

LE SCIENZE MOTORIE: RICERCA SCIENTIFICA E DANZA SPORTIVA.

LA PRESTAZIONE ATLETICA DI ALTO LIVELLO

Roma, 20 gennaio 2014



Talento e Analisi della Performance

“Le componenti Fisiche e Fisiologiche del Danzatore di Alto Livello giovanile”

Bruno RUSCELLO, Ph.D

Coordinatore Sezione Training e Valutazione Funzionale





Dance Biomechanics A Tool for Controlling Health, Fitness, and Training

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Abstract

The need for superior performance in dance has impelled teachers and choreographers to use increasingly effective and sophisticated methods of preparation. To that end, such modalities of biomechanics as advanced motion-capture, muscle-function and muscle-strength techniques are being used to provide useful information about which of the dancers' needs require special attention. This often involves improving aspects of dance technique, which, in turn, may help dancers to prevent disabling injuries, the most frequent cause of notoriously short dance careers. Biomechanics may also help dancers to assess fitness levels, to control overtraining or "burnout," and assist them and their teachers in the effective scheduling of practice and exercise sessions.

From the biological sciences point of view, physical performance is mainly a function of an individual's size, shape, sex, age, and physical fitness. In particular, professional dance performance is a complex phenomenon, depending on a large number of interrelated elements that are derived from such dissimilar and

diverse areas as material science, body science, and even space science.¹ These include a number of technical and medical elements, directly related to the discipline of biomechanics, that are used to detect areas of weakness that require special attention.

Biomechanics is the study of the human body in motion. By applying principles from mechanics and engineering, biomechanists are able to study the forces that act upon the body and the effects they produce. In other words, biomechanics is the scientific discipline that studies the mechanical codes of human movement, such as muscle fiber recruitment, by using state-of-the-art technologies and techniques.

Although Aristotle (384-322 BCE) was the first to examine and write about complex movements of the human body, such as running and walking, and Archimedes (287-212 BCE) was the first to examine floating bodies and their movements in water, biomechanics was primarily developed during the 1970s, when there was a widespread tendency for sport coaches

to slavishly copy the training methods and, particularly, the techniques of current champions and present them as models to young hopefuls. More recently it has been established that every individual is biomechanically different and what we perceive as superior technique is uniquely reserved for a specific individual. Nevertheless, biomechanics can help dance educators to detect the root causes of faults (e.g., anatomical imbalances) that arise during particular movements, secure the best possible use of their dancers' natural abilities (talent), and avoid movements that may cause injuries.

Common Biomechanical Techniques

Biomechanists are using a large range of equipment to measure and record time, motion, and force, thereby advancing knowledge in such areas as developmental biomechanics, biomechanics of exercise and sports (including dance), and rehabilitative biomechanics. The most common techniques used worldwide include motion capture, electromyography, dynamography, and dynamometry.

Motion Capture

Over the centuries the evolution of methods for capturing human movement has been motivated by the need for new information on the characteristics of normal and pathological human movement. The optical devices used in biomechanics for this purpose

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Il Centro Studi FIDS e le Scienze Motorie di “Tor Vergata”



Studio del Top Level assoluto

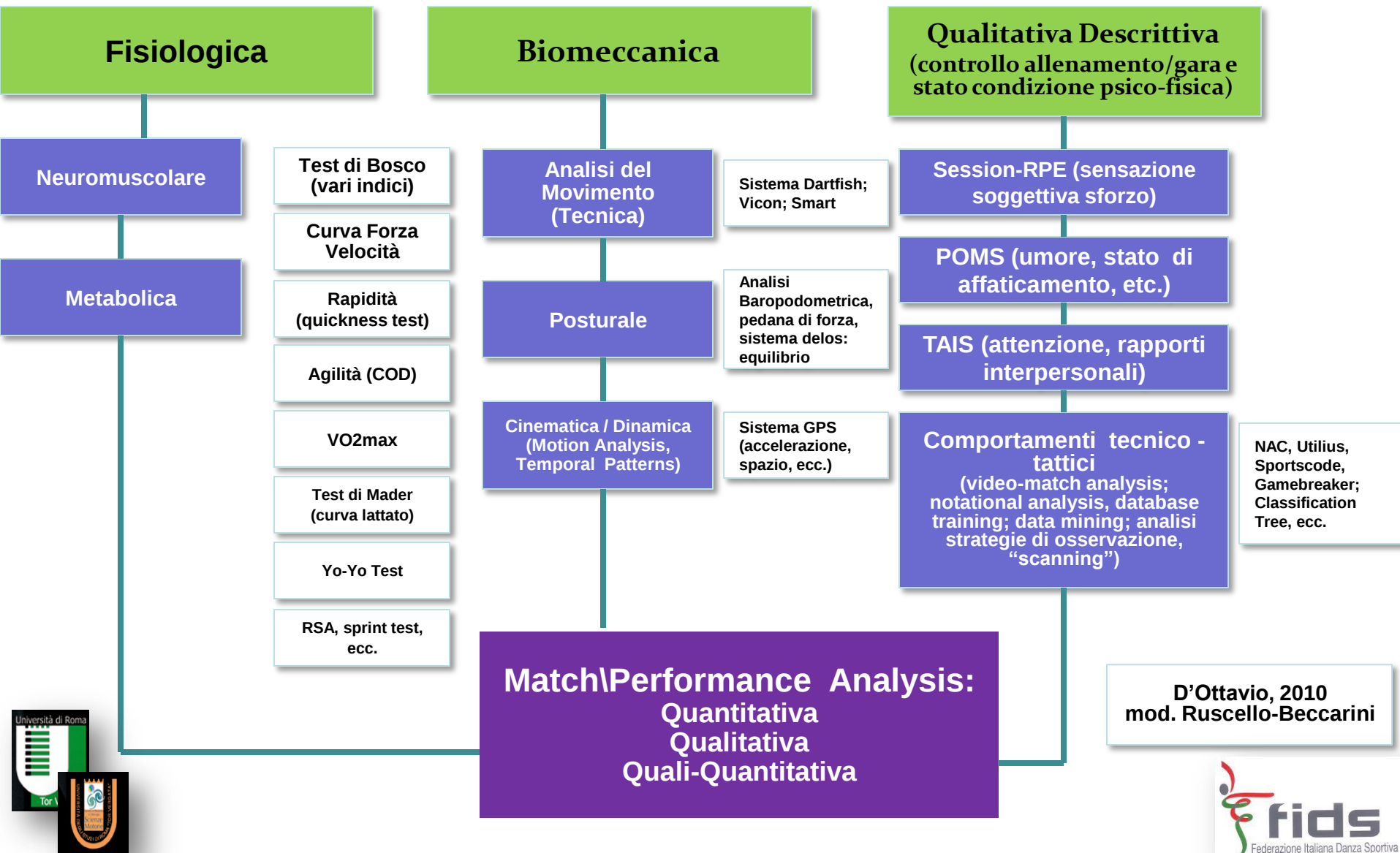
**Studio del Top Level giovanile
(progetto Talento)**

Studi comparativi Elite – Sub Elite



Gli Strumenti della Valutazione Sportiva

Protocolli principali (Università di Roma "Tor Vergata")



2013

Progetto Talento: Danze Standard e Latino Americane



Analisi di parametri cinematici, dinamici, fisiologici e posturali-funzionali, in giovani atleti di elite, praticanti la Danza Sportiva.

A cura del Centro Studi e Ricerche Federale:
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Dott. Gianluca Briotti – Dott. Fabrizio Pallocchia

Coordinamento Federale "Progetto Talento"
Prof.ssa Laura Lunetta

2013

Progetto Talento: Danze Jazz, Freestyle e Caraibiche



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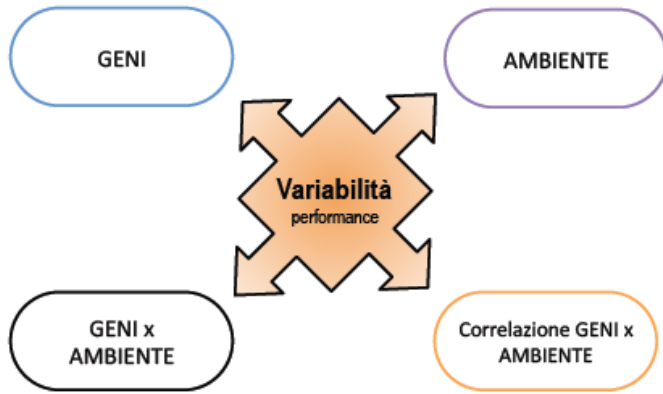
L'obiettivo di questi studi è stato quello di definire alcuni **parametri cinematici, dinamici, fisiologici e posturali-funzionali** di giovani atleti dell'élite nazionale praticanti la Danza Sportiva nelle diverse discipline regolamentate.

I riferimenti scientifici di tale lavoro sono quelli della **biomeccanica della valutazione funzionale e dell'analisi posturale e funzionale** negli sport tecnico-compositori a valutazione qualitativa.

L'applicabilità di tale studi viene identificata in:

1. **Definizione di profili biomeccanici, fisiologici e posturali-funzionali personalizzati, dell'eccellenza giovanile della Danza Sportiva.**
2. **Fase specifica di ricerca sul tema: "Analisi comparativa di atleti di Elite e Sub Elite, nella Danza Sportiva".**

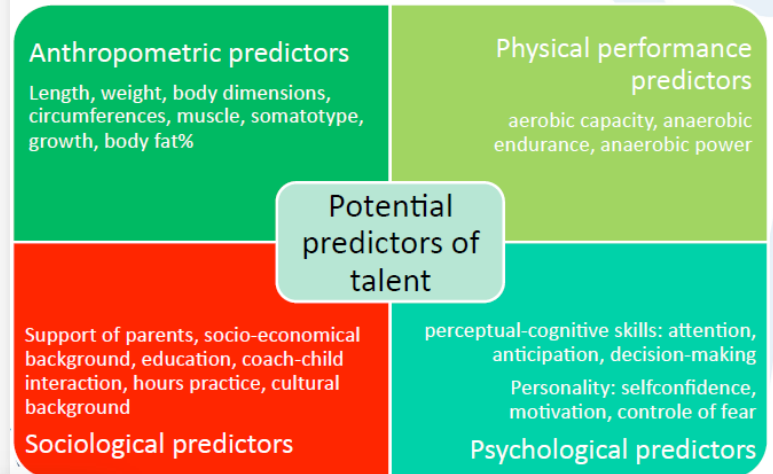
Il Talento: una struttura complessa



(Brutsaer & Parra, 2006)

POTENTIAL PREDICTORS OF TALENT

Vaeyens, 2011



Psychological Review
1993, Vol. 100, No. 3, 363-406

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0033-295X/93/\$3.00

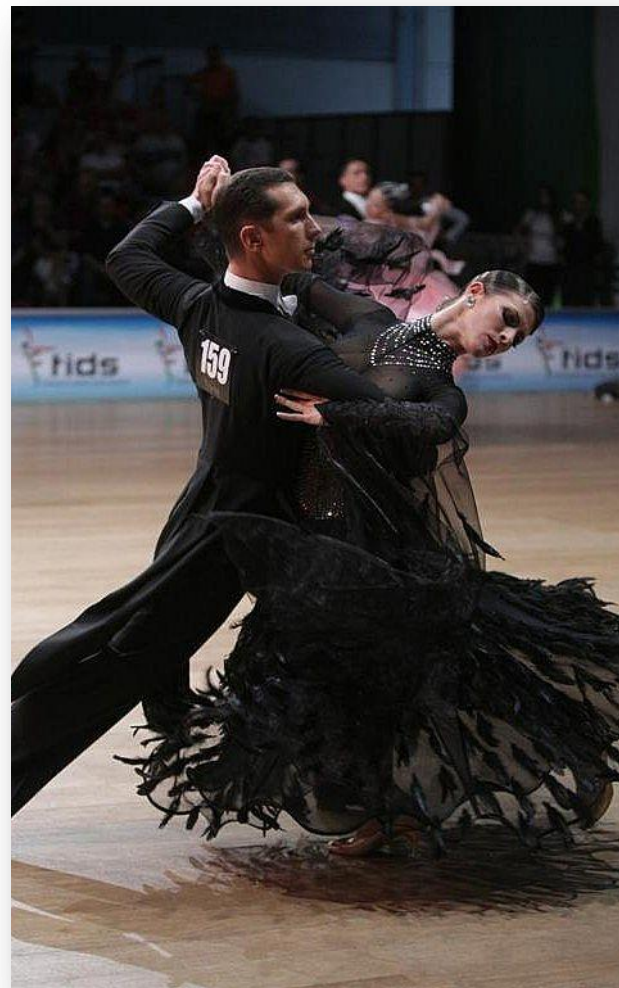
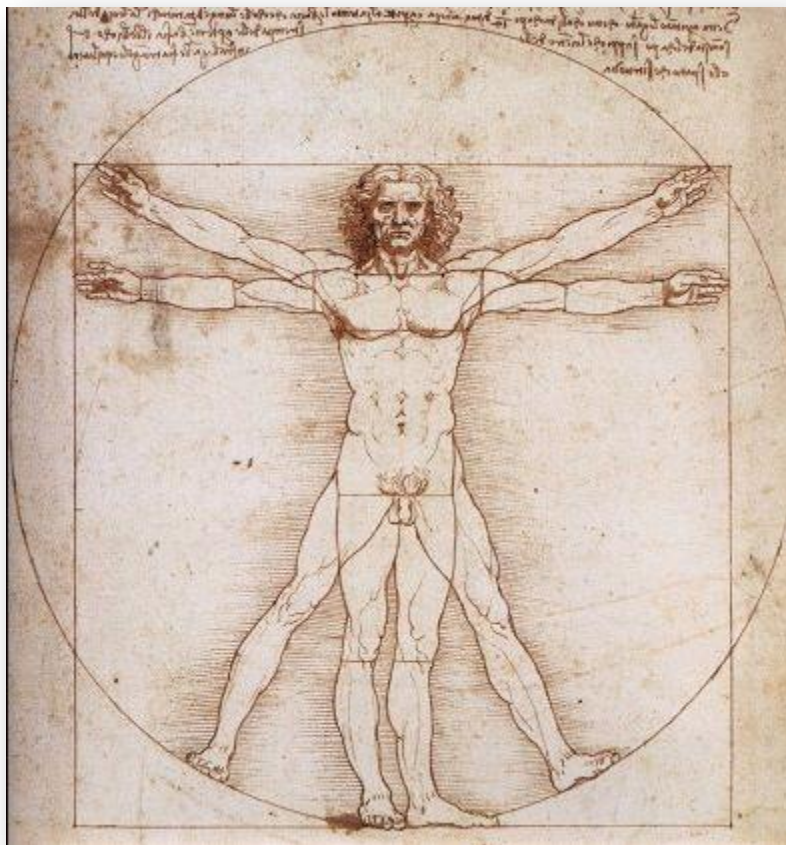
The Role of Deliberate Practice in the Acquisition of Expert Performance

K. Anders Ericsson, Ralf Th. Krampe, and Clemens Tesch-Romer

The theoretical framework presented in this article explains expert performance as the end result of individuals' prolonged efforts to improve performance while negotiating motivational and external constraints. In most domains of expertise, individuals begin in their childhood a regimen of effortful activities (deliberate practice) designed to optimize improvement. Individual differences, even among elite performers, are closely related to assessed amounts of deliberate practice. Many characteristics once believed to reflect innate talent are actually the result of intense practice extended for a minimum of 10 years. Analysis of expert performance provides unique evidence on the potential and limits of extreme environmental adaptation and learning.



Misurare la bellezza e l'armonia... un tentativo antico....



Nel corso dei Raduni finalizzati al progetto **Talento FIDS**, sono state effettuate varie misure, di tipo:

1. **Cinematico** (attraverso riprese video a 25-210 fpm delle prove tecniche di danza; cronografia).
2. **Dinamico** (accelerometria e valutazioni giroscopiche; cronografia).
3. **Fisiologico** (frequenza cardiaca, lattato ematico).
4. **Tecnico-Compositorio** (prove di ballo complete, valutate da un panel di esperti)
5. **Ergonomico-posturale-funzionale.**





Strumentazione e Software

Per lo studio sono stati utilizzati i seguenti strumenti e software di analisi.

Analisi Cinematica

2 Videocamere Casio Exilim FX-H20 (con campionamento a 420-210-25 Hz)

Marker passivi

Software Dartfish e Kinovea ver. 08.20

Analisi Dinamica

Sensorize FreeSense (accelerometri e giroscopi triassiali, 200 Hz)

Sistema di Cronometraggio Automatico Elettrico con Fotocellule.

Analisi Posturale-Funzionale

Analisi Baro-Podometrica Elettronica e Stabilometrica (software Milletrix; pedana Physical Software)

Analisi di alcune componenti fisiologiche

Frequenza Cardiaca (cardiofrequenzimetri SUUNTO; software)

Lattato Ematico (LactatePro Analyzer, Arkray, Japan)



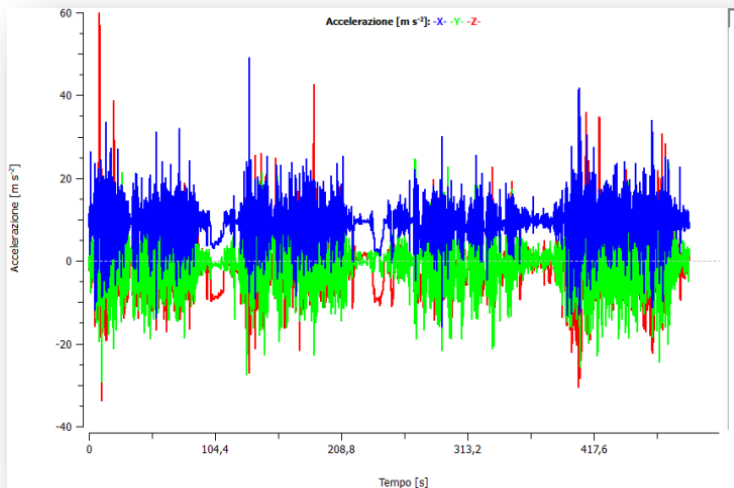
Simplified Blood Lactate Test Meter

Lactate Pro™ 2
LT-1730



Analisi Cinematica e Dinamica

Studio dei Momenti Notevoli



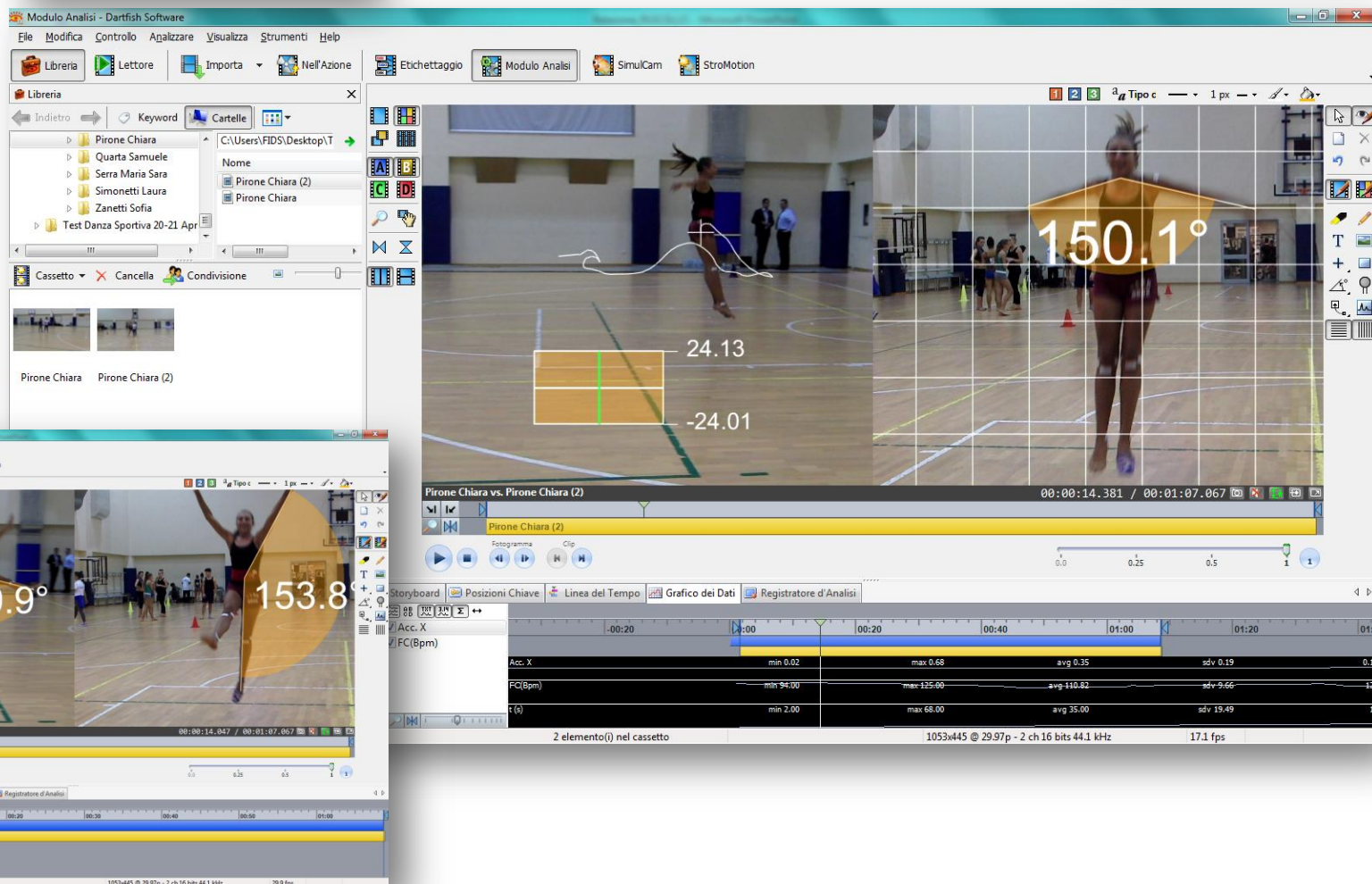
Esempio di accelerometria ed analisi giroscopica, in prova di gara (FreeSense – Sensorize)



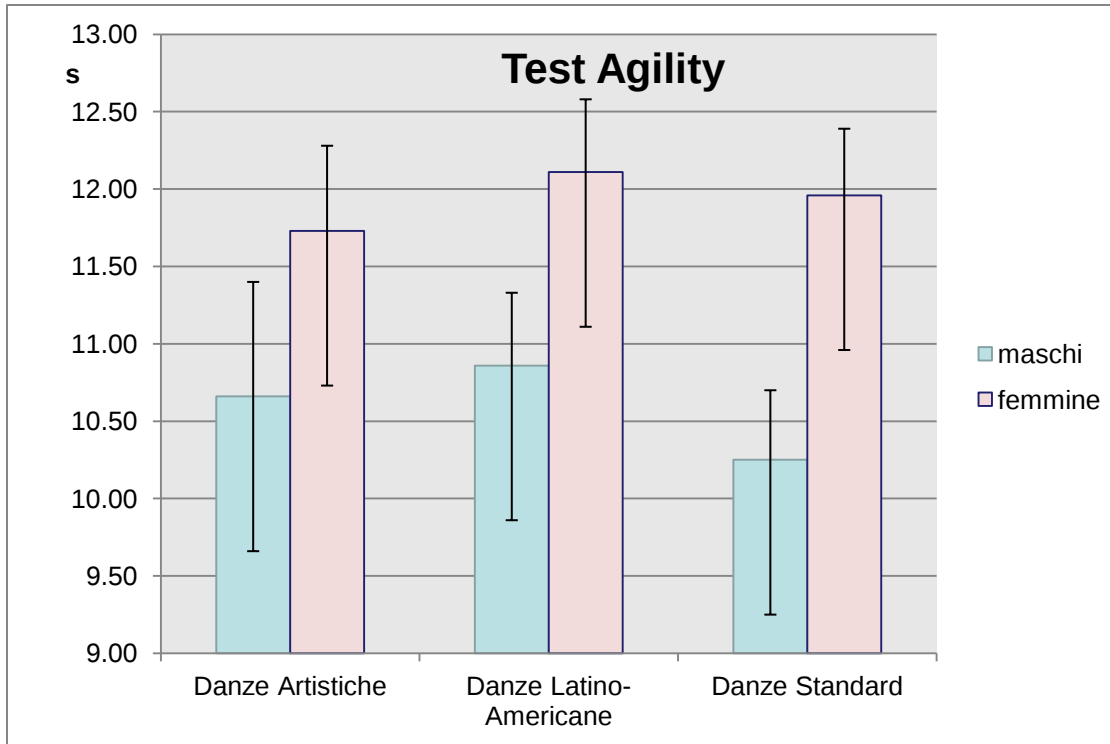
Atleti strumentati in prova di gara (elab. DartFish e Kinovea)



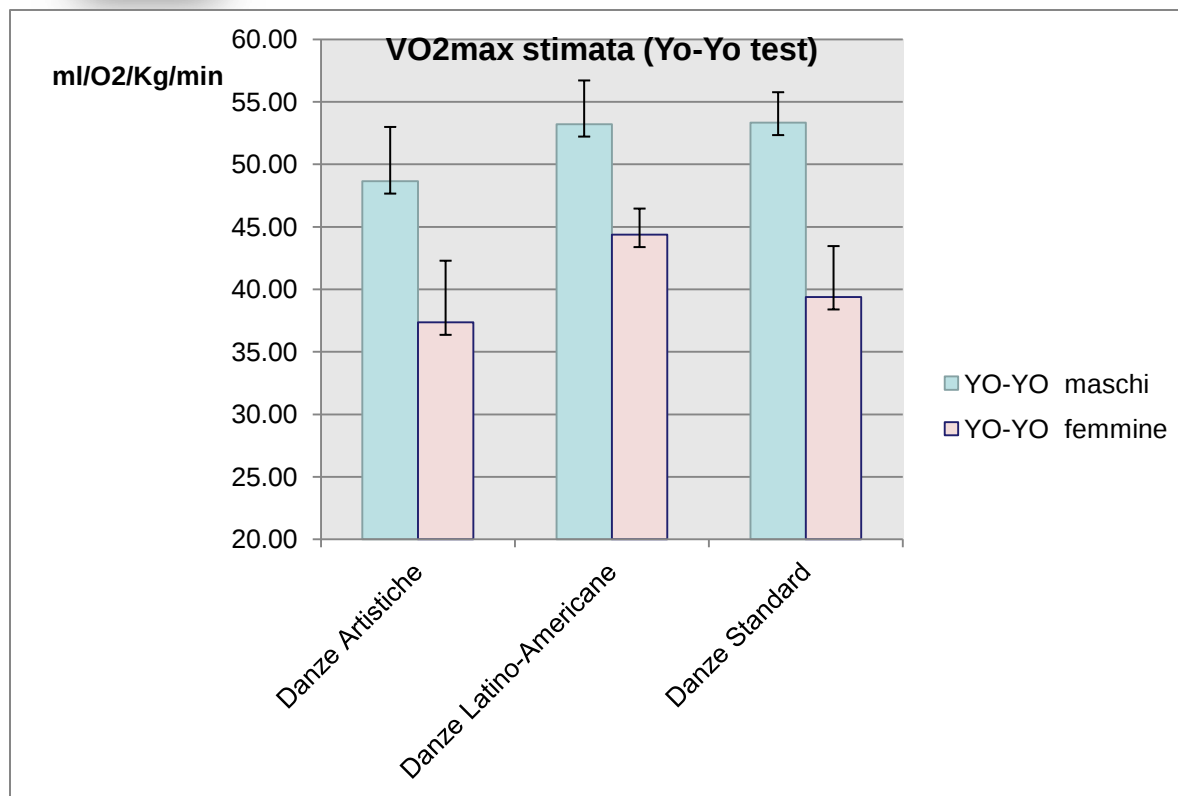
Video Analisi integrata della performance



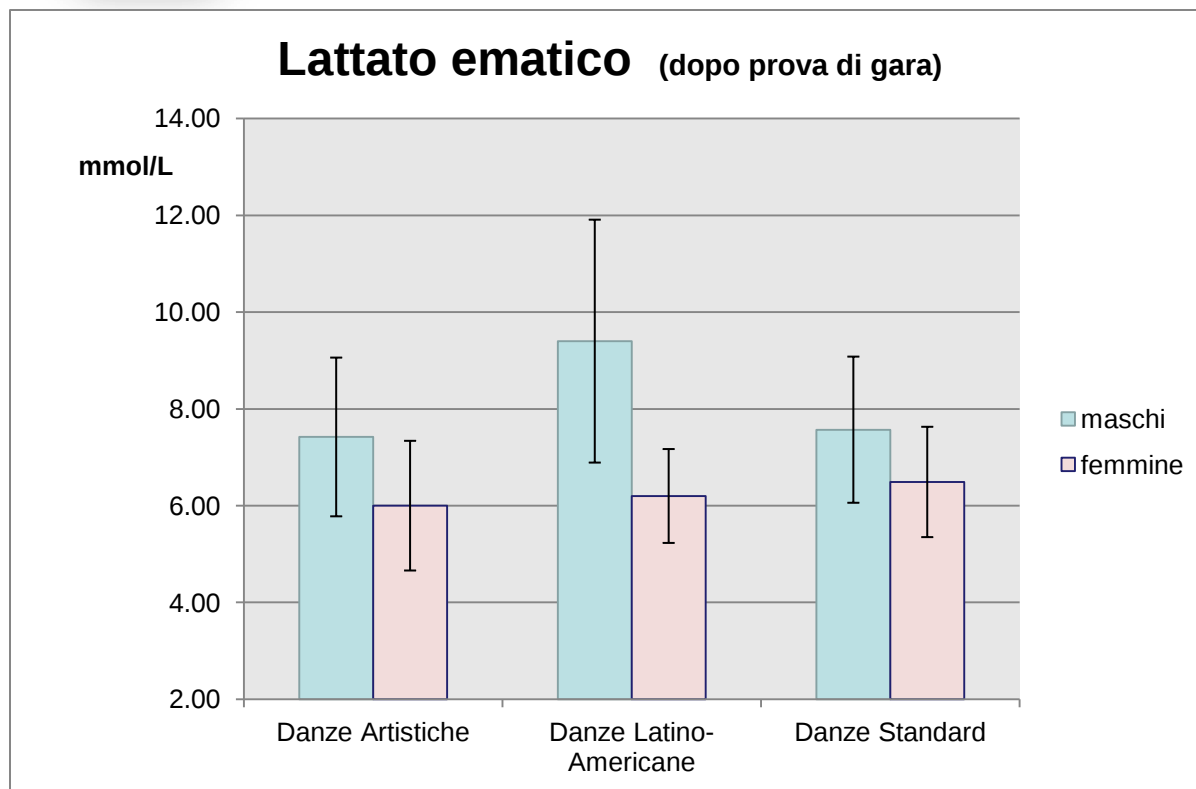
Alcune risultanze...



**Agility Test - Media e deviazione standard.
(Fonte: Centro Studi e Ricerche FIDS, 2013)**

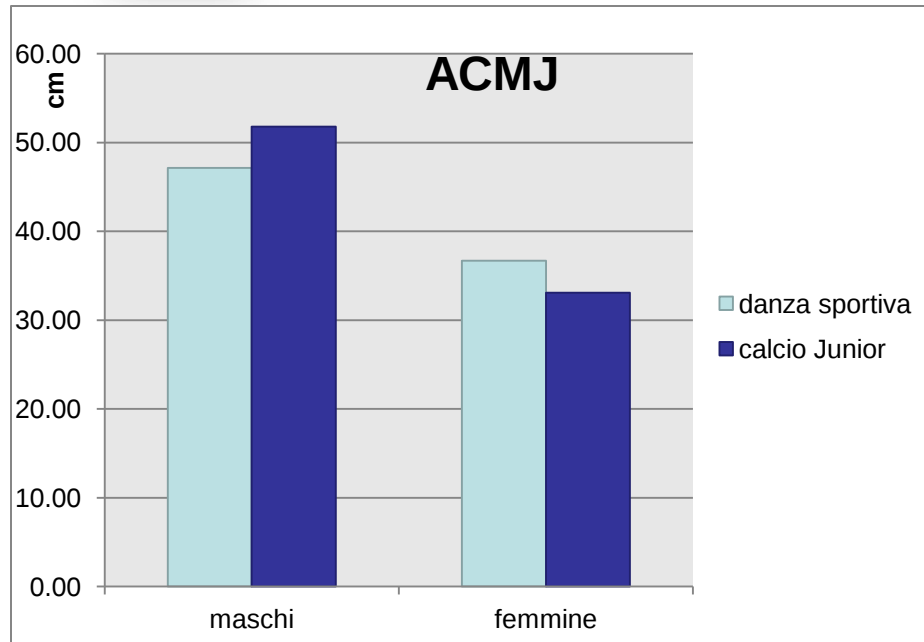


Yo-Yo Test (Bangsbo, 1993) - Media e deviazione standard.
 (Fonte: Centro Studi e Ricerche FIDS, 2013)

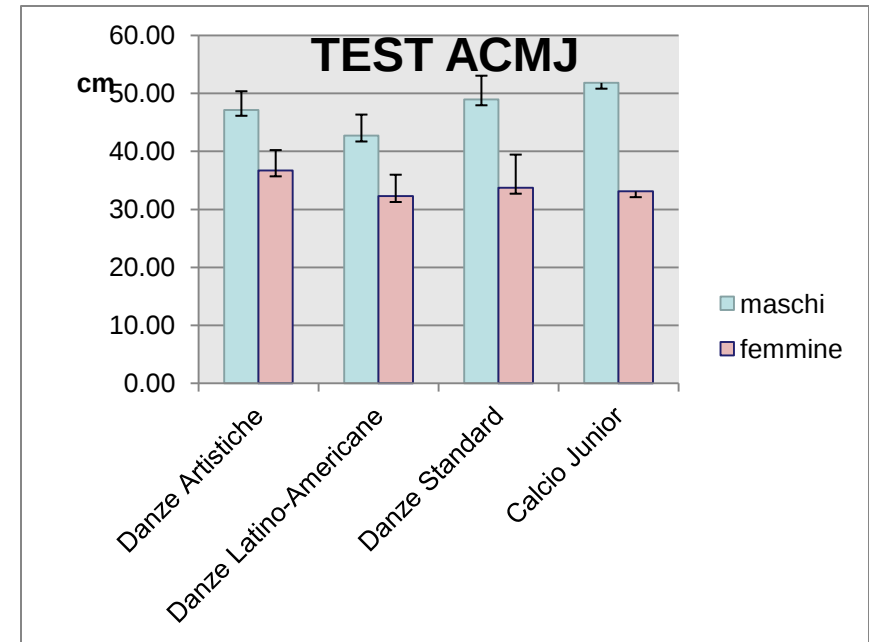


**Lattato Ematico dopo prestazione di gara - Media e deviazione standard.
(Fonte: Centro Studi e Ricerche FIDS, 2013)**

La Danza Sportiva... ed altri Sport

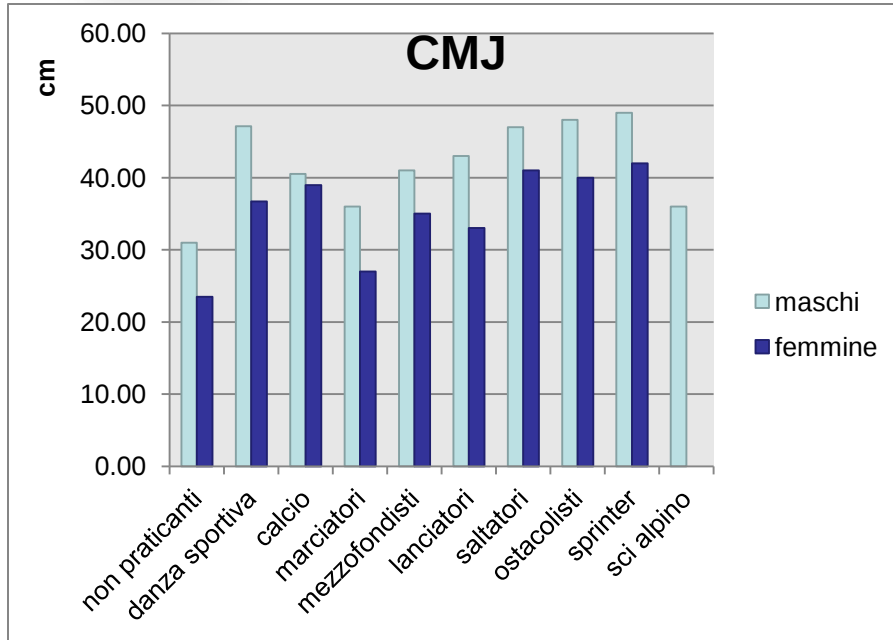


Comparazione fra i valori di ACMJ (braccia libere) fra danzatori e calciatori juniores, maschi e femmine (fonte D'Ottavio et al. 2006; Mujika et al., 2008).

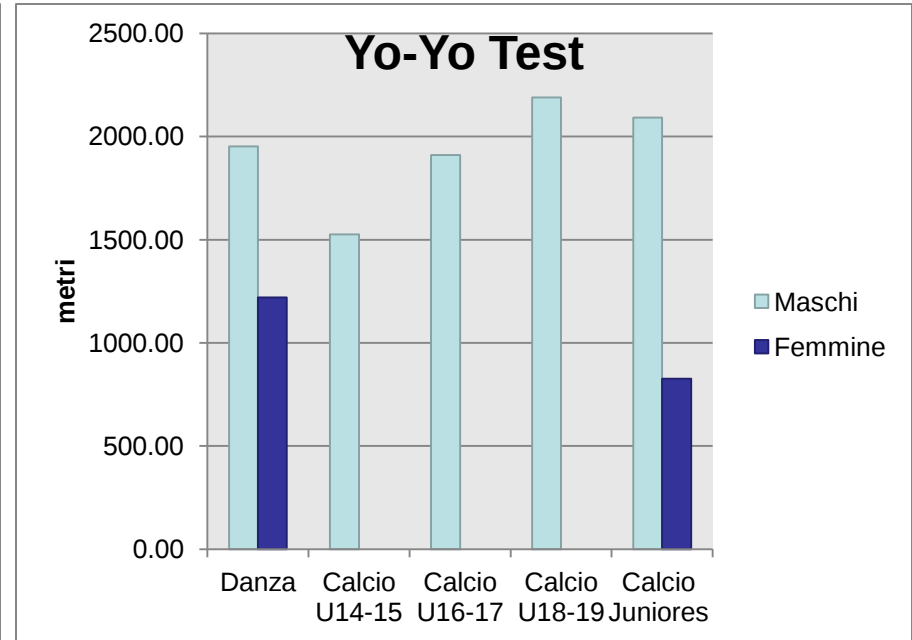


Test CMJ con braccia libere (ACMJ) - Media e deviazione standard. Si riportano a titolo esemplificativo alcuni valori registrati nel calcio di livello juniores (fonte D'Ottavio et al. 2006; Mujika et al. 2008; Centro Studi e Ricerche FIDS, 2013).

La Danza Sportiva... ed altri Sport



Comparazione fra i valori di CMJ fra danzatori e altre discipline atletiche, maschi e femmine (fonte Bosco).



Comparazione fra i valori di Yo-YO fra danzatori e calcio (diverse categorie giovanili) maschi e femmine (fonte Mujika et al., 2008; Deprez et al., 2012; D'Ottavio et al., 2006)

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*“Per esempio, attraverso la collaborazione con il **laboratorio mobile di scienze motorie di Tor Vergata** è stato ideato un protocollo di valutazione che permette, direttamente sull'atleta mentre compie l'esercizio, la misurazione di parametri di riferimento”. (D'Ottavio, 2013)*



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