




Máster en Investigación en Actividad Física y Deporte

MOVIMIENTO ONDULATORIO SUBACUATICO

Teoría e Investigación

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Investigación avanzada en los deportes acuáticos
2023/2024

Aquatics Lab
Faculty of Sport Sciences, University of Zaragoza

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Evaluación





- Portada – datos básicos
 - Nombre, curso académico, ...
- Preguntas que incluir en el trabajo
 - Presentación
- Formato PDF

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Antes de empezar



¿Cuántos estilos de nado existen?



¿Cuál es el estilo de nado mas rápido de todos? ¿Por qué?



¿Cuál es el estilo de nado mas lento de todos? ¿Por qué?

3

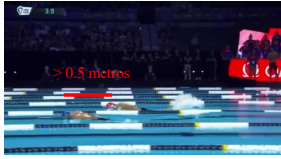



Pensemos...

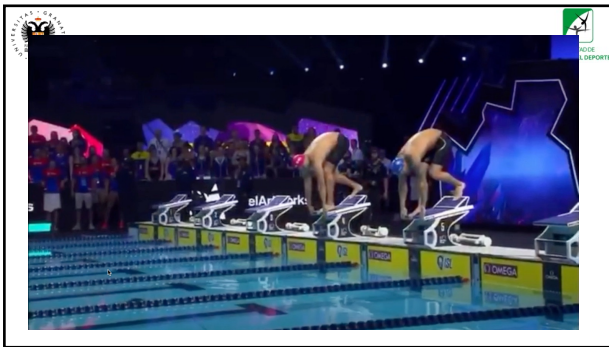
Inicio



15 metros después



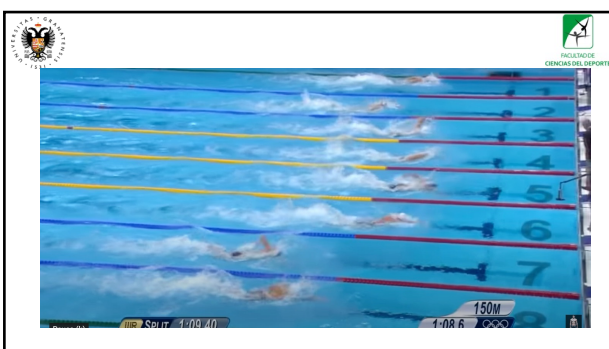
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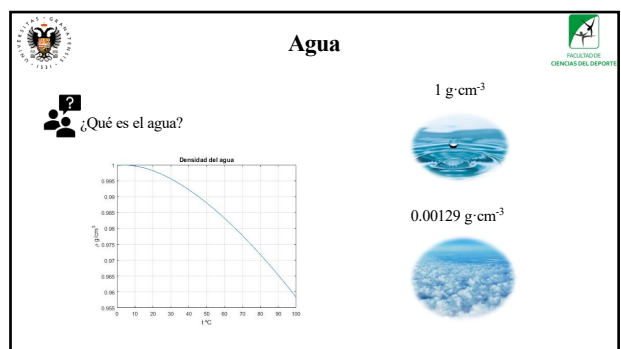
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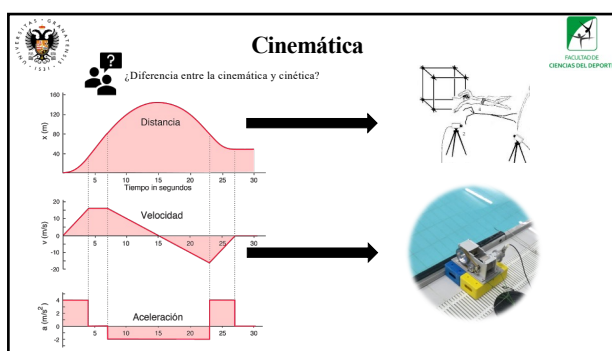
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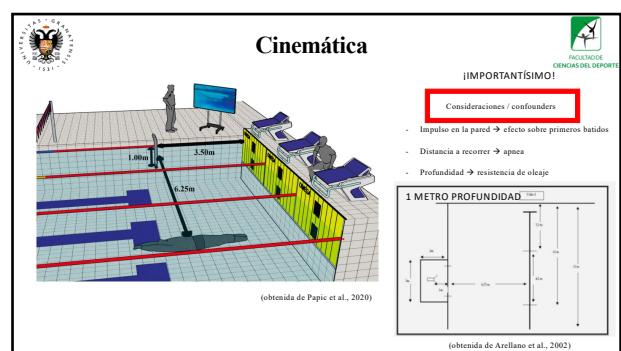
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Evaluación

- **EVALUACIÓN INICIAL Y FINAL (mínimo)** Para comprender el efecto de un programa de entrenamiento.
- **CONDICIONES** Las evaluaciones deben ser idénticas. Controlar:
 - ◆ Hora (mañana, tarde, noche)
 - ◆ Calentamiento (estandarizarlo, realizar siempre el mismo)
 - ◆ Nº repeticiones
 - ◆ Descanso entre repeticiones (influencia del número de nadadores)
 - ◆ Feedback (correcciones, animar o no, etc...)
- **DIFERENTES HABILIDADES** diferentes evaluaciones para desplazamiento y para subacuático.
- **FIABILIDAD** realizar más de una repetición. Variabilidad del entrenador (al menos 3 repeticiones).



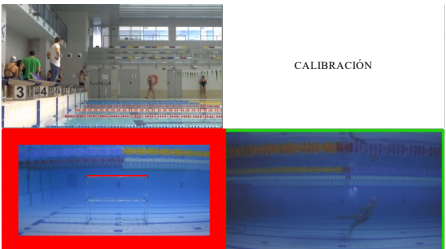

Valid and Reliable Reliable but not Valid Not Reliable or Valid
(©Wassilios Waskop, 2020)

Roa-Naveas et al., 2022

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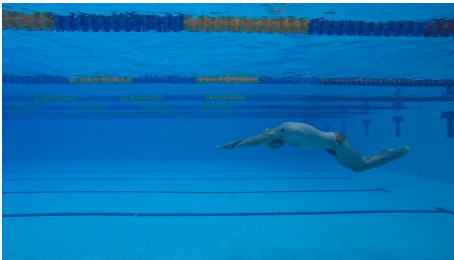
Cinemática

CALIBRACIÓN



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Cinemática



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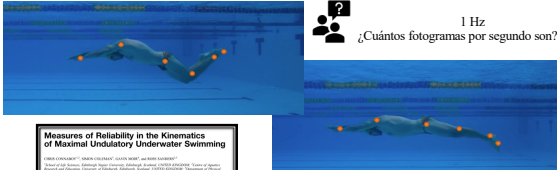
Cinemática

¿Cuántos fotogramas por segundo son?

1 Hz

2 batidos
1,29 seg x 60 Hz = 77 fotogramas

6 batidos
77 fotogramas x 3 videos = 231 fotogramas/sujeto



Measures of Reliability in the Kinematics of Maximal Undulatory Underwater Swimming

Abstract: The purpose of this study was to determine the reliability of kinematic measures of maximal undulatory underwater swimming. Ten male swimmers performed three trials of maximal undulatory underwater swimming. Kinematic measures included stroke length, stroke rate, stroke frequency, and stroke volume. Reliability was assessed using intraclass correlation coefficients (ICC) and Bland-Altman plots. Results showed that stroke length, stroke rate, and stroke frequency were highly reliable (ICC > 0.9), while stroke volume was less reliable (ICC < 0.9). Bland-Altman plots showed that the difference between trials was small for stroke length, stroke rate, and stroke frequency, but larger for stroke volume. These findings suggest that kinematic measures of maximal undulatory underwater swimming are reliable, but stroke volume is less reliable. This information is important for researchers and coaches who are interested in the kinematics of maximal undulatory underwater swimming.

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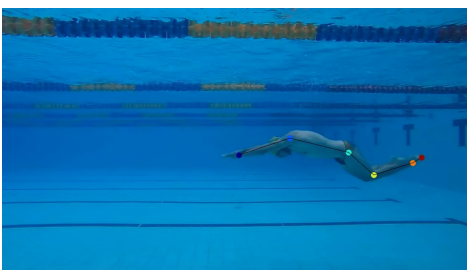
[illegible]

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Cinemat́ica

PALESTRICO
CIENCIAS DEL DEPORTE



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El diagrama ilustra la percepción de la altura y timbre de los sonidos. A la izquierda, un gráfico de 'Amplitud' vs 'Frecuencia / Longitud de ciclo' muestra ondas de diferentes alturas (Soprano, Alto, Tenor, Bajos) y timbres (Violín, Oboe, Trompa, Trombon, Tuba). A la derecha, un gráfico de 'Frecuencia' vs 'Longitud de onda' muestra ondas de diferentes alturas (Soprano, Alto, Tenor, Bajos) y timbres (Violín, Oboe, Trompa, Trombon, Tuba).

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Cinematica

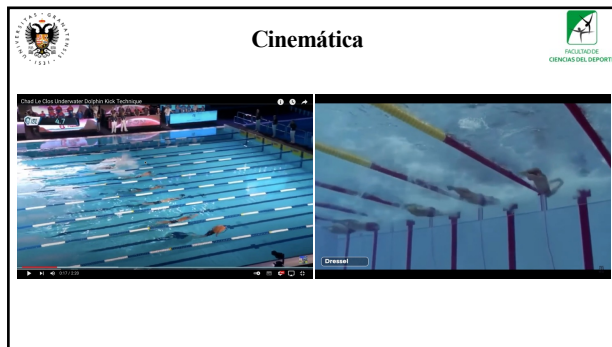
Variable **Average Int.** **Average Nat.** **t** **p**

V of CM (m/s)	1.614	1.152	6.891	0.000
Vy of CM (m/s)	1.604	1.137	7.041	0.000
Vy of CM (m/s)	0.100	-0.045	0.865	0.342
V of toe (m/s)	1.696	1.258	6.547	0.000
Vy of toe (m/s)	1.587	1.161	6.434	0.000
Vy of toe (m/s)	0.022	-0.042	2.735	0.010
V of toe (m/s)	1.218	2.811	3.568	0.001
V of toe (m/s)	1.622	1.137	7.330	0.000
V of toe (m/s)	-0.066	-0.042	-0.793	0.434
V of toe (m/s)	-0.013	0.819	0.389	0.699
Horizontal distance of toe (m)	0.760	0.669	1.750	0.090
Angular velocity of toe (rad/s)	1.259	0.973	3.416	0.002
Angular frequency (Hz)	1.315	0.970	3.801	0.000
Maximal toe flexion (°)	113.7	104.9	3.214	0.003
Maximal V of CM (m/s)	1.660	1.181	7.436	0.000
Maximal V of CM (m/s)	1.419	0.951	7.004	0.000
Range of V of CM (m/s)	0.450	0.427	0.474	0.639
Strutural number	0.794	0.660	-3.328	0.002
Body Height (m)	1.801	1.692		

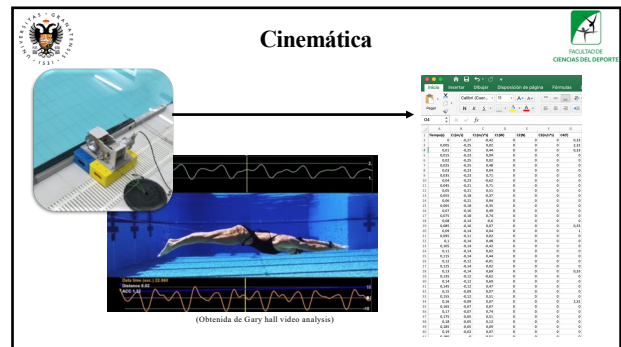
(schneider de Arlante et al., 2002)

¿Existe una combinación óptima de frecuencia y amplitud?

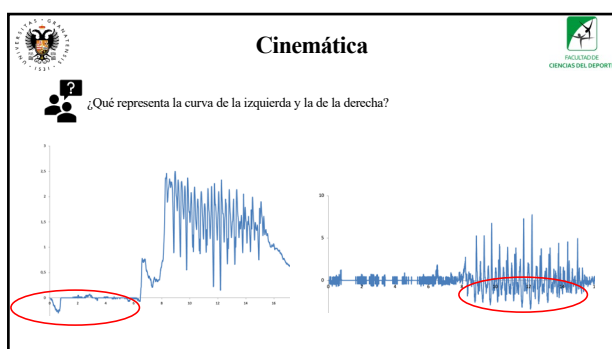
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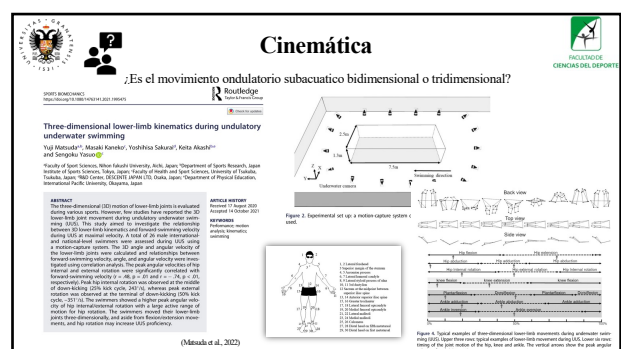
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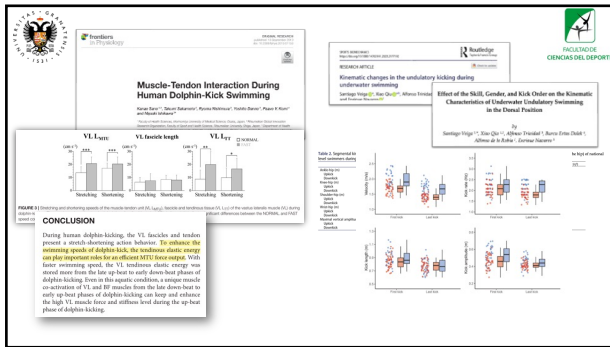
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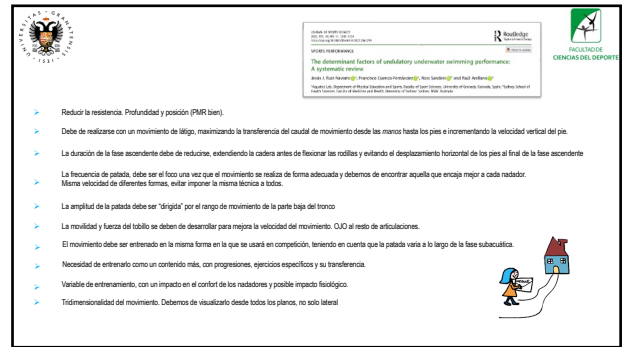
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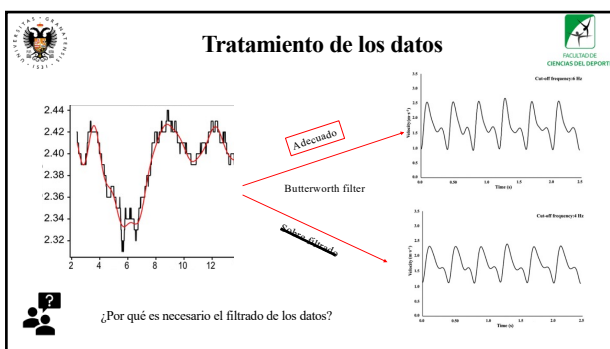
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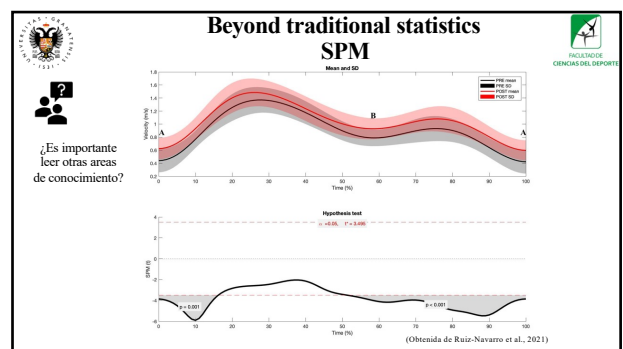
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