the future. "It is kind of that never-ending question of how close can you get. It's definitely the way things are headed, absolutely. I have already envisioned a huge use for this when Pete's doing his battery of

testing at his facility. He doesn't have optical capture out there, but let's put the IMUs on them."

Bommarito hopes to further integrate data capture into his work, but also to improve turnaround times. "It all comes back to how efficiently this 3D motion analysis can be done and how fast the data can come back," he says. "To a

performance coach like me, when I get those reports they're like gold, and the medical team and I spent a lot of time on this and I truly do believe that's why we get the results we get."

"This is the way the industry is going and we scientists have to get it in the practitioners' hands as quickly as possible," Dr. Mokha agrees.



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