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Design 3D Educational Animation Software on the Basis of Some Biomechanical Parameters for Learning Some Basic Skills in Boxing.

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Abstract

The research aims to design a 3D Educational Animation Software on the basis of anthropometric and three-dimensional Biomechanics parameters for learning some basic skills in Boxing. One amateur boxer, practice boxing at the local level, international and Registered in Egyptian amateur boxing association as a model of 3D Educational Animation movies. He performed the straight left and right punch to the head and trunk (6) times. The researchers extracted the average of biomechanical variables, and that means the simple of the research was (6) attempts for each punch (Straight left punch to the head, Straight left punch to the trunk, Straight right punch to the head, Straight right punch to the trunk.

The researchers used Simi Motion 13 for Biomechanics analysis some of Basic skills to the head in three axes (horizontal x, vertical y, sagittal z) and (Absolute resulting R) to get biomechanical variables in three phases (Windup - Critical Instant - Follow Through). Within the limits of the research objectives, the research questions and the results the researchers concluded the Tables of specifications that will be used in the design of a 3D Educational Animation Movies and Four Basic Phases to product a 3D Educational Animation Software for learning the basic skills in boxing as follows (Design & Preparation - Biomechanics analysis - Scenario Building – Execution.

Keywords: *Animation, 3D, Biomechanics, Boxing.*

Introduction:

Animation plays potential role in supporting the visualization of a dynamic process such as not easily observable in real space and time scales, the real process that is practically impossible to realize in a learning situation, or the process that is not inherently visual. Animation also plays potential role in reducing the cognitive cost of mental simulation thus saving cognitive resources for learning task especially for novice learners (Betancourt, 2005). Therefore, Animation movies must be designed on scientific basis so that it can accurately simulate true technical form especially of psychomotor skills in sports.

Biomechanics word divided into two parts: the prefix bio- and the root word mechanics. The prefix bio indicates that biomechanics has something to do with living or biological systems. The root word mechanics indicates that biomechanics has something to do with the analysis of forces and their effects. So it appears that biomechanics is the study of forces and their effects on living systems. (McGinnis, 2005)

The ultimate goal of exercise and sport biomechanics is performance improvement in exercise or sport. A secondary goal is injury prevention and rehabilitation. The equipment worn may have an effect on the performance, either directly or through injury prevention. Besides shoes and apparel, many sports require the use of some sort of implement. (McGinnis, 2005).

Biomechanics provides information for a variety of kinesiology professions to analyze human movement to improve effectiveness or decrease the risk of injury. How the movement is analyzed falls on a continuum between a qualitative analysis and a quantitative analysis. Quantitative analysis involves the measurement of biomechanical variables and usually requires a computer to do the voluminous numerical calculations performed. Even short movements will have thousands of samples of data to be collected, scaled, and numerically processed. In contrast, qualitative analysis has been defined as the "systematic observation and introspective judgment of the quality of human movement for the purpose of providing the most appropriate intervention to improve performance" (Knudson, 2007).

Boxing is one of the sports activities that the Egyptian government is giving a high level of care. Therefore, boxing is included in the curricula of all physical education faculties, military and sports schools. This positively affects the recruitment of a wide range of people to practice it. And it requires tremendous physical conditioning, mental toughness, and very high mastery of technical skills. So when using the 3D animation movies to learn the basic skills in sports generally and in boxing especially due to its ability to present psychomotor skills from different angles , directions and supporting the visualization of psychomotor skills. Must take into account congruence in performance between reality in psychomotor skills performance and fantasy performance in 3D animation.

This congruence is the basic idea of this research, Where most of the applications are using to design 3D Animation movies such as E FRONTIER POSER APPLICATION need to enter Anthropometric values for designing figures like Dimensions, Weight and Muscular style. Also need Biomechanics Parameters like Time, Displacement, Velocity and Acceleration in 3D. And the following figure shows Poser application interface and design requirements.

Figure (1)
Poser7 interface

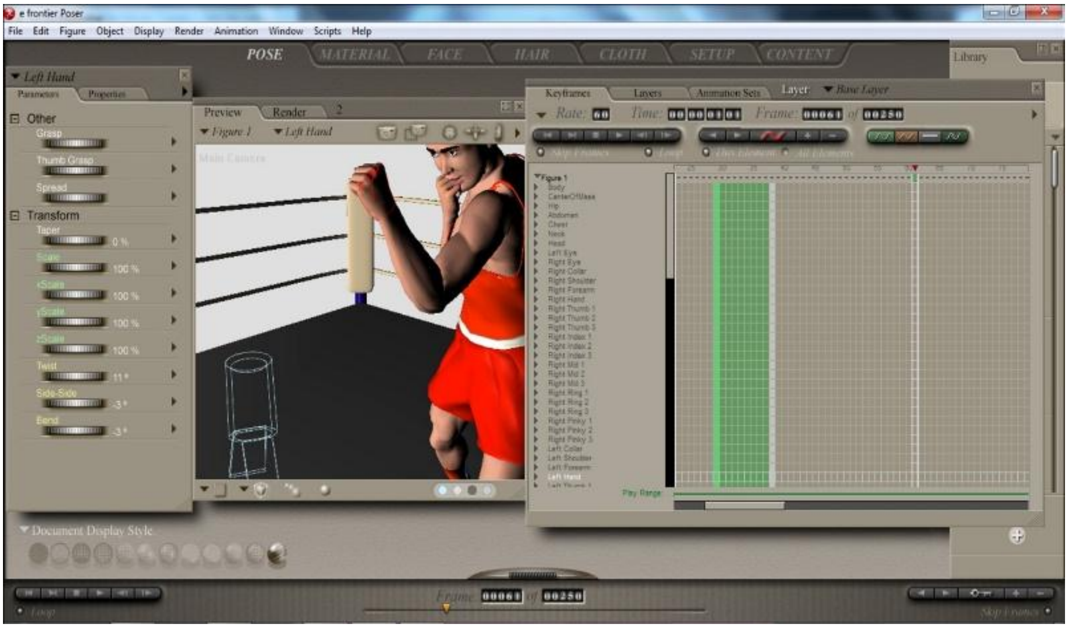


Figure (1) show poser7 interface that contains three basic window Object properties window, preview window and Key frame window.

Figure(2) :
Object properties window to enter Body and body parts parameters

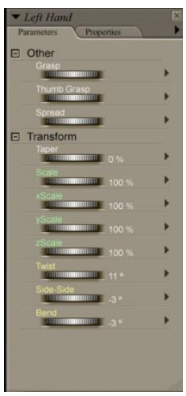


Figure (2) Show Object properties window to determine Body and body parts parameters like (Twist, Side to side and Bend) in every frame in 3D animation movie

Figure (3):
Key frames window.

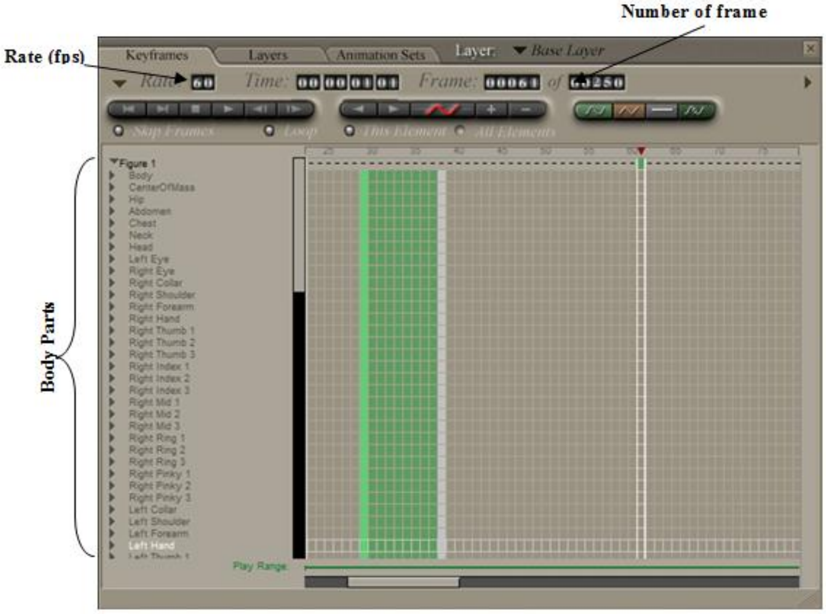


Figure (3) Show Key frames window to determine the rate (number of frames per second "fps"), time, frames number, putting key frame for each body parts and body properties for each frame.

3/0 Research Aim:

The research aims to design a 3D Educational Animation Software on the basis of anthropometric and three-dimensional Biomechanics parameters for learning some basic skills in Boxing.

4/0 Research Questions:

4/1 What are the Biomechanical Parameters used in design a 3D Educational Animation Software for learning some basic skills in Boxing?

4/2 What are the Basic steps to product a 3D Educational Animation Software for learning some basic skills in Boxing?

5/0 Research Procedures:

5/1 Research Methodology:

The researcher used the descriptive method by using Biomechanics analysis, as this is more suitable for the nature of the research.

5/2 Research Simple:

One amateur boxer, practice boxing at the local level, international and Registered in Egyptian amateur boxing association. He performed the straight left and right punch to the head and trunk (6) times. The researchers extracted the average of biomechanical variables, and that means the simple of the research was (6) attempts for each punch (Straight left punch to the head, Straight left punch to the trunk, Straight right punch to the head, Straight right punch to the trunk).

The Description of research sample

Table 1
The Description of research sample (n=1)

variables	Unit of measurement	The measurement
Height	Cm	166
Weight	Kg	68.50
Age	Month	300
Training age	Month	120

From (Table 1) it is clear The Description of research sample

5/3 Anthropometric Data collection tools

The research used **Modern Lab MX1** device to determine:

- Height - Thickness of the fat
- Weight - Muscular pattern

Figure (4)
Modern Lab MX1

5/4 Biomechanics Data collection tools

5/4/1 Capture 3D Video

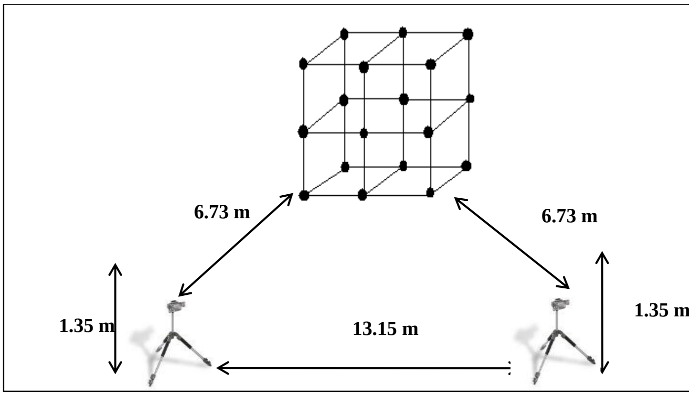
- Two Camera (Fastic Imaging SportsCam) frequencies 250 field / second.
- Two-tripod stand, one for each camera.
- Cubic calibration 2×2×1.
- Steel measuring tape (30m) to determine the dimensions of Capturing Video.
- A sticker tape to mark the beginning and end of the calibration cube (white - blue).
- Numbered plates to determine the order attempts.
- A suitable source of lighting.
- Balance of aqueous.
- Scissor.
- The dimensions of the cameras for cubic calibration as in Table (2) and form (2)

Table 2
The dimensions of the cameras for cubic calibration

Situations	Right camera	Left camera
Distance of cameras for the location of capture video	**6.73 m**	**6.73 m**
Height of the camera from the ground	**1.35 m**	**1.35 m**
The distance between the two cameras	**13.15 m**	
Inclination angle of the camera on the target	**90^{O}**	**90^{O}**

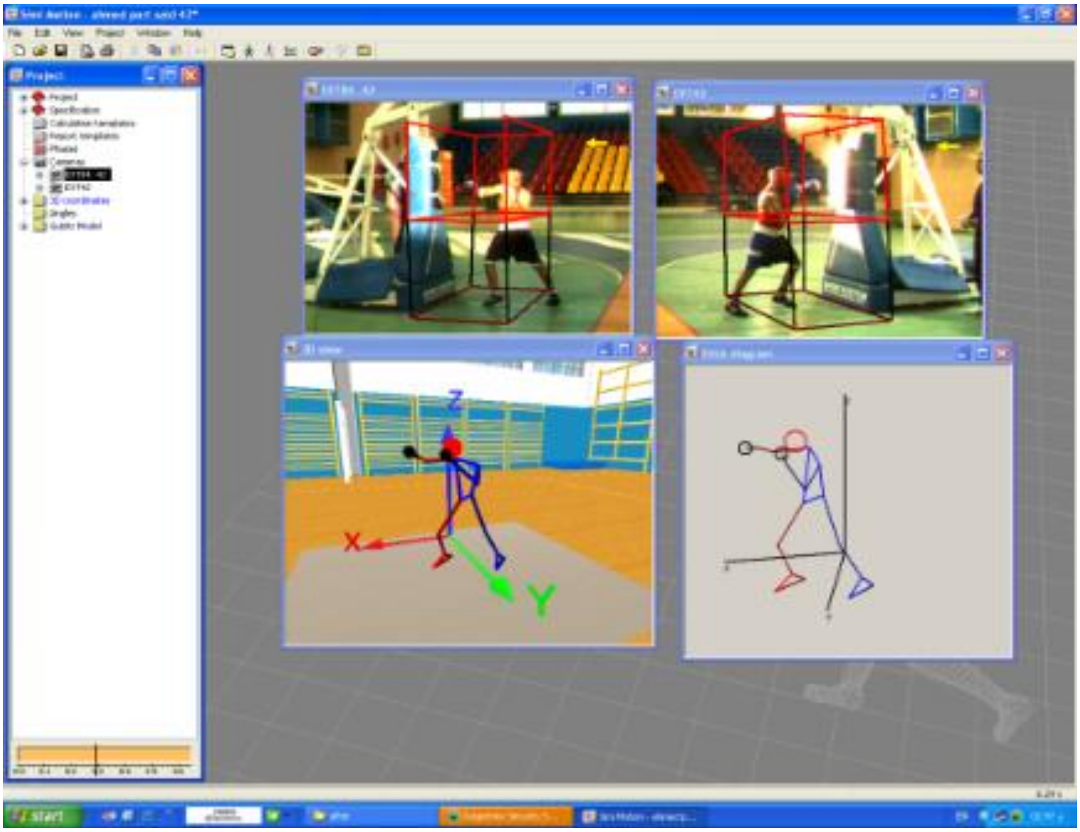
From (Table 2) it is clear the dimensions of the cameras for cubic calibration

Figure (5)
the dimensions of the cameras for cubic calibration



5/4/2 Biomechanics analysis by "Simi Motion 13" software

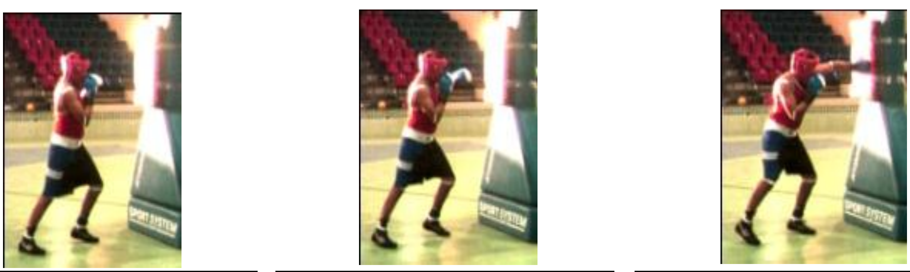
Figure (6)
Simi Motion 13 for Biomechanics analysis



The researchers used Simi Motion 13 for Biomechanics analysis some of Basic skills to the head in three axes (horizontal x, vertical y, sagittal z) and (Absolute resulting R) to get biomechanical variables in three phases as the following:

- First phase (Windup): The swings that will power the movement.
- Second phase (Critical Instant): This is the point of impact or miss; the point of no return.
- Third phase (Follow Through): continue through the motion in the direction of the intended force. (Wigle, 2012)

Figure (7)
Biomechanical analysis phases of the straight left punch to the head



First phase (Windup)	Second phase (Critical Instant)	Third phase (Follow Through)

Figure(8) Biomechanical analysis (segments, Joints) model of the punch

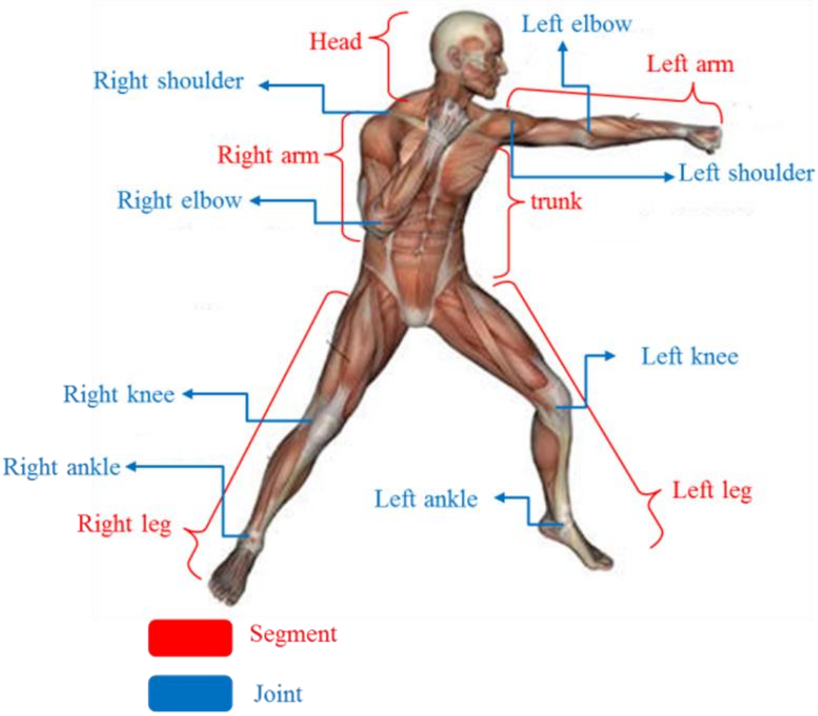


Figure (9)
Biomechanical analysis model of the straight punch
(Right arm, Left arm, Right leg, Left leg, Trunk and Head)

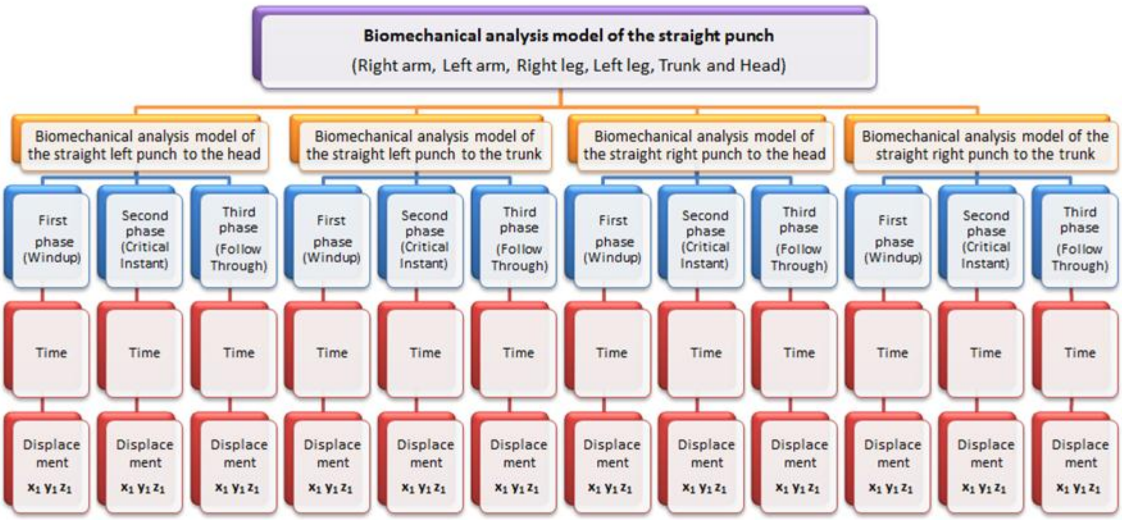
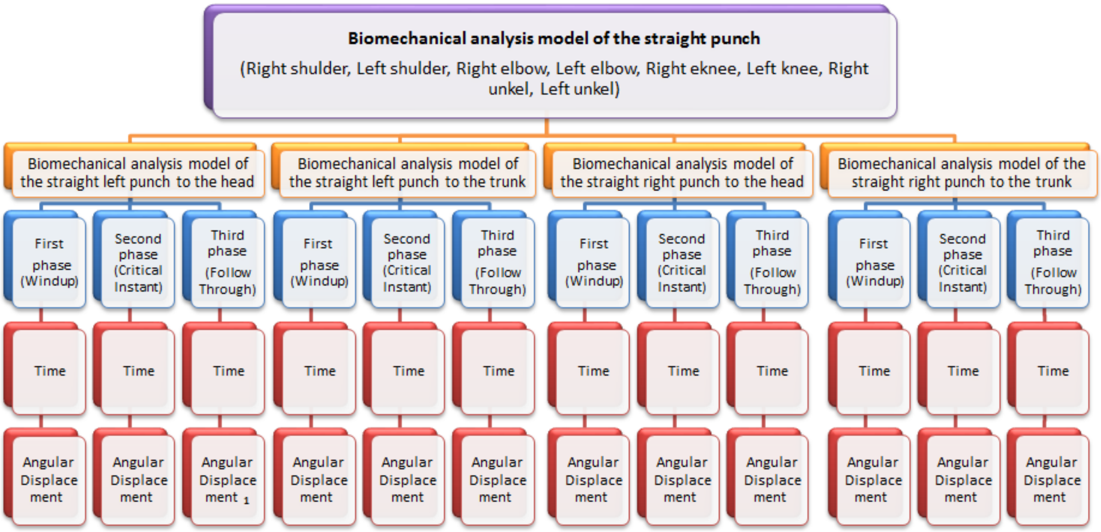


Figure (10)
Biomechanical analysis model of the straight punch
(Right shoulder, Left shoulder, Right elbow, Left elbow, Right knee, Left knee, Right ankle, Left ankle)



Results:

8/1 Present the results of the first question "What are the Biomechanical Parameters used in design a 3D Educational Animation Software for learning some basic skills in Boxing?"

8/1/1 The Averages of biomechanical variables for the phases of performance of the straight left punch to the head and trunk.

Table 3
The Averages of biomechanical variables for the phases of performance of the straight left punch to the head and trunk.

		First phase (Windup)				Second phase(Critical Instant)				Third phase (Follow Through)			
		time	Displacement			time	Displacement			time	Displacement		
			x	y	z		x	y	z		x	y	z
Biomechanical analysis of the straight left punch to the head	Head	0.06	2.4	3.2	-1.7	0.15	3.2	-0.8	-0.8	0.18	4.1	-2.1	-3.4
	Trunk	0.06	6.8	-2.6	2.5	0.15	2.8	-0.4	1.5	0.18	7.2	2.4	-6.2
	Right arm	0.06	-0.3	0.6	6.3	0.15	-2.1	3.1	-1.2	0.18	-4.3	2.4	-2.4
	Left arm	0.06	8.6	2.7	1.1	0.15	11.5	2.4	1.4	0.18	14.5	-3.3	2.8
	Right leg	0.06	0.7	0.2	0.8	0.15	3.5	0.5	2.4	0.18	4.7	1.8	-0.9
	Left leg	0.06	0.4	0.3	-0.4	0.15	0.8	0.3	-2.1	0.18	1.4	0.7	-5.4
Biomechanical analysis of the straight left punch to the trunk	Head	0.12	1.5	0.7	-0.9	0.19	-3.2	1.5	-2.1	0.84	-1.9	2.9	-0.3
	Trunk	0.12	4.2	-0.4	-2.1	0.19	-2.9	-1.6	-2.4	0.84	-1.4	-2.1	-1.0
	Right arm	0.12	-1.4	1.1	-1.7	0.19	-4.0	0.7	-1.3	0.84	-2.3	2.6	1.3
	Left arm	0.12	4.9	0.9	1.07	0.19	14.7	1.1	2.9	0.84	7.6	0.7	-0.4
	Right leg	0.12	1.4	0.4	4.2	0.19	-2.1	2.1	4.9	0.84	-1.7	1.7	2.6
	Left leg	0.12	1.1	1.7	4.7	0.19	1.4	2.01	5.1	0.84	3.2	3.3	1.7

8/1/2 The Averages of biomechanical variables for the phases of performance of the straight right punch to the head and trunk.

Table 4
The Averages of Biomechanical analysis of the straight right punch to the head and trunk

		First phase (Windup)				Second phase(Critical Instant)				Third phase (Follow Through)			
		time	Displacement			time	Displacement			time	Displacement		
			x	y	z		x	y	z		x	y	z
Biomechanical analysis of the straight right punch to the head	Head	0.08	-0.4	1.4	-3.5	0.17	-1.2	2.1	2.4	0.22	2.7	2.6	0.9
	Trunk	0.08	-0.6	1.2	-3.2	0.17	-2.4	2.7	2.8	0.22	2.9	2.1	2.8
	Right arm	0.08	4.6	1.4	-2.8	0.17	9.12	-0.8	1.6	0.22	14.8	-2.4	2.4
	Left arm	0.08	-6.1	-1.4	0.7	0.17	-2.1	-0.7	3.4	0.22	-3.4	-5.7	-2.9
	Right leg	0.08	9.4	2.7	-3.8	0.17	4.2	4.5	-2.4	0.22	-2.1	-1.4	4.1
	Left leg	0.08	0.9	0.0	-0.9	0.17	0.7	0.4	-0.5	0.22	-1.8	1.3	1.2
Biomechanical analysis of the straight right punch to the trunk	Head	0.13	1.5	2.4	-0.8	0.16	-2.2	1.9	-2.8	0.45	-2.7	2.4	-0.9
	Trunk	0.13	4.5	-0.8	-2.7	0.16	-2.1	-2.6	-3.6	0.45	-1.1	-4.1	-2.0
	Right arm	0.13	3.2	1.2	1.2	0.16	3.7	0.7	2.4	0.45	4.1	-0.3	-1.0
	Left arm	0.13	-0.7	-2.7	0.9	0.16	-3.2	-0.4	-2.1	0.45	0.8	1.6	1.7
	Right leg	0.13	1.4	0.4	4.2	0.16	-2.1	2.1	4.9	0.45	-1.7	1.7	2.6
	Left leg	0.13	1.1	1.7	4.7	0.16	1.4	2.01	5.1	0.45	3.2	3.3	1.7

8/1/3 The Averages of Biomechanical analysis model of the straight left punch to the head and trunk.

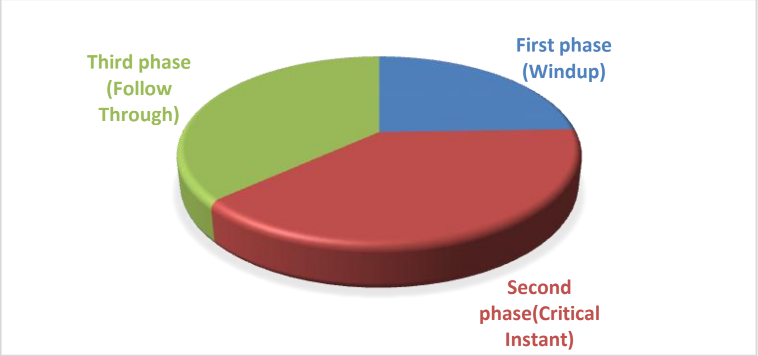
Table 5.
The Averages of Biomechanical analysis model of the straight left punch to the head and trunk.

		First phase (Windup)		Second phase(Critical Instant)		Third phase (Follow Through)	
		time	Angular Displacement	time	Angular Displacement	time	Angular Displacement
Biomechanical analysis model of the straight left punch to the head	Right shoulder	0.06	30.1	0.15	24.6	0.18	14.9
	Left shoulder	0.06	45.4	0.15	66.7	0.18	89.3
	Right elbow	0.06	24.2	0.15	20.7	0.18	28.1
	Left elbow	0.06	80.4	0.15	114.0	0.18	174.9
	Right knee	0.06	140.1	0.15	174.3	0.18	130.4
	Left knee	0.06	119.6	0.15	99.6	0.18	108.4
	Right ankle	0.06	95.6	0.15	102.7	0.18	120.4
	Left ankle	0.06	92.4	0.15	84.7	0.18	85.4
Biomechanical analysis model of the straight left punch to the trunk	Right shoulder	0.12	91.2	0.19	87.9	0.84	78.10
	Left shoulder	0.12	98.6	0.19	114.2	0.84	97.9
	Right elbow	0.12	78.2	0.19	71.1	0.84	56.8
	Left elbow	0.12	91.8	0.19	108.9	0.84	176.8
	Right knee	0.12	107.8	0.19	89.7	0.84	84.4
	Left knee	0.12	145.7	0.19	110.7	0.84	89.7
	Right ankle	0.12	74.3	0.19	64.2	0.84	56.8
	Left ankle	0.12	86.4	0.19	66.4	0.84	57.0

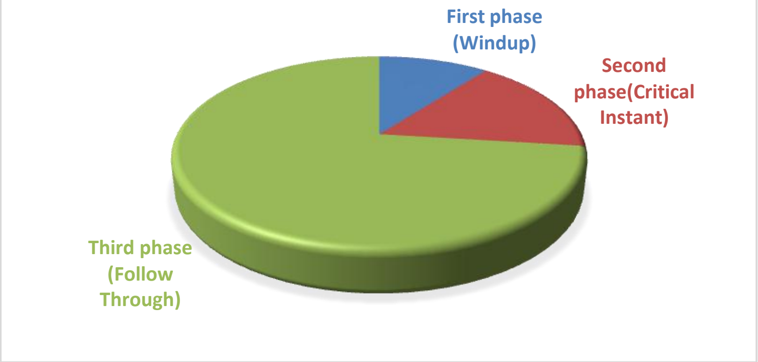
8/1/4 The Averages of Biomechanical analysis model of the straight right punch to the head and trunk.

Table 6.
The Averages of Biomechanical analysis model of the straight right punch to the head and trunk.

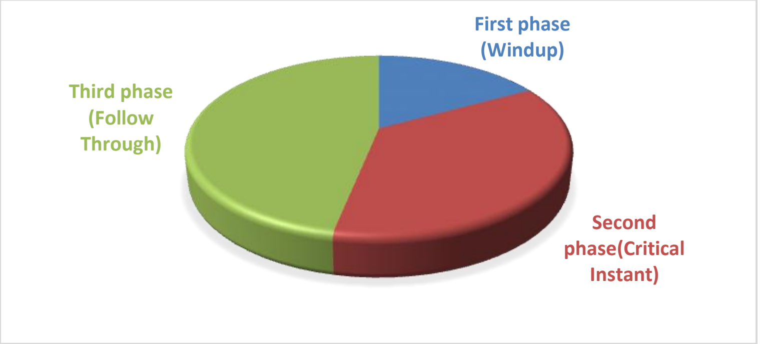
		First phase (Windup)		Second phase(Critical Instant)		Third phase (Follow Through)	
		time	Angular Displacement	time	Angular Displacement	time	Angular Displacement
Biomechanical analysis model of the straight right punch to the head	Right shoulder	0.08	35.2	0.17	95.2	0.22	94.4
	Left shoulder	0.08	30.7	0.17	24.9	0.22	13.8
	Right elbow	0.08	94.5	0.17	100.7	0.22	178.6
	Left elbow	0.08	28.7	0.17	23.2	0.22	25.8
	Right knee	0.08	174.2	0.17	98.4	0.22	179.01
	Left knee	0.08	169.6	0.17	158.7	0.22	162.4
	Right ankle	0.08	87.6	0.17	87.3	0.22	90.06
	Left ankle	0.08	101.2	0.17	98.4	0.22	101.8
Biomechanical analysis model of the straight right punch to the trunk	Right shoulder	0.13	84.3	0.16	98.7	0.45	92.3
	Left shoulder	0.13	29.1	0.16	25.9	0.45	15.8
	Right elbow	0.13	80.6	0.16	119.9	0.45	178.5
	Left elbow	0.13	34.7	0.16	35.2	0.45	30.8
	Right knee	0.13	133.0	0.16	94.8	0.45	78.3
	Left knee	0.13	148.1	0.16	94.01	0.45	90.7
	Right ankle	0.13	97.0	0.16	98.7	0.45	78.2
	Left ankle	0.13	98.6	0.16	90.2	0.45	94.2



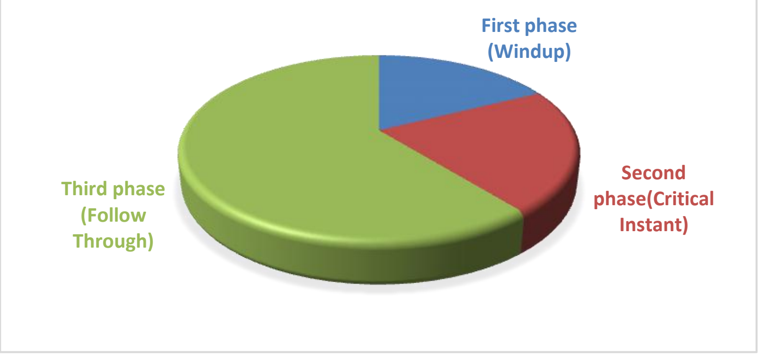
Figure(11) Biomechanical analysis of the straight left punch to the head



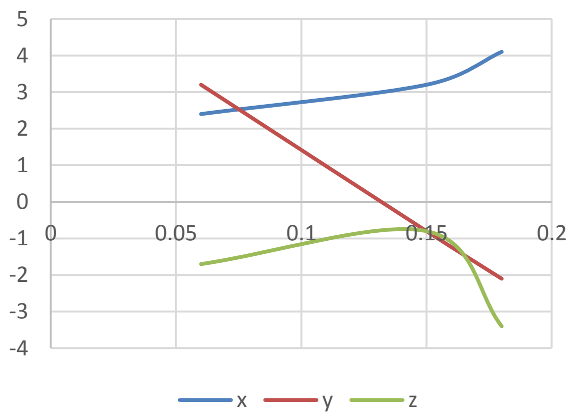
Figure(12) Biomechanical analysis of the straight left punch to the Trunk



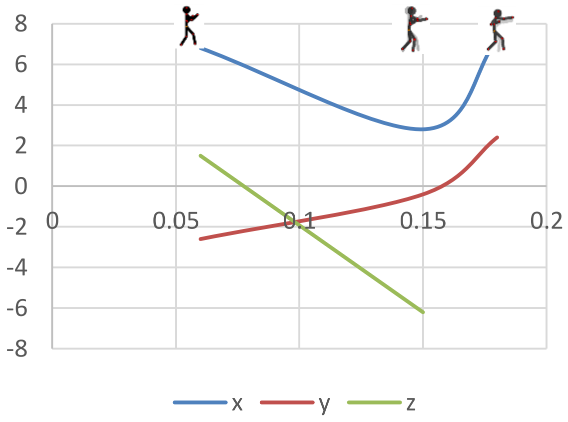
Figure(13) Biomechanical analysis of the straight right punch to the head



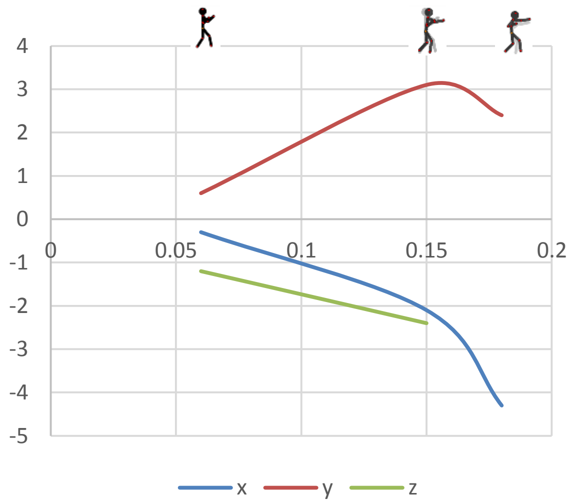
Figure(14) Biomechanical analysis of the straight right to the Trunk



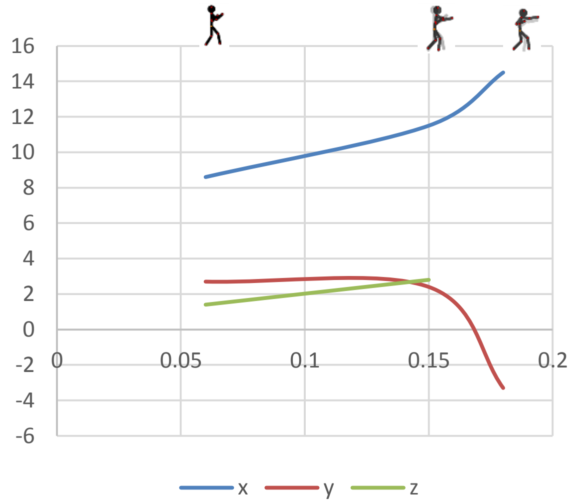
Figure(15-a) Head



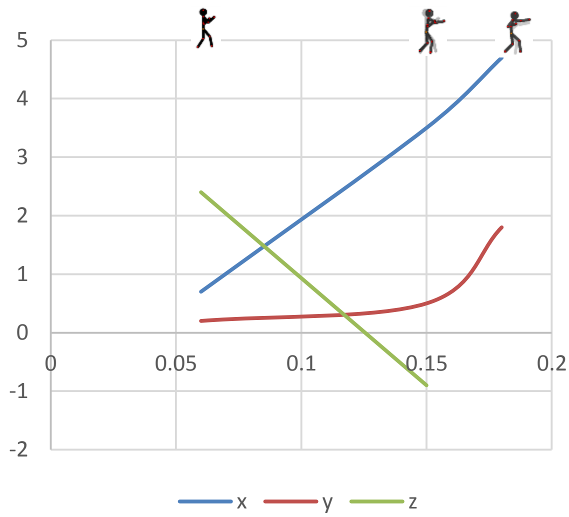
Figure(15-b) Trunk



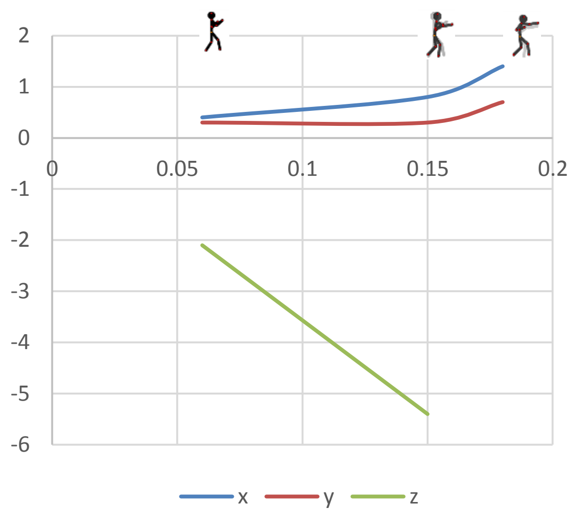
Figure(15-c) Right arm



Figure(15-d) Left arm

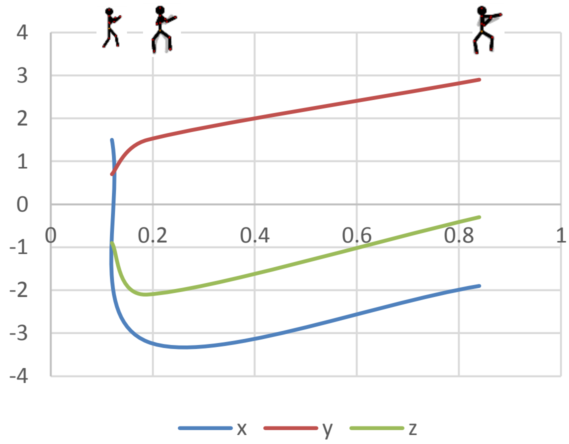


Figure(15-e) Right leg

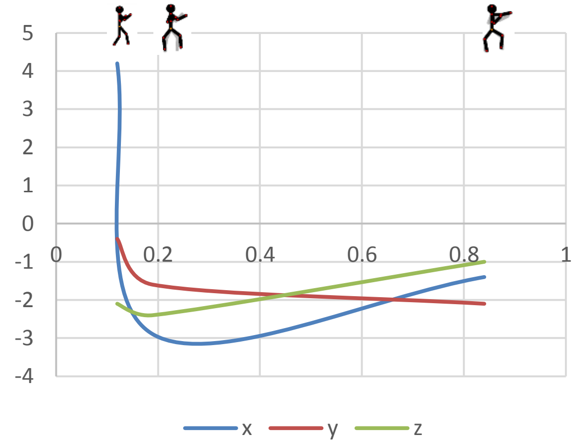


Figure(15-f) Left leg

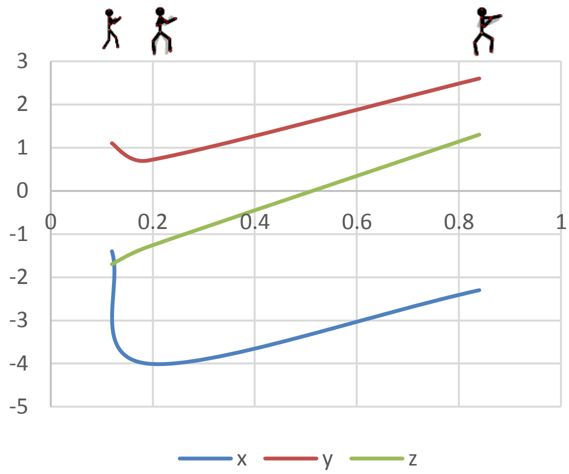
Figure(15) Biomechanical analysis of the straight left punch to the head



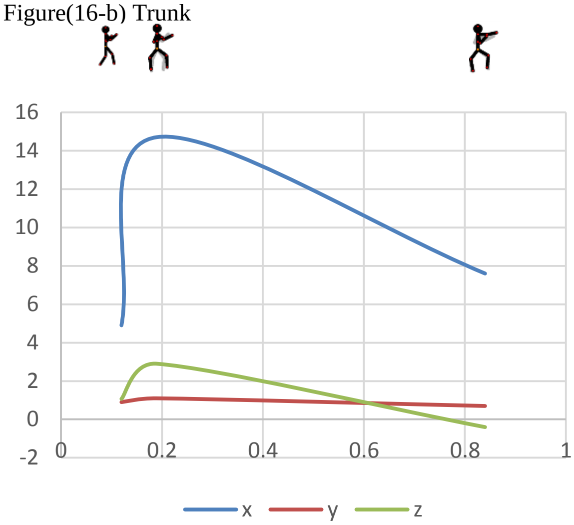
Figure(16-a) Head



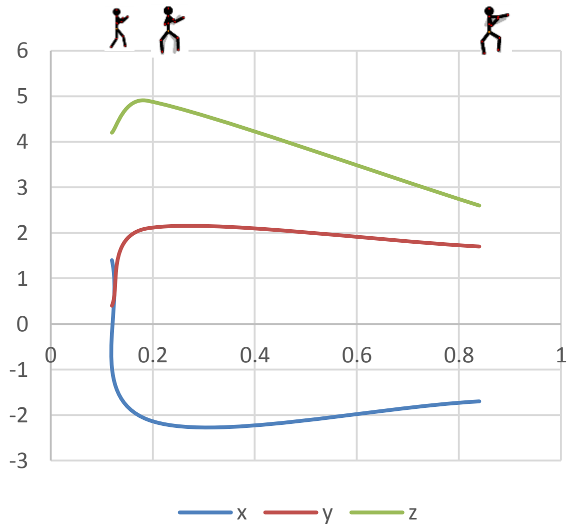
Figure(16-b) Trunk

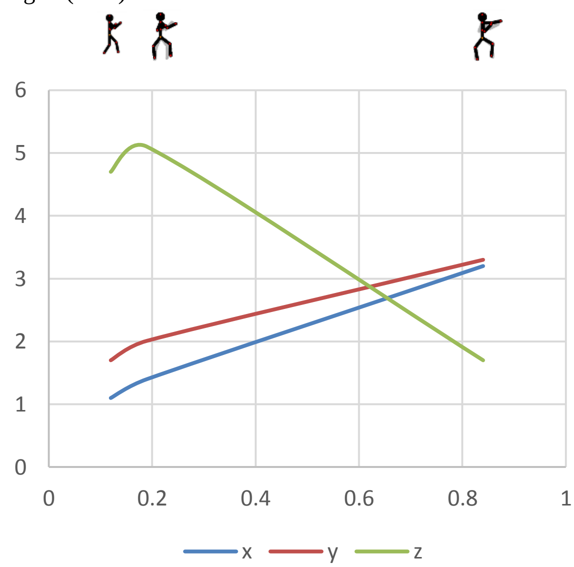


Figure(16-c) Right arm



Figure(16-d) Left arm

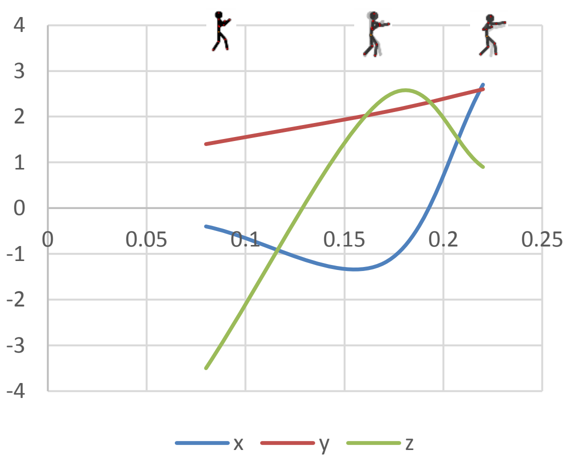




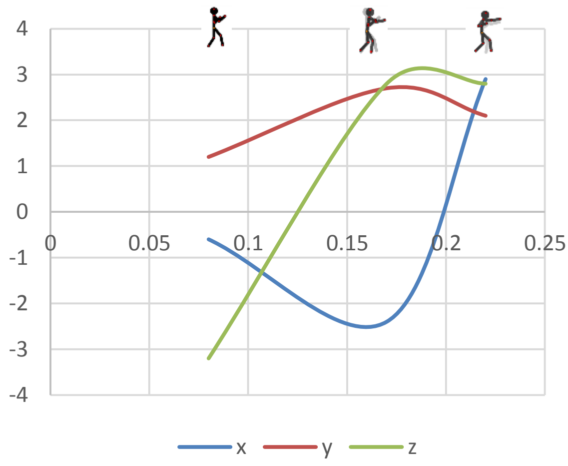
Figure(16-f) Left leg

Figure(16-e) Right leg

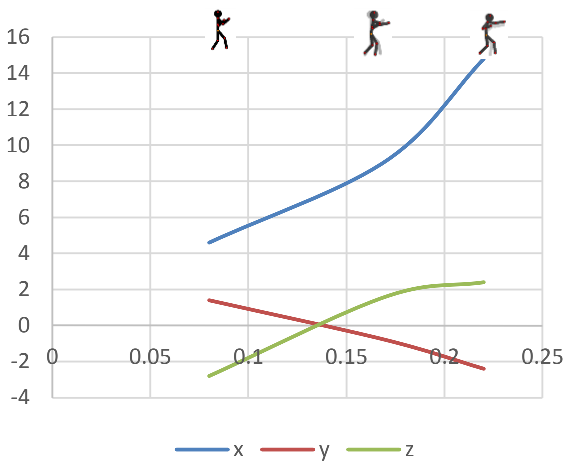
Figure(16) Biomechanical analysis of the straight left punch to the trunk



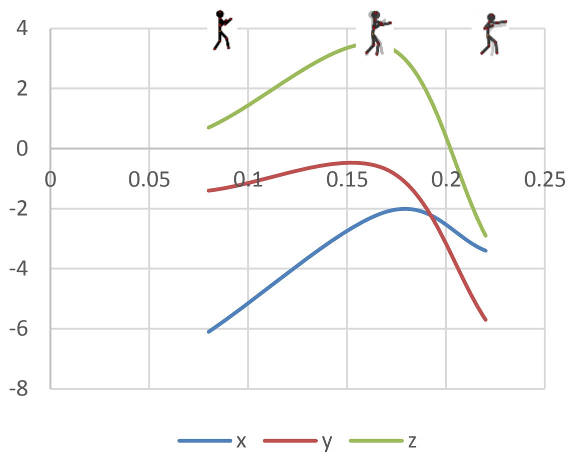
Figure(17-a) Head



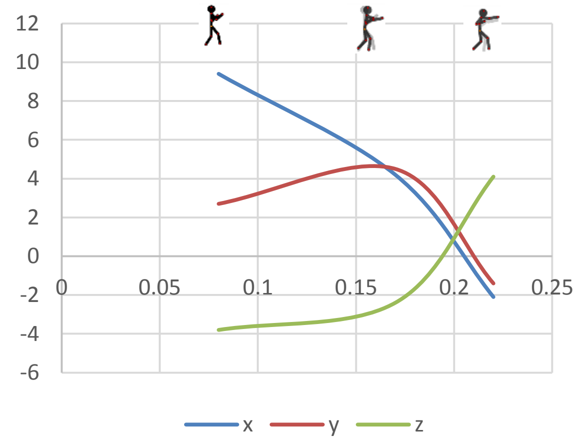
Figure(17-b) Trunk



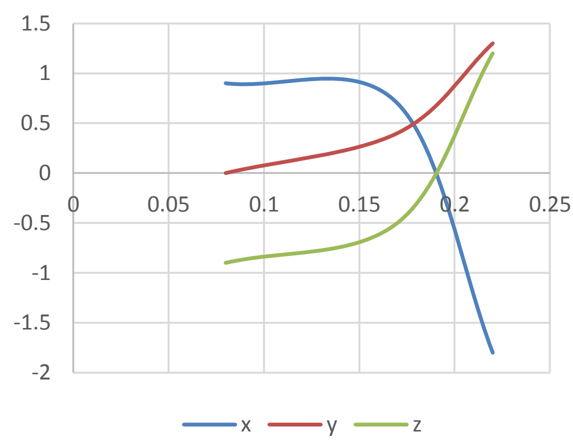
Figure(17-c) Right arm



Figure(17-d) Left arm

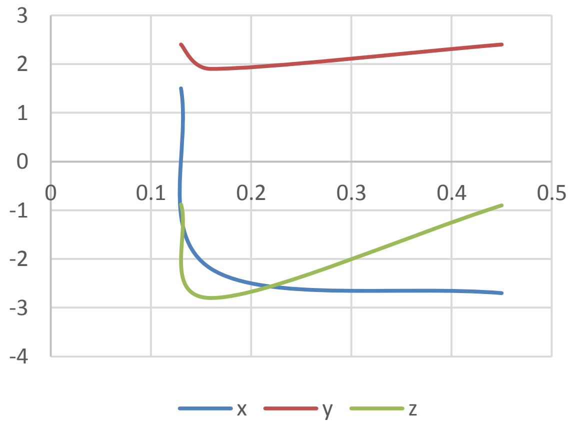


Figure(17-e) Right leg

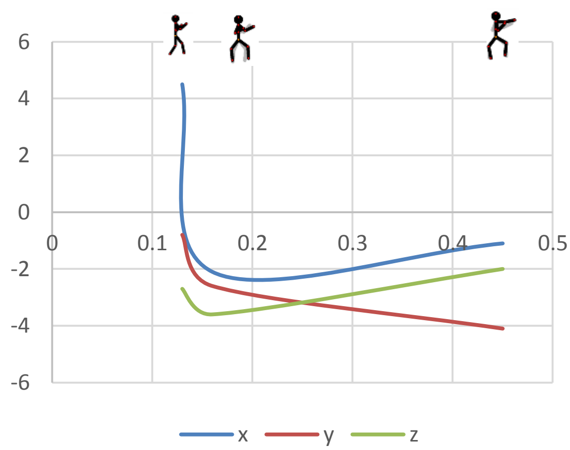


Figure(17-f) Left leg

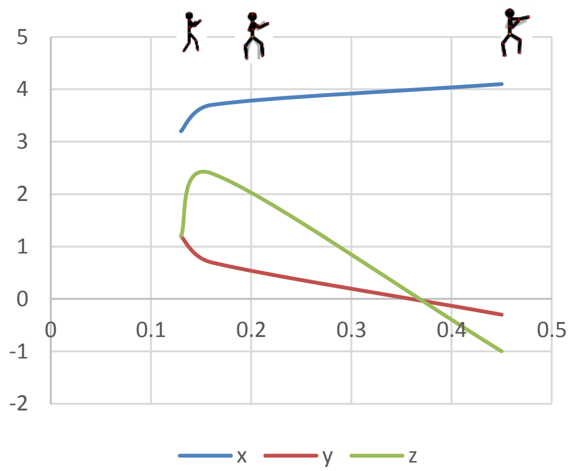
Figure(17) Biomechanical analysis model of the straight right punch to the head



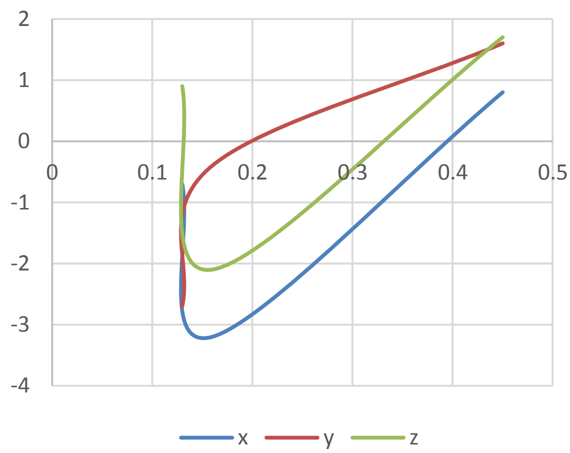
Figure(18-a) Head



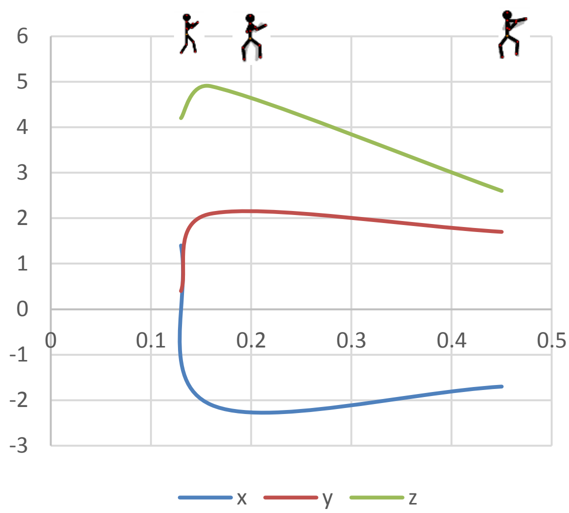
Figure(18-b) Trunk



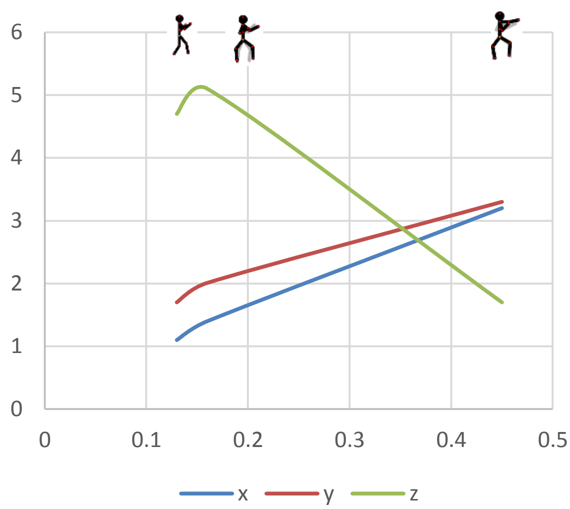
Figure(18-c) Right arm



Figure(18-d) Left arm

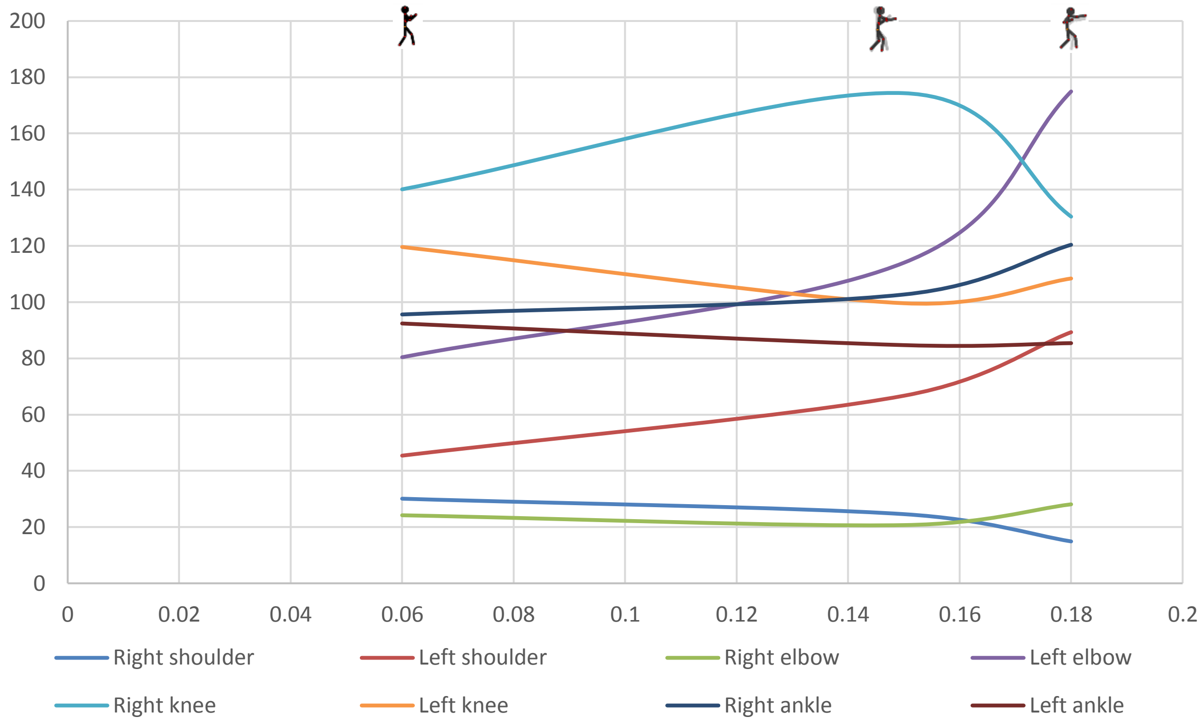


Figure(18-e) Right leg

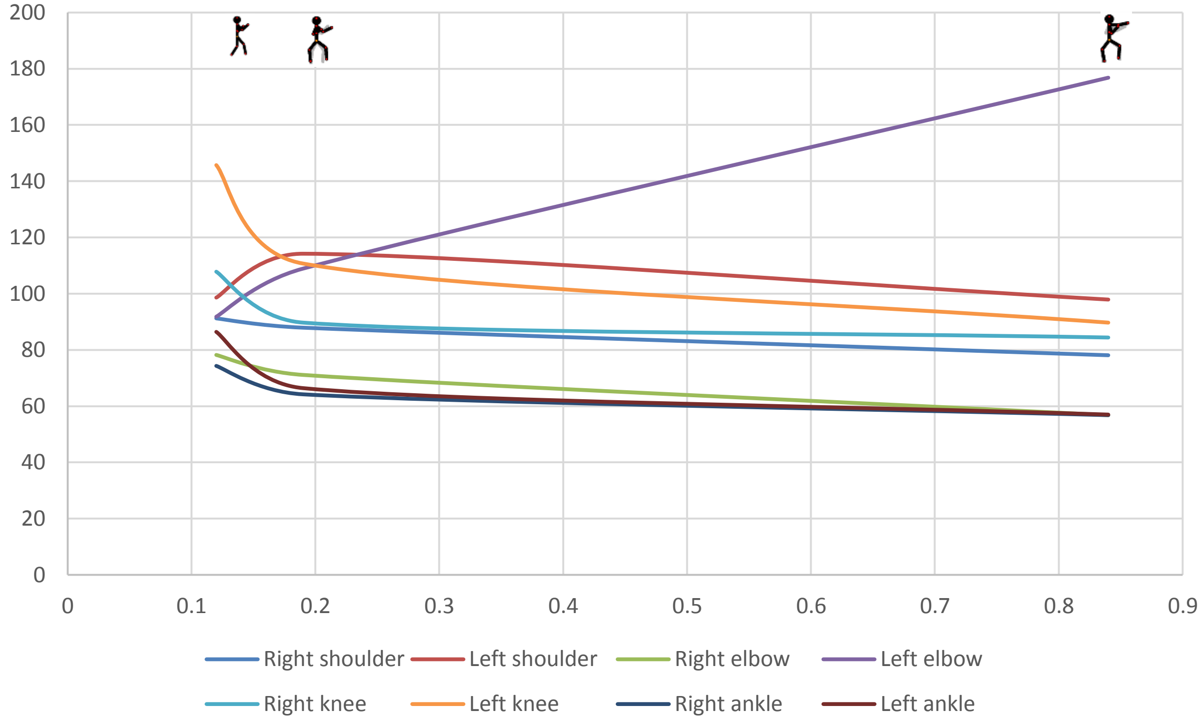


Figure(17-f) Left leg

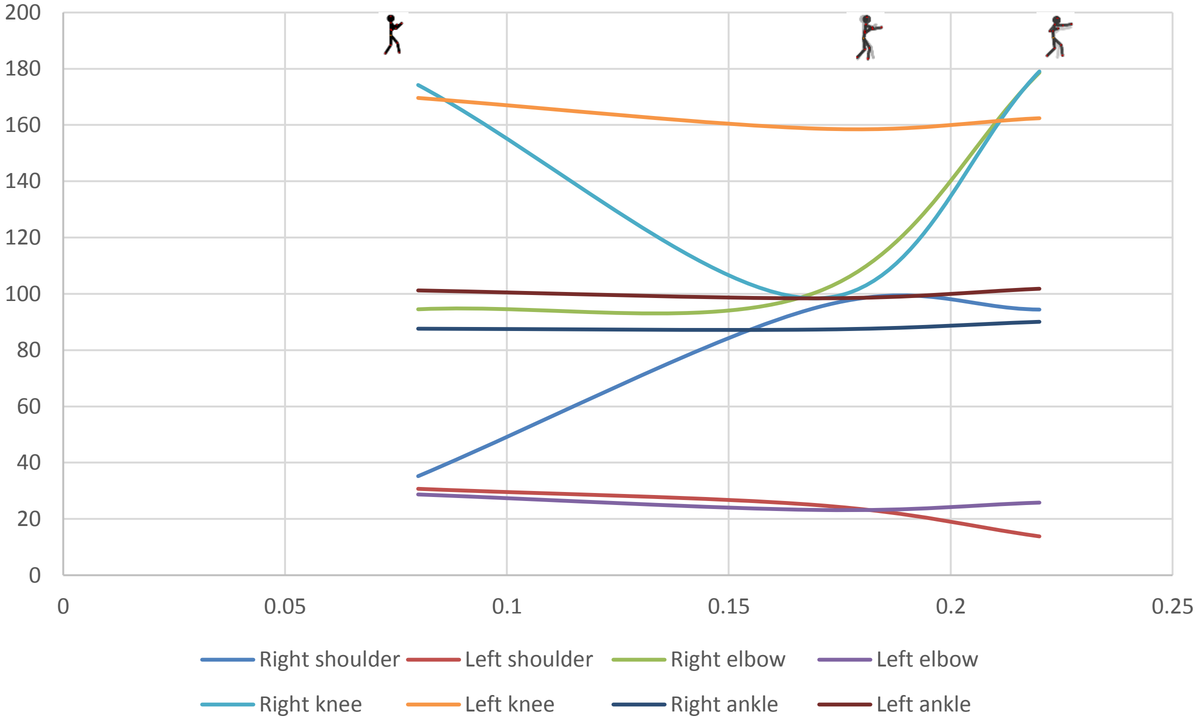
Figure(18) Biomechanical analysis model of the straight right punch to the trunk



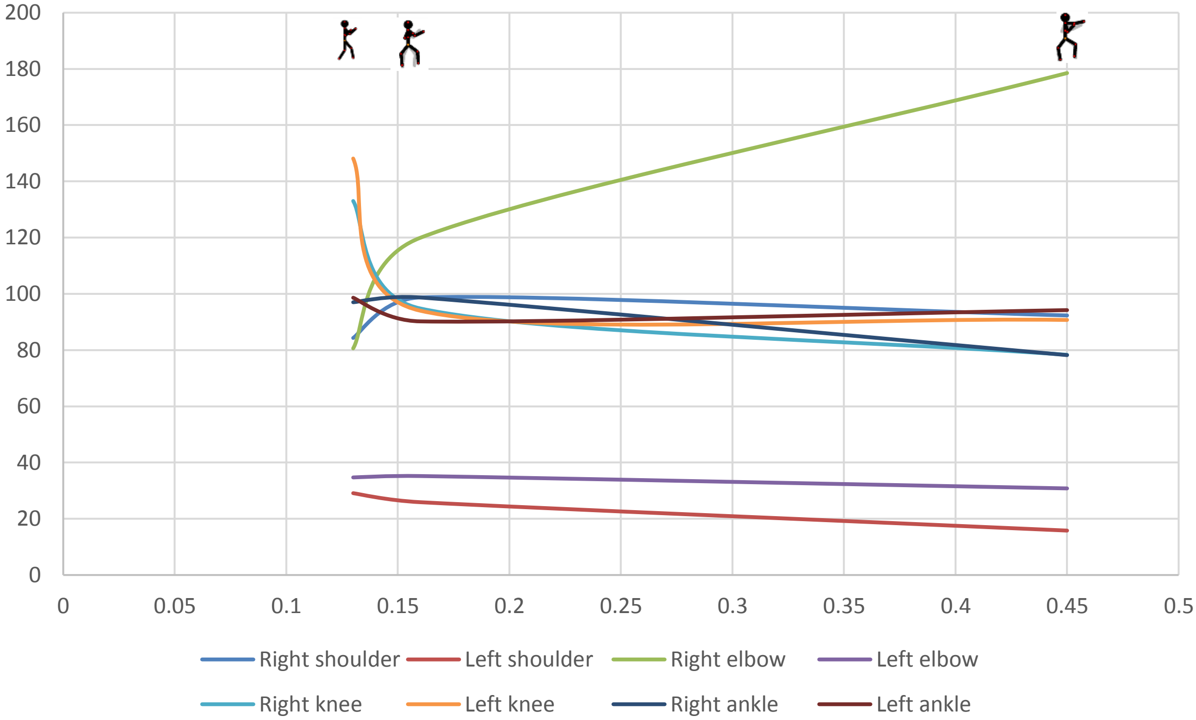
Figure(19) Biomechanical analysis model of the straight left punch to the head



Figure(20) Biomechanical analysis model of the straight left punch to the trunk



Figure(21) Biomechanical analysis model of the straight right punch to the head



Figure(22) Biomechanical analysis model of the straight right punch to the trunk

Discussion

9/1 Discusses the result of first question "What are the Biomechanical Parameters used in design a 3D Educational Animation Software for learning some basic skills in Boxing?"

9/1/1 The average times of phases of the performance of the punches under study:

Noted from Table (3) , (4) that The average times of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.06, 0.12, 0.08, 0.13 .

Noted from Table (3) , (4) that The average times of second phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.15, 0.19, 0.17, 0.16 .

Noted from Table (3) , (4) that The average times of third phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.18, 0.84, 0.22, 0.45 .

9/1/2 The average displacement of phases of the performance of the punches under study:

9/1/2/1 The average displacement in axe (x) of phases of the performance of the punches under study:

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **HEAD** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 2.4, 1.5, -0.4, 1.5 . And second phase was 3.2, -3.2, -1.2, -2.2 . And second phase was 4.1, -1.9, 2.7, -2.7 .

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **TRUNK** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 6.8, 4.2, -0.6, 4.5 . And second phase was 2.8, -3.2, -2.4, -2.1 . And second phase was 7.2, 91.4, 2.9, -1.1 .

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **RIGHT ARM** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was -0.3, -1.4, 4.6, 3.2 . And second phase was -2.1, 0.7, -0.8, 0.7 . And second phase was -4.3, -2.3, 14.8, 4.1 .

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **LEFT ARM** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 8.6, 4.6, -6.1, -0.7 . And second phase was 11.5, -2.1, -3.2 . And second phase was 14.5, 7.6, -3.4, 0.8 .

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **RIGHT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.7, 1.4, 9.4, 1.4 . And second phase was 3.5, -2.1, 4.2, -2.1 . And second phase was 4.7, -1.7, -2.1, -1.7 .

Noted from Table (3) , (4) that The average displacement in axe (*x*) to the center of gravity of **LEFT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.4, 1.1, 0.9, 1.1 . And second phase was 0.8, 1.4, 0.7, 1.4 . And second phase was 1.4, 3.2, -1.8, 3.2 .

9/1/2/2 The average displacement in axe (y) of phases of the performance of the punches under study:

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **HEAD** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 3.2, 0.7, 1.4, 2.4 . And second phase was -0.8, 1.5, 2.1, 1.9 . And second phase was -2.1, 2.9, 2.6, -4.1 .

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **TRUNK** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was -2.6, -0.4, 1.4, 2.4 . And second phase was -0.4, -1.6, 2.7, 1.9 . And second phase was 2.4, -2.1, 2.1, -4.1 .

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **RIGHT** ARM of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.65, 1.1, 1.4, 1.2 . And second phase was 3.1, 0.7, -0.8,0.7 . And second phase was 2.4, 2.6, -2.4, 0.3 .

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **LEFT ARM** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 2.7, 0.9, -1.4, -2.7 . And second phase was 2.4, 1.1, -0.7, -0.4 . And second phase was -3.3, 0.7, -5.7, 1.6 .

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **RIGHT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.2, 0.4, 2.7, 0.4 . And second phase was

0.5, 2.1, 4.5, 2.1 . And second phase was 1.8, 1.7, -1.4, 1.7 .

Noted from Table (3) , (4) that The average displacement in axe (*y*) to the center of gravity of **LEFT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.3, 1.7, 0.0, 1.7 . And second phase was 0.3, 2.0, 0.4, 2.1 . And second phase was 0.7, 3.3, 1.3, 3.3 .

9/1/2/3 The average displacement in axe (z) of phases of the performance of the punches under study:

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **HEAD** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was -1.7, -0.9, -3.5, -0.8 . And second phase was -0.8, -2.1, 2.4, -2.8 . And second phase was -3.4, -0.3, 0.9, -0.9 .

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **TRUNK** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 2.5, -2.1, -3.2, -2.7 . And second phase was 1.5, -2.4, 2.8, -3.6 . And second phase was -6.2, -1.0, 2.8, -2.0 .

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **RIGHT ARM** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 6.3, -1.7, -2.8, 1.2 . And second phase was -1.2, -1.3, 1.6, 2.4 . And second phase was -2.4, 1.3, 2.4, -1.0 .

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **LEFT ARM** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 1.1, 1.07, 0.7, 0.9 . And second phase was 1.4, 2.9, 3.4, -2.1 . And second phase was 2.8, -0.4, -2.9, 1.7.

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **RIGHT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 0.8, 4.2, -3.8, 4.2 . And second phase 2.4, 4.9, -2.4, 4.9 . And second phase was -0.9, 2.6, 4.1, 2.6 .

Noted from Table (3) , (4) that The average displacement in axe (*z*) to the center of gravity of **LEFT LEG** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was -0.4, 4.7, -0.9, 4.8 . And second phase was -2.1, 5.1, -0.5, 5.1 . And second phase was -5.4, 1.7, 1.2, 1.7 .

9/1/2/4 The average of angular displacement of phases of the performance of the punches under study:

Noted from Table (5) , (6) that The average of angular displacement to the **RIGHT SHULDER** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 30.1, 91.2, 35.2, 84.3 . And second phase was 24.6, 87.9, 95.2, 98.7 . And second phase was 14.9, 78.1, 94.4, 92.3 .

Noted from Table (5) , (6) that The average of angular displacement to the **LEFT SHULDER** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 54.4, 98.6, 30.7, 29.1 . And second phase was 66.7, 114.2, 24.9, 25.9 . And second phase was 89.3, 97.9, 13.8, 15.8.

Noted from Table (5) , (6) that The average of angular displacement to the **RIGHT ELBOW** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 24.2, 78.2, 94.5, 80.6. And second phase was 20.7, 71.1, 100.7, 119.9 . And second phase was 28.1, 56.8, 178.6, 178.5 .

Noted from Table (5) , (6) that The average of angular displacement to the **LEFT ELBOW** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 80.4, 91.8, 28.7, 34.7 . And second phase was 114.0, 108.9, 23.2, 35.2 . And second phase was 174.9, 176.8, 25.8 .

Noted from Table (5) , (6) that The average of angular displacement to the **RIGHT KNEE** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 140.1, 107.8, 174.2, 133.0 . And second phase was 174.3, 89.7, 98.4, 94.8 . And second phase was 130.4, 84.4, 179.01, 78.3 .

Noted from Table (5) , (6) that The average of angular displacement to the **LEFT KNEE** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 119.6, 145.7, 169.6, 148.1 . And second phase was 99.6, 110.7, 158.7, 94.01 . And second phase was 108.4, 89.7, 162.4, 90.7.

Noted from Table (5) , (6) that The average of angular displacement to the **RIGHT ANKLE** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 95.6, 74.3, 87.6, 97.0 . And second phase was 102.7, 642, 87.3, 98.7 . And second phase was 120.4, 56.8, 90.06, 78.2 .

Noted from Table (5) , (6) that The average of angular displacement to the **LEFT ANKLE** of first phase of the performance of the straight left punch to the head, to the trunk, the straight left punch to the head, to the trunk was 92.4, 86.4, 101.2, 98.6 . And second phase 84.7, 66.4, 98.4, 90.2 . And second phase was 85.4, 57.0, 101.8, 94.2 .

Conclusion

Within the limits of the research objectives, the research questions and the results the researchers concluded the following :

1- **Table of specifications that will be used in the design of a 3D Educational Animation Movies as shown in tables (3,4,5,6)**

2- **The Basic Phases to product a 3D Educational Animation Software for learning the basic skills in boxing as follows :**

First: Design & Preparation Phase

1- Identifying the general aim of the program

According to the research aim, the researchers identified the following aim as a general aim for the program, which is "Enhancing the effectiveness of learning some basic boxing skills for beginners students of the Faculty of Physical Education .

2- Identifying the program content

According to the Boxing course for beginners students in second year at the Faculty of Physical Education in Port-Said, the researchers identified the following skills:

- Straight left punch to the Head
- Straight left punch to the Trunk
- Straight right punch to the Head
- Straight right punch to the Trunk

3- Formulating the general aim in the shape of behavioral aims

After identifying the general aim of the program, the researchers formulated it in the form of procedural educational aims in a shape of final behavioral aim and describes them accurately to illustrate the different forms of performance expected from the learner at the end of learning the program. The educational software tried to achieve the following behavioral aims:

The learner should be able to perform:

- Straight left punch to the Head according to the correct performance conditions.
- Straight left punch to the Trunk according to the correct performance conditions.
- Straight right punch to the Head according to the correct performance conditions.
- Straight right punch to the Trunk according to the correct performance conditions.

Second: Biomechanics analysis phase

The researchers at this phase determined the Biomechanical parameters of the skills under study as follows :

1- Providing appropriate lighting at the filming location .

2- Preparing cubic calibration at the filming location as described in Figure (5).

3- Equipping the appropriate Cameras at the filming location and adjust their frequency as described in Figure (2).

4- Preparing Biomechanical analysis model as described in Figures (9,10).

5- Equipping the player with anatomical labeling for filming process as described in Figure (8).

6- The filming Process.

7- Biomechanical Analysis Process and determine a biomechanical parameters as shown in Figure (6).

Third: Scenario Building Phase

During this phase the researchers prepared a scenario of three-dimensional movies, which includes the voiceover of explain the skills under consideration, the relationship between the paragraph and pre onwards and determine the camera angle. The researchers considered some important rules,These are:

1-Avoiding long and complicated sentences, unused terminology, abbreviations and synonyms.

2-Using terminology in a coherent and unified mood all along the scenario.

3-Considering the sequence and logics of the demonstration through preparation, concentration on essences, leaving distracting details and gradually moving from simple to complex.

- The researchers used several studies and data about boxing for writing the material of the scenario. These are references (Al-Azab, 1990; Kurzel, 1998; Ellwanger, 2009 ; Rakha, 2009).

Table 7

A sample of Straight left punch to the Head scenario of three-dimensional movies.

No	Voiceover	Angle of the Camera
1	Stance position	Whole Location & Body
2	From stance position rushing the left fist to the midway. Taking into consideration: - Fist is in the same stance until midway - And Elbow is still down of the fist. - At the same time Push the land by the rear foot to transfer the weight of the body on the front foot - and the beginning of the rotation of the trunk to the right side.	Left : Whole Left arm Close zoom on left fist Move to close zoom on left elbow Move to Rear foot Move to the trunk from right side
3	Extend left arm forward with the rotation inwards of the fist and Look is towards the opponent.	Move to left side Close zoom on eyes
4	Right elbow covers and protects the trunk while chin is protected by right fist . Trunk leans slightly forward and rotates to the right. Rear foot Fulcrum Instep	Move to right side Close zoom on right elbow Close zoom on right fist Close zoom on rear foot
5	Chin is protected by left shoulder from the left side.	Close zoom on left shoulder

Fourth: Execution Phase

1- Preparation

This phase required some software and hardware requirements. The researchers used the following:

a) Hardware : computer Intel(R)Core (TM) i5 – 3320M CPU 2.60GHz

b) Software

The researcher used the following software in producing the three-dimensional movies:

- *Poser 7*: To produce a three-dimensional movies, which contributed to create a situation between-in, change shapes, area, volume, angle of shape, color, speed, surfaces of things, the viewing angle of the artwork whole, add shadows, compressing, flipping, twisting, split-screen for the moving parts, making storyboard, making transitions.
- *AutoPlay Media Studio 6.0*: which is used in the production of three-dimensional software interface.

2- Programming

a) The software control strategy

The researchers chose "learner control with advisement strategy". This means to give the learner the freedom to decide the learning duration and to order the suitable amount of exercises, in addition to decide the required feedback and directions and advice to the learner related to the choices covering frequently introduced notes about the best choices (El-Far 1998, 46).

b) design three-dimensional software screens:

In producing the three-dimensional software screens, the researcher used AutoPlay Media Studio 6.0 which enabled the researcher to prepare the material with good and suitable presentation effects (photos, drawings, texts, videos, 3D videos, voices, music) to support the three-dimensional movies. This enables the learner to self-step according to his/her needs, interests and learning rates so that time adaptation is reached , deal with the presented material, process and recall them when needed by clicking the mouse.

Future Researches

1- Apply the suggested 3D Educational Animation Software on a sample of beginners to identify its effectiveness in terms of emotional , cognitive and Technically.

2- Design more of 3D Educational Animation based on biomechanical parameters for some other basic skills in Boxing.

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