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Wearable vs. Motion Capture: Unravelling the Secrets of Human Movement

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“Merging wearable and motion capture data provides a more holistic view of an athlete's performance.”

Imagine being able to see the invisible forces that shape an athlete's performance. That is the power of biomechanics, a field that uses science to understand how the human body moves. In archery, where split-second decisions and precise movements are crucial, understanding these forces can mean the difference between hitting the bullseye and missing the target. Two key tools in a biomechanist's arsenal are wearable technology and motion capture systems. Let us dive into these two giants

and explore how they help us unravel the mysteries of human movement.

Wearable Technology: The Personal Trainer on Your Body

At the forefront of wearable technology in sports is the ZEPHYR Bioharness [1]. This tiny, yet mighty device is like a personal trainer strapped to your body. It tracks a multitude of physiological parameters such as heart rate, breathing rate, and even sweat rate [1]. By monitoring these vital signs, we



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can gain insights into an athlete's physical stress, energy expenditure, and recovery patterns.



Figure 1: ZEPHYR Bio-Harness

Imagine an archer wearing a Bioharness during practice. We can monitor their heart rate to assess their level of arousal, which can influence focus and performance. By analyzing breathing patterns, we can identify areas for improvement in breath control, a key component of archery [2] [3].



Archer shooting postural sway output

Pros of Wearable Technology

- Portability: Wearables are easy to use in various environments, including outdoors and in training facilities.
- Continuous monitoring: They provide real-time data on physiological parameters, allowing for continuous assessment.
- Affordability: Compared to motion capture systems, wearables are more cost-effective.

Motion Capture: Seeing the Unseen

On the other end of the spectrum is motion capture, a technology that creates a digital skeleton of a person. Systems like OptiTrack Prime x 13 use cameras to track reflective markers placed on an athlete's body [4]. This creates a precise 3D model of their movement, allowing us to analyze every joint angle, velocity, and acceleration.

For an archer, motion capture can reveal subtle nuances in their posture, draw length, and release technique. By quantifying these movements, we can identify areas for improvement and develop targeted training plans.

Pros of Motion Capture

- Detailed data: Motion capture provides highly accurate and comprehensive data on movement mechanics.
- Visualization: It allows for detailed visualization of movement patterns, making it easier to understand and communicate findings.
- Versatility: Motion capture can be used to analyze a wide range of movements and sports.

The Best of Both Worlds

While wearable technology and motion capture have their strengths and weaknesses, they are not mutually exclusive. Combining these technologies can provide a more complete picture of an athlete's performance. For example, we can use wearables to monitor physiological responses during a motion capture session to understand how physical factors influence movement patterns.

By merging the strengths of both technologies, we can unlock new insights into human movement. This knowledge can be used to optimize performance, prevent injuries, and improve the overall human experience.

In the world of archery, where even the smallest details can make a significant difference, the combination of wearable technology and motion capture is a powerful tool for unlocking the secrets of the perfect shot.

Benefits of Both Technologies in Human Movement Quantification:

Both wearable technology and motion capture systems offer unique advantages when it comes to understanding human movement. Let us explore how combining these technologies can provide a comprehensive picture of athletic performance.

The Power of Synergy

By merging the data from wearables and motion capture systems, we can create a more holistic view of an athlete's performance. This constructive interaction allows us to:

- Correlate physiological and kinematic data: We can link changes in heart rate, breathing, and sweat rate to specific movements and postures. This helps us understand how physical stress impacts technique and performance.
- Identify performance limiting factors: By analyzing both physiological and kinematic data, we can pinpoint the root causes of performance plateaus. Is it a physical limitation, a technical issue, or a combination of both?
- Optimize training and recovery: Understanding the relationship between physiological strain and movement patterns helps us tailor training programs and recovery strategies for maximum effectiveness.
- Prevent injuries: By identifying movement patterns associated with increased injury risk, we can develop targeted prevention programs.

Real-World Applications

The combination of wearable technology and motion capture has a wide range of applications beyond elite sports. Here are a few examples:

- Rehabilitation: By tracking movement patterns and physiological responses during rehabilitation, we can assess progress and adjust treatment plans accordingly.

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- Ergonomics: Analyzing movement patterns in workplace settings can help identify ergonomic risks and improve work efficiency.
- Biomechanics research: Combining these technologies allows for more in-depth studies of human movement, leading to discoveries and innovations.

The Future of Human Movement Analysis

As technology continues to advance, we can expect even more exciting developments in the field of biomechanics. Wearable devices are becoming smaller, more accurate, and capable of tracking an increasing number of parameters. Motion capture systems are becoming more affordable and accessible, making them available to a wider audience. The future holds the promise of real-time feedback systems that can provide athletes with instant information about their performance. Imagine an archer receiving feedback on their posture, draw length, and release timing as they shoot, allowing them to adjust on the fly.

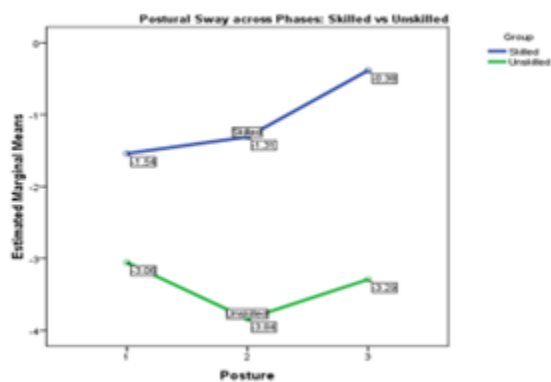


Figure 2: Postural sway differences between skilled

The goal is to enhance human performance and well-being. By harnessing the power of wearable technology and motion capture, we can unlock the full potential of the human body.

In conclusion, both wearable technology and motion capture systems are valuable tools for understanding human movement. While each technology has its strengths and limitations, their combined use offers a powerful approach to quantifying and optimizing performance. As technology continues to evolve, we can expect to see even more ground-breaking advancements in this exciting field.

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