The Effect of Fit Light Training on the Second Reaction of Épée Fencers

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Abstract:

The current research aims to identify the effect of light stimuli training (Fit Light) on the secondary reaction time for some blade attacks (Battement, Pression) from the four fencing positions (Sixte, Quarte, Septime, Octave) among épée fencers. The researcher used the experimental method with a one-group pre-test/post-test design. The research sample was deliberately selected from the university team at the Faculty of Sports Sciences, Beni-Suef University, and consisted of 18 players. They were divided into an experimental group (8 players) and a pilot group (10 players).

The most important findings indicated that light stimuli training (Fit Light) had a positive effect in significantly improving performance, as well as improving the secondary reaction time in the blade attacks (Battement, Pression). The positions with the highest improvement in reaction time were Sixte and Quarte, followed by Octave and Septime. The researcher recommends paying attention to light stimuli training for different age groups and for other fencing weapons.

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Introduction:

Scientific research has become one of the most vital necessities in our modern society across all aspects of life, especially in the sports field. Fencing is one of the sports that require high physical and motor abilities. These abilities may integrate to form physical or motor skills essential for athletes to develop their physical and technical levels. The psychological aspect also plays a significant role in enhancing these levels, whether physical, technical, tactical, or psychological.

According to Fatenat Gabriel, Mahrousa Ali, and Wafaa Darwish (2000), the aim in modern fencing is to score the maximum number of touches using the easiest methods. This is achieved by extending the armed arm or extending the arm with a lunge or advancing forward. During an opponent's attack, the threat from the opponent's blade can be countered by the fencer's blade—this is called a defense. After completing the defense, the fencer can touch the opponent's target, which is known as a riposte. (10:18)

It is well known that sports technology plays a vital role in enhancing athletic performance through the use of modern techniques such as light stimuli (Fit Light), as referred to by the researcher. Hanaa Mohamed (2022) emphasizes the use of light stimulus training, which relies on modern technologies in sports like the Fit Light device. These devices use light stimuli as targets, and the athlete moves toward them to turn off the light either by direct contact or close proximity. The height and distance of the light units can be adjusted to achieve the training objective. (15:22)

Light stimulus training relies on modern technologies in sports, such as the Fit Light and Fusion Sport devices. These are used as target indicators that athletes move toward to turn off the lights either through full contact or near proximity. The height and distance between the light points

can be adjusted to achieve training goals. These are among the most recent trends globally in the sports field, rapidly spreading and gaining popularity due to their significant contribution to improving athletes' physical and technical performance. (21), (22), (23), (24), (25)

According to El-Sayed Sami (2008), focusing on the secondary reaction style enables the athlete to create openings to score touches or perform various maneuvers aimed at disrupting the opponent's strategy. Due to the proximity of the opponent's blade to the armed arm—which is within the target areas—the opponent may strike during these feints. The athlete uses the secondary reaction to turn anticipation into reality by using stimuli and deceptive moves with specific intentions to lure the opponent into a particular response, resulting in the planned secondary reaction. (5:88)

Research Problem:

Through the researcher's experience as a first-division fencer with the Egyptian Fencing Federation, her current role as a coach, and her work teaching fencing to students at the Faculty of Sports Sciences, as well as through scientific observation, attending numerous championships, and reviewing a wide range of Arabic and international references and studies, the researcher noticed a shortcoming in reaction speed among fencers.

This gap calls for training methods that meet the specific demands of the sport. Since performance in fencing heavily depends on quick reaction times and proper timing, which significantly affects the effectiveness of executing skills—particularly blade attacks—the researcher was motivated to employ light stimuli training as a serious attempt to improve the secondary reaction time of fencers.

This research also aims to contribute to ongoing scientific efforts advocating for structured and well-designed training programs that leverage modern advancements and integrate technology in sports training.

Light stimuli devices, as technological tools that can be controlled in terms of location and lighting intensity, can be effectively incorporated into training programs.

Believing in the importance of staying current with innovations in the field of training, the researcher presents this study as a serious attempt to enhance performance levels among the research sample and help athletes reach elite levels.

Research Objective:

The current research aims to:

Identify the effect of light stimuli training (Fit Light) on the secondary reaction time in performing certain blade attacks (Battement, Pression) from the four fencing positions (Sixte, Quarte, Septime, Octave) among épée fencers.

Research Hypotheses:

In light of the research objectives, the researcher hypothesizes the following:

1. There are statistically significant differences between the pre- and post-tests for the four positions (Sixte, Quarte, Septime, Octave) in the *Alonge* skill for the Battement attack, in favor of the post-test.
2. There are statistically significant differences between the pre- and post-tests for the four positions in the *Alonge* skill for the Pression attack, in favor of the post-test.
3. There are statistically significant differences between the pre- and post-tests for the four positions in the *Alonge Marche* skill for the Battement attack, in favor of the post-test.
4. There are statistically significant differences between the pre- and post-tests for the four positions in the *Alonge Marche* skill for the Pression attack, in favor of the post-test.
5. There are statistically significant differences between the pre- and post-tests

for the four positions in the *FaNDy* skill for the Battement attack, in favor of the post-test.

6. There are statistically significant differences between the pre- and post-tests for the four positions in the *FaNDy* skill for the Pression attack, in favor of the post-test.

Research Terminology:

Fit Light Device:

A system composed of a set of lights that operate through touch or proximity. When touched or approached, the light turns off and another lights up depending on the objective of the exercise. The researcher varied the execution of skills using the Fit Light device by assigning each light to a specific skill, and by diversifying the skills, the training contributed to improving and developing secondary reaction time. *(Operational Definition)*

Secondary Reaction:

As defined by El-Sayed Sami (2008), secondary reaction is the response resulting from the sequence of movements between the athlete and the opponent. It begins with a feint as a stimulus that elicits a reaction, which the fencer then counters, ensuring that the exchanged movements between both athletes occur within proper timing and in a sequential flow without interruption. (4:4)

Épée:

According to Ibrahim Nabil (2006), the épée is the heaviest**,** longest**,** and most rigid of the fencing weapons, with the widest cross-section. The total weight of the épée is 770 grams, and its maximum length is 110 cm. (1:22)

Research Procedures

Research Methodology:

The researcher used the experimental method with a one-group pre-test/post-test design, as it is the most suitable approach for handling the research sample and provides the researcher with control over and the ability to regulate the variables effectively.

Research Population:

The research population consists of the university fencing team at the Faculty of Sports Sciences, Beni-Suef University, for the academic year 2024–2025, including 20 players registered with the Egyptian Fencing Federation.

Research Sample:

The research sample was intentionally selected from the university fencing team at the Faculty of Sports Sciences, Beni-Suef University. The sample included 18 players, after excluding two players due to irregular attendance at training sessions. The sample was distributed as follows:

- Experimental group**:** 8 players
- Pilot group**:** 10 players

Statistical Description of the Research Sample in the Variables Under Study:

The research sample was described according to a set of variables, as shown in Table **(**1**)** below.

Table (1):

Mean, Median, Standard Deviation, and Skewness Coefficient of Anthropometric and Physical Variables for the Pilot Group N=10

No.	Variable	Unit of Measurement	Mean	Median	Standard Deviation	Skewness
1	Height	Cm	164.1	164	3.725	0.386
2	Weight	Kg	59.8	59	5.329	1.014
3	Chronological Age	Years	18.2	18	0.789	-0.407
4	Training Age	Years	3.2	3	0.919	0.601
5	Agility (4x10 m shuttle run)	Seconds	14.46	14.99	1.104	-0.368
6	Speed (50 m sprint)	Seconds	7.917	8.14	0.660	-1.941
7	Coordination	Seconds	18.6	19	1.955	-1.526
8	Lunge Speed (10 seconds)	Repetitions	7.8	8	0.789	0.407
9	Advance Speed (14 m)	Seconds	7.82	8.27	1.013	-1.621
10	Retreat Speed (14 m)	Seconds	8.11	8.475	0.881	-0.957

No.	Variable	Unit of Measurement	Mean	Median	Standard Deviation	Skewness
11	Special Endurance (6-sec M.F test)	Repetitions	27.6	27.5	2.119	0.571
12	Explosive Strength (E.G test for 10 sec)	Repetitions	7.3	7	0.949	1.210

It is evident from Table **(**1**)** that the skewness coefficient for the pilot research sample in the variables under study ranges between **-**1**.**941 and 1**.**210, indicating that the data distribution is normal, as the values fall within the acceptable range of ±3.

Table (2)
Mean, Median, Standard Deviation, and Skewness Coefficient of Anthropometric and Physical Variables for the Main Research Sample (n = 8)

No.	Variable	Mean	Median	Standard Deviation	Skewness
1	Height	166.88	164.5	4.291	1.112
2	Weight	60.5	59	5.581	0.921
3	Chronological Age	16.5	16.5	0.535	0.000
4	Training Age	3.63	3	0.916	0.999
5	Agility (4x10 m shuttle run)	14.26	14.185	1.140	0.075
6	Speed (50 m sprint)	7.87	8.14	0.738	-1.630
7	Coordination	18.38	19	2.134	-1.240
8	Lunge Speed (10 seconds)	7.88	8	0.835	0.277
9	Advance Speed (14 m)	7.67	8.13	1.095	-1.297
10	Retreat Speed (14 m)	7.99	8.46	0.955	-0.579
11	Special Endurance (60-sec M.F test)	27.63	27.5	2.387	0.508
12	Explosive Strength (E.G test for 10 sec)	7.38	7	1.061	0.913

It is evident from Table **(**2**)** that the skewness coefficient for the main research sample in the variables under study ranges between **-**1**.**630 and 1.112, indicating that the data distribution is normal, as the values fall within the acceptable range of **±3**.

Scientific Criteria for Describing the Pilot Sample:

Validity: Using Construct Validity (Differences between Groups):

To calculate the validity of the tests under investigation, the researcher used construct validity (differences between groups). This was done by applying measurements to a group of trainees (the pilot sample) from the same research population, but outside of the main sample. The pilot sample consisted of 10 players, who were arranged in descending order and divided into two groups, each containing 5 players. Table (3) illustrates this.

Table (3):

Mean, Standard Deviation, and "t" Values between the Distinguished and Undistinguished Groups in the Research Variables **(n1 = n2 = 5)**

No	Variable			Unit of Measurement	Distinguished Group		Undistinguished Group		t-value
	Position	Skill	Attack		Mean	S.D	Mean	S.D	
1	Octave	Along	Battement	Seconds	19.4	4.93	37.2	6.80	4.74
			Pression	Seconds	22.0	4.90	34.2	5.26	3.79
		Marche Along	Battement	Seconds	19.4	5.50	39.2	8.26	4.46
			Pression	Seconds	24.2	4.82	40.2	7.60	3.98
		FaNdy	Battement	Seconds	26.0	7.35	69.8	20.74	4.45
			Pression	Seconds	29.2	4.92	75	21.11	4.73
2	Septime	Along	Battement	Seconds	13.6	2.88	32	9.27	4.24
			Pression	Seconds	20.4	2.07	37	8.19	4.40
		Marche Along	Battement	Seconds	27.2	0.45	41.4	9.91	3.20
			Pression	Seconds	28.2	6.34	43	7.25	3.44
		FaNdy	Battement	Seconds	29.0	7.48	69.8	21.29	4.04
			Pression	Seconds	25.6	3.58	101	14.88	11.01
3	Qurte	Along	Battement	Seconds	24.4	9.69	41.4	3.71	3.66
			Pression	Seconds	21.8	6.57	42.2	7.29	4.65
		Marche Along	Battement	Seconds	28.2	3.83	40.8	9.73	2.69
			Pression	Seconds	27.8	6.22	42	7.25	3.32
		FaNdy	Battement	Seconds	29.4	5.50	76.2	25.41	4.02
			Pression	Seconds	27.6	10.29	84.6	21.65	5.32
4	**Sixte**	Along	Battement	Seconds	18.6	7.23	36.4	6.95	3.97
			Pression	Seconds	27	8.22	38.8	4.71	2.79
		Marche Along	Battement	Seconds	21.2	4.02	43.2	11.14	4.15
			Pression	Seconds	28.2	7.53	44.4	4.22	4.20
		FaNdy	Battement	Seconds	26.8	12.19	76	19.81	4.73
			Pression	Seconds	24.4	5.08	70.8	20.36	4.94

The critical "t" value at 8 degrees of freedom and a significance level of 0.05 is 2.306.

It is evident from Table (3) that there are statistically significant differences between the distinguished and undistinguished groups in the skill variables under investigation, with a direction favoring the distinguished group. This indicates that the tests are at an acceptable level of validity.

Reliability:

The reliability of the variables under investigation was calculated. The researcher used Pearson's simple correlation coefficient by conducting the first and second applications with a time interval of 7 days on a sample consisting of 10 players from the same research population but outside the original sample. Table (4) shows the correlation coefficients between the first and second applications.

Table (4)

Mean, Standard Deviation, and "r" Values between the First and Second Applications in the Research Variables
(n = 10)

No	Variables			Unit of Measurement	First Application		Second Application		R
	Position	Skill	Attack		M	(SD)	M	(SD)	
1	Octave	Along	Battement	Second	33.6	14.89	33.1	14.74	0.979
			Pression	Second	30.6	7.96	29.7	7.39	0.985
		Marche Along	Battement	Second	38.9	11.22	39.1	9.90	0.978
			Pression	Second	37	7.26	36.6	8.49	0.974
		FaNdy	Battement	Second	57.2	16.48	58.7	13.42	0.961
			Pression	Second	65.1	19.59	62.3	18.77	0.983
2	Septime	Along	Battement	Second	28.3	13.85	26.3	10.21	0.975
			Pression	Second	29.4	11.64	29.3	9.93	0.957
		Marche Along	Battement	Second	32.7	15.01	33.7	14.10	0.988
			Pression	Second	35.6	12.57	36.2	9.87	0.955
		FaNdy	Battement	Second	61	22.64	59.6	22.21	0.989
			Pression	Second	54.44	38.18	52.84	35.73	0.997
3	Qurte	Along	Battement	Second	36.5	7.84	34.1	9.56	0.895
			Pression	Second	34.4	7.35	34.4	11.13	0.921
		Marche Along	Battement	Second	37	12.78	36.2	9.48	0.942
			Pression	Second	39.7	9.26	39.2	7.51	0.900

No	Variables			Unit of Measurement	First Application		Second Application		R
	Position	Skill	Attack		M	(SD)	M	(SD)	
		FaNdy	Battement	Second	55.20	34.96	54.00	33.12	0.998
			Pression	Second	53.92	35.62	53.71	34.54	0.996
4	Sixte	Along	Battement	Second	24.3	4.60	25.2	4.10	0.974
			Pression	Second	30.6	9.90	30.7	8.56	0.913
		Marche Along	Battement	Second	37.5	10.52	38.5	9.43	0.967
			Pression	Second	32.7	8.18	35.2	4.02	0.934
		FaNdy	Battement	Second	70.6	22.53	69.1	23.02	0.994
			Pression	Second	65.5	24.57	63.4	23.90	0.994

The "r" tabulated value at 8 degrees of freedom and a significance level of 0.05 = 0.666.

It is evident from Table (4) that the correlation coefficients between the first and second applications in the physical and skill tests ranged from 0.895 to 0.998, which are statistically significant at the 0.05 level. This indicates that the tests are of an acceptable level of reliability.

Tools and Data Collection Methods:

- Anthropometric measurements.
- Physical and skill tests (Appendix 1 & 2).
- Fencing sword (Epee), Foil, Connection pulley, Masks.
- Second reaction device (designed by Ayman Ghoneim) (Appendix 3).
- Registration forms (Appendix 4).
- Digital video camera.

Pilot Studies:

The researcher conducted a pilot study from Sunday, March 4, 2024, to April 9, 2024, on a sample of 10 players from the research population who were outside the main sample. The purpose of the pilot study was to:

1. Identify any issues faced during the implementation process.

2. Test the tools and verify their validity.
3. Ensure the ease of use of the device.
4. Train on the second reaction device and confirm its suitability.
5. Conduct the scientific criteria for the tests under investigation.

Program Preparation (Under Investigation):

The researcher designed the visual stimulus training program through a literature review of Arabic and foreign books, references, previous studies, and research related to the study variables, as well as consultation with experts regarding the program's components. The program was designed according to the following criteria:

- The training should achieve the intended goal.
- It should consider individual differences and be flexible (easy to modify according to individuals' levels).

The researcher ensured that the training load corresponded with gradual increases in the load within each training session and between the different program units. Three main levels of intensity were used, as outlined by "Hassan Allawi" in terms of intensity and volume: Maximum load (90%-100%), High load (75%-90%), Moderate load (55%-75%). Additionally, the researcher accounted for rest periods and repetitions during training.

Time Division for Training:

- **Program Duration:** Two months.
- **Number of Weeks:** 8 weeks.
- **Number of Training Units per Week:** 3 units.
- **Total Number of Units:** 24 units.
- **Duration of Each Training Unit:** Ranges from 120 to 180 minutes.

- **Training Stimuli:** Includes (special physical, wall exercises, individual lessons).
- **Preparation Period:** (Specific preparation phase).

Dynamic Load Formation (Appendix 5):

The researcher used a 2:1 load formation for the fencing sword players over a period of 8 weeks across two months.

Application of the Study:

Pre-Test Measurements:

The pre-test measurements for the sample (under investigation) were conducted on Saturday, April 13, 2024.

Main Experiment:

The **Fit Light** training was applied to the sample (under investigation) from Monday, April 15, 2024, to Saturday, June 8, 2024. The training involved light stimuli within the training program. This was carried out within the framework of dividing the weekly units into three sessions per week: Saturday, Monday, and Wednesday (Appendix 6).

Post-Test Measurements:

The post-test measurements for the sample (under investigation) were conducted between Monday, June 10, 2024, and Wednesday, June 12, 2024, using the same tools as the pre-test measurements.

Statistical Procedures:

The researcher used the following statistical procedures throughout the study:

1. Arithmetic Mean.
2. Standard Deviation.
3. Median.
4. Skewness for Normality.
5. Percentages.
6. Pearson Correlation Coefficient.
7. "t" Test for Significant Differences.
8. One-Way ANOVA.

The researcher used the **SPSS** statistical software, and the

significance level was set at (0.05) to ensure the statistical significance of the study results.

Presentation and Discussion of Results

First: Presentation of Results:

Table (5)

One-Way ANOVA Between the Four Conditions in (Battement Attack Along Skill) Under Investigation

N = 8

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Value	Significance Level
Battement Attack Along Skill					
Between Groups	1340.688	7	191.527	4.759	0.000
Within Groups	2253.750	56	40.246		
Total	3594.438	63			

The critical value of "F" at degrees of freedom 7, 56 and a significance level of 0.05 is 2.18.

It is evident from Table (5) that:

1. There are statistically significant differences between the four conditions in the (Battement Attack Along skill) under investigation, as the calculated "F" values are greater than the critical "F" value.

a) To determine the significance of the differences in these variables, the Least Significant Difference (L.S.D.) test was used.

Table (6)

Least Significant Difference (L.S.D) Between the Four Conditions in (Battement Attack Along Skill) Under Investigation

Variable	Conditions	Measurement	Mean	Qurte (Pre)	Qurte (Post)	Sixte (Pre)	Sixte (Post)	Septime (Pre)	Septime (Post)	Octave (Pre)	Octave (Post)
Attack Battement Along	Qurte	Pre	24.5	0.01	0.10	0.00	0.72	0.01	0.91	0.06	-
		Post	16.375	-	0.39	0.09	0.03	0.84	0.01	0.53	-
	Sixte	Pre	19.125	-	0.01	0.19	0.29	0.08	0.81	-	-
		Post	10.875	-	-	0.00	0.13	0.00	0.02	-	-

Variable	Conditions	Measurement	Mean	Qurte (Pre)	Qurte (Post)	Sixte (Pre)	Sixte (Post)	Septime (Pre)	Septime (Post)	Octave (Pre)	Octave (Post)
	Septime	Pre	23.375	-	-	0.02	0.64	0.12	-	-	-
		Post	15.75	-	-	-	0.01	0.41	-	-	-
	Octave	Pre	24.875	-	-	-	-	-	0.05	-	-
		Post	18.375	-	-	-	-	-	-	-	-

"Significant at a significance level of 0.05"

Table (6) Interpretation:

1. There are statistically significant differences between the pre-test and post-test measurements for the four conditions in Battement Attack Along Skill in the direction of the post-test measurements for all conditions.
2. There are statistically significant differences between the post-test measurements of the four conditions in Battement Attack Along Skill, specifically in the direction of the post-test measurement for the Sixte condition.

Table (7)
One-Way ANOVA Analysis for the Four Conditions in (Pression Attack Skill Along) Under Investigation
n = 8

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F Value	Significance Level
Between Groups	1676.859	7	239.551	18.551	0.000
Within Groups	723.125	56	12.913		
Total	2399.984	63			

The tabulated "F" value at 7, 56 degrees of freedom and a significance level of 0.05 = 2.18

It is evident from **Table (7)** that:

1. Statistically significant differences exist between the four conditions in **(**Pression

Attack Skill Along) under investigation, as the calculated "F" values are greater than the critical "F" value.

a) To determine the significance of the differences in these variables, the Least Significant Difference (L.S.D) test was used.

This indicates that the observed variations in performance across the four conditions are statistically meaningful, and further analysis with the L.S.D test will help identify where these differences specifically occur.

Table (8)
Least Significant Difference (L.S.D) between the four conditions in (Pression Attack Skill Along) under investigation

Variable	Conditions	Measurement	Mean	Qurte	Sixte	Septime	Octave
Pression Along	**Qurte**	Pre-Measurement	19.875	0.00	0.49	0.00	0.02
		Post-Measurement	13	0.00	0.08	0.00	0.53
	Sixte	Pre-Measurement	21.125	0.00	0.09	0.00	0.24
		Post-Measurement	9.75	0.00	0.24	0.00	0.00
	Septime	Pre-Measurement	24.25	0.00	0.58	0.00	0.01
		Post-Measurement	11.875	0.00	0.01		
	Octave	Pre-Measurement	23.25	0.00			
		Post-Measurement	17	0.00			

- Significant at the 0.05 level

It is evident from Table (8) the following:

1. There are statistically significant differences between the pre- and post-measurements for the four conditions in the Pression Attack Skill Along, with the differences being in favor of the post-measurements for all conditions.
2. There are statistically significant differences between the post-

measurements for the four conditions in the Pression Attack Skill Along, with the differences being in favor of the post-measurements for the Sixte condition.

Table (9)

One-Way ANOVA Analysis between the Four Conditions in the Battement Attack Skill Marche Along Under Research

N = 8

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-value	Significance Level (p-value)
(Battement - Marche Along					
Between Groups	3215.734	7	459.391	14.748	0.000
Within Groups	1744.375	56	31.150		
Total	4960.109	63			

"The tabulated F-value at degrees of freedom (7, 56) and a significance level of 0.05 is 2.18."

It is evident from Table (9) the following:

1. There are statistically significant differences between the four conditions in the Battement Attack Skill Marche Along under research, as the calculated F-values are greater than the F-critical value.

A) To identify the significance of the differences in these variables, the Least Significant Difference (L.S.D.) test was used.

Table (10)

Least Significant Difference (L.S.D) between the Four Conditions in the Battement Attack Skill Marche Along under Research

Variable	Conditions	Measurement	Mean	Qurte	Sixte	Septime	Octave
Battement Marche Along	**Qurte**	Pretest	33.875	0.00	0.09	0.00	0.21
		Posttest	15	0.00	0.50	0.00	0.01
	Sixte	Pretest	29.125	0.00	0.66	0.03	0.69
		Posttest	13.125	0.00	0.00	0.00	0.00
	Septime	Pretest	30.375	0.01	0.96	0.01	0.96
		Posttest	22.875	0.01	0.96		
	Octave	Pretest	30.25			0.01	
		Posttest	22.75				

Statistically significant at the 0.05 level

Table (10) shows the following:

1. There are statistically significant differences between the pre- and post-test measurements across the four positions in the Battement attack – Marche Along skill, in favor of the post-test measurements for all positions.
2. There are statistically significant differences among the post-test measurements of the four positions in the Battement attack – Marche Along skill, in favor of the Sixte position.

Table (11)
One-Way Analysis of Variance Between the Four Conditions in **Pression Attack Skill Marche Along** Under Research

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance Level
Pression Marche Along	Between Groups	2480.750	7	354.393	9.869
	Within Groups	2011.000	56	35.911	
	Total	4491.750	63		

The tabulated F value at 7, 56 degrees of freedom and a 0.05 significance level is 2.18.

It is evident from Table (11) the following:

1. There are statistically significant differences between the four conditions in the Pression Attack Skill Marche Along under research, as the calculated F values are greater than the tabulated F value.

a) To determine the significance of the differences in these variables, the Least Significant Difference (L.S.D) test was used.

Table (12)
Least Significant Difference (L.S.D) Between the Four Conditions in Pression Attack Skill Marche Along Under Research

Variable	Conditions	Measurement	Mean	Qurte	Sixte	Septime	Octave
Pression Attack Skill Marche Along	Qurte	Pre-test	24.125	0.01	0.03	0.00	0.02
		Post-test	16.25	0.00	0.32	0.00	0.00
	Sixte	Pre-test	30.875	0.00	0.93	0.16	0.26
		Post-test	13.25	0.00	0.00	0.00	0.03
	Septime	Pre-test	31.125	0.14	0.23	0.00	
		Post-test	26.625	0.00			
	Octave	Pre-test	27.5	0.01			
		Post-test	19.75				

Significant at the 0.05 level

From Table (12), the following conclusions can be drawn:

1. There are statistically significant differences between the pre-test and post-test measurements for the four conditions in Pression Attack Skill Marche Along in the direction of post-test measurements for all conditions.
2. There are statistically significant differences between the post-test measurements for the four conditions in Pression Attack Skill Marche Along, especially for the post-test measurement of the Sixte position.

Table (13)
One-Way Analysis of Variance (ANOVA) Between the Four Positions in Battement Attack Skill FaNdy Under Research
N=8

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F Value	Significance Level
Battement FaNdy	Between Groups	3277.188	7	468.170	3.751
	Within Groups	6989.750	56	124.817	
	Total	10266.938	63		

The tabulated F value for degrees of freedom 7 and 56 at a significance level of 0.05 = 2.18

It is clear from Table (13) that:

1. There are statistically significant differences between the four positions in Battement Attack Skill FaNdy under research, as the calculated F values are greater than the critical F value.

a) To determine the significance of the differences in these variables, the Least Significant Difference (L.S.D) test was used.

Table (14)
Least Significant Difference (L.S.D) Test Between the Four Positions in Battement Attack Skill "FaNdy" Under Study

Variable	Positions	Measurement	Mean	Qurte	Sixte	Septime	Octave
Battement FaNdy	Qurte	Pre	45.75		0.98	0.96	0.93
		Post	27.875		0.61	0.19	0.32
	Sixte	Pre	45.875			0.95	0.91
		Post	30.75			0.42	0.62
	Septime	Pre	45.5				0.96
		Post	35.25				0.76
	Octave	Pre	45.25				
		Post	33.5				

Significant at the 0.05 level

the following can be concluded from Table (14):

1. There are statistically significant differences between the pre- and post-measurements of the four positions in the Battement attack using the FaNdy skill, in favor of the post-measurements across all positions.
2. There are statistically significant differences between the post-measurements of the four positions in the Battement attack using the FaNdy skill, with the advantage observed in the Qurte position.

Table (15)
One-Way ANOVA Analysis Between the Four Positions in (Pression Attack – FaNdy Skill) Under Study
n = 8

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	F Value	Significance Level
Pression Attack – FaNdy Skill	Between Groups	4138.109	7	591.158	3.604
	Within Groups	9184.875	56	164.016	
	Total	13322.984	63		

The tabulated F value at degrees of freedom (7, 56) and significance level 0.05 = 2.18

It is clear from **Table (15)** that:

1. There are statistically significant differences between the four positions in the Pression attack using the FaNdy skill under study, as the calculated F values are greater than the tabulated F value.

a) To determine the significance of these differences among the variables, the Least Significant Difference **(L.S.D.) test** was used.

Table (16)
Least Significant Difference (L.S.D) between the four positions in the Pression Attack using the FaNdy skill under study

Variable	Positions	Measurement	Mean	Qurte		Sixte		Septime		Octave	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post
Pression FaNdy	Qurte	Pre	45.125	—	0.20	97.0	0.00	0.94	0.04	0.98	0.03
		Post	36.875	—		0.19	0.04	0.18	0.43	0.21	0.02
	Sixte	Pre	45.375	—		—	0.00	0.97	0.04	0.95	0.27
		Post	23.5	—		—		0.00	0.20	0.00	0.02
	Septime	Pre	45.625	—		—		—	0.03	0.92	0.86
		Post	31.75	—		—				0.04	0.03
	Octave	Pre	45	—		—		—		—	
		Post	30.625	—		—		—		—	

Significant at the 0.05 level

It is evident from Table (16) that:

1. There are statistically significant differences between the pre- and post-measurements for the four positions in the Pression attack using the FaNdy skill, in favor of the post-measurements for all positions.
2. There are statistically significant differences among the post-measurements of the four positions in the Pression attack using the FaNdy skill, in favor of the Sixte position.

Discussion and Interpretation of Results

Based on the presentation of the statistical analysis of the research data and supported by scientific references and previous studies, the researcher will now analyze and discuss the findings in light of the following research hypotheses:

Discussion of the First Hypothesis

Hypothesis:

There are statistically significant differences between the pre- and post-tests of the four positions (Qurte, Septime, Octave, Sixte) in the "Alonge" skill during the Battement attack, in favor of the post-test.

As shown in Tables (5) and (6), there are statistically significant differences at the 0.05 significance level between the pre- and post-measurements for the four positions (Qurte, Septime, Octave, Sixte) in the "Alonge" skill during the Battement attack, in favor of the post-test.

The results notably favored the Sixte position, with a mean post-test score of 10.875. This significant improvement is attributed to the fact that the Sixte position holds strategic importance among the four fencing positions due to its alignment with the upper lines of attack and its proximity to the weapon arm.

The positions ranked as follows based on their post-test mean scores:

- **Sixte**: 10.875

- **Septime**: 15.75
- **Qurte**: 16.375
- **Octave**: 18.375

This confirms the validity of the hypothesis, as the results clearly indicate improvement in reaction time for the second phase of the Battement blade attack.

According to *Ibrahim Nabil (2006)*, the "hit" or "strike" technique is a simple and effective means of preparing or initiating an attack, frequently used by fencers due to its influence on the opponent's weapon, especially when executed with precision in speed and timing.

The researcher attributes this observed improvement to the effectiveness of FitLight visual stimulus training, and the careful planning and variation in these training exercises. Using footwork paired with the Alonge extension of the weapon arm, in combination with wall drills involving the same movement and light stimuli, contributed to this positive change. Further contributing factors include: Consistency and discipline in training among participants, Emphasis on speed and variation in drills, maintaining correct technical form during execution and Enhancing reaction speed and dynamic performance during skill training.

Discussion of the Second Hypothesis:

There are statistically significant differences between the pre- and post-tests of the four positions (Sixte, Qurte, Septime, Octave) in the "Alonge" skill during the Pression attack, in favor of the post-test.

As presented in Tables (7) and (8), statistically significant differences were found at the 0.05 significance level between the pre- and post-test measurements for the four positions (Qurte, Septime, Octave, Sixte) in the **"**Alonge**"** skill during the Pression attack, in favor of the post-test.The results leaned toward the **Sixte** position, with a clear improvement between the pre- and post-

measurements and a mean post-test score of **9.75**. The **Sixte** position holds high relative importance among the four fencing positions as it aligns with the upper lines, being closest to the weapon arm and the point of original engagement.The other positions followed as: Septime: 11.875, Qurte: 13, Octave: 14

This validates the hypothesis, as the results favor post-test improvements in reaction time for the second phase of the **Pression** blade attack. According to *Ibrahim Nabil (2006)*, the **Pression** technique is a simple and effective way to prepare or initiate an attack. Unlike the **Battement**, the **Pression** requires greater accuracy and sensitivity to the opponent's blade reactions. It begins by applying controlled pressure to the opponent's blade from an engagement position, using fingers and the wrist. The noticeable improvement in reaction time is attributed to: The effectiveness of Fit Light visual stimulus training, Carefully planned and varied training routines, including footwork paired with **Alonge** arm extension, and wall drills using light stimuli, Regular and disciplined training attendance by participants, Focus on training speed, variation, technical correctness, and rapid movement execution. The researcher observed significant enhancement in second-phase reaction speed during blade attacks, which positively impacted the athletes' ability to detect cues from their coach and consequently reduced overall reaction time. This is supported by *Osama Abdel Rahman (2005)*, who emphasized that speed is a fundamental attribute of a fencer—essential for both offensive and defensive techniques. Whether using the weapon arm alone, the legs, or both, speed is critical for successful performance. He noted that movement speed is linked to reaction speed, and without rapid reactions, a fencer cannot hope to win a bout. Similarly, *Hussein Haggag* and *Ramzy El-Tonboly (2005)* agreed that fencing requires quick motor responses to stimuli in the shortest time possible. Since fencing is executed in fractions

of a second, the researcher focused on improving second-phase reaction time, which became the core of the study.

Discussion of the Results of the Third Hypothesis:

There are statistically significant differences between the pre- and post-measurements for the four positions (Sixte, Qurte, Septime, Octave) in the skill of Alonge Marche during the Battement attack, in favor of the post-measurement.

The results from **Tables (9) and (10)** show statistically significant differences at the significance level of (0.05) between the pre- and post-measurements in the four positions under study, in favor of the **post-measurement**, confirming the validity of the third hypothesis. The results indicate a tendency toward the **Sixte position**, with a post-measurement average of **13.125**, followed by: Qurte: 15, Octave: 22.75, Septime: 22.875

Positions in the high lines (such as Sixte and Qurte) were prioritized in terms of importance, which is attributed to the frequent use of these positions during training and matches. Sixte, in particular, was ranked the most important due to its frequent use and its proximity to the armed arm, facilitating control during offensive movements. The researcher attributes this improvement to: The positive impact of Fit Light visual stimulus training, which was varied between skill drills, wall exercises, and individual lessons. The focus and enthusiasm during training, which played a crucial role in improving reaction time. This clear improvement in second reaction time was evident from the pre- and post-measurement comparisons.

This conclusion is supported by the work of: Khaled Hegazy (2024), Marwan Abdullah, and Essam Shaker (2017), who emphasized the importance of light stimuli training in improving physical and skill variables. Mar'i Hussein and Hesham Ahmed (2002) noted that visual stimuli lead to more precise focus than auditory ones, improving physical

attributes more rapidly and effectively. Moftee Ibrahim (2001) highlighted that unfit players tend to tire quickly, diminishing their efficiency on the field. Moreover, increasing repetition and speed of drills contributed to an exciting and competitive training environment, which enhanced performance. Kamal Abdel Hamid Sobhy Hassanain (2001) also agreed that light stimulus training, with its variety, played a significant role in improving skills. Aseel Majid Thalij (2020) found that light stimulus technology greatly improved reaction speed and accuracy, stressing the importance of educating coaches on how to apply this technology to different age groups.

Discussion of the Results of the Fourth Hypothesis

There are statistically significant differences between the pre- and post-measurements for the four positions (Sixte, Qurte, Septime, Octave) in the skill of Alonge Marche during the Pression attack, in favor of the post-measurement. The results from Tables (11) and (12) reveal statistically significant differences at the significance level of (0.05) between the pre- and post-measurements for the sample in the four positions under study, in favor of the post-measurement. This confirms the validity of the fourth hypothesis. The post-measurement averages were as follows: Sixte: 13.25, Qurte: 16.25, Octave: 19.75, Septime: 26.625**.** Once again, the Sixte position maintained its rank as the most important due to its position in the "high lines" and its proximity to the armed arm, making it a frequently used position during real matches. The researcher attributes the positive results to the effectiveness of Fit Light visual stimulus training, especially: Footwork drills combined with the Alonge arm extension. Wall-based exercises performed from the Alonge position using visual stimuli. The regularity of the players' training and the emphasis on speed, varied drills, and correct technical form all contributed to the improvement in second reaction time.

In summary, the results of both the third and fourth hypotheses indicate: The Sixte position was the most important in terms of improvement due to its technical characteristics and frequent use. Fit Light training played a crucial role in enhancing second reaction time and overall skill development. The variety of modern training methods contributed significantly to improving players' motor skills and reaction times. Thus, the researcher observed a noticeable improvement and development in the second reaction time to blade attacks, which positively impacted the players' ability to detect the reaction from their coach, and consequently, reduced the time taken for the second reaction.

The researcher employed various methods and drills to develop the second reaction time through diverse training exercises using Fit Light visual stimuli. These exercises had a significant and effective impact on the sample in the study variables, as confirmed by Awis Al-Jabali (2000), who states that reaction time can be developed through:

- **Repetition of Reaction Time**: This is achieved by maintaining alertness to respond to stimuli, whether auditory or visual, and ensuring that this is aligned with skill performance. Moreover, players should perform motor skills while anticipating changes in reaction by the coach.
- **Development of Motor Perception Reaction**: Here, the player, through varied training, attempts to recognize the speed and direction of the skill, determining the appropriate reaction. This is aimed at improving motor perceptual reactions, whether for boxers or fencers.
- **Choosing the Reaction**: This refers to selecting a motor response from a pool of available responses, based on the speed with which the

player adjusts to changing performance conditions according to the competitive situation. For example, the fencer adopts a defensive posture and selects an appropriate reaction in response to a quick shift from defense to attack or to counter unexpected movements from the opponent.

In this context, the researcher used the **visual stimulus** (Fit Light), a system comprising a series of lights that are activated upon touch. Once a light is touched or approached, it turns off, and another light is illuminated depending on the training objective. The researcher varied the performance of skills using the **Fit Light system**, where each light was assigned to a specific skill, allowing for diversity in the drills. This variation contributed significantly to improving and developing the second reaction time.

This detailed approach not only helped in enhancing the **reaction time** but also created an engaging and dynamic training environment that emphasized quick decision-making and response, which is essential in competitive fencing.

Discussion of the Results of Hypothesis 5

There are statistically significant differences between the pre-test and post-test measurements of the four positions (Sixte, Qurte, Septime, Octave) in the **FaNDy skill** for the **Battement attack**, in favor of the post-test.

It is clear from Tables (13) and (14) that there are statistically significant differences at the significance level of (0.05) between the pre-test and post-test measurements for the sample being studied across the four positions (Qurte, Septime, Octave, Sixte) in the FaNDy skill for the Battement attack, in favor of the post-test. The results showed a clear difference in favor of the post-test for the Qurte position, with an average measurement of 27.875. The Qurte position came first in relative importance among the four

fencing positions for the FaNDy movement, as this position is in the "high lines," and the player typically uses the sword strike from the fourth position, followed by a downward thrust into the high lines. The Sixte position came next in importance with an average measurement of 13.75, followed by the Octave position with an average measurement of 5.33, and lastly, the Septime position with an average measurement of (35.25).

These results confirm the hypothesis, showing that the post-test measurement for the Battement attack was superior, demonstrating a significant improvement in the second reaction time for this attack. The researcher attributes this positive improvement in the second reaction time to the effectiveness of the Fit Light visual stimuli training, which was carefully integrated and varied. The training consisted of different foot movement exercises and FaNDy movement drills from various positions, either individually based on the coach's instructions or with fast foot movements, wall drills, or drills with the coach or a partner using visual stimuli. All of these training methods contributed to the observed improvement in the sample.

Additionally, the results can be linked to the regularity of the players' training, the focus on speed, the variation in drills, and maintaining the correct technique for skill execution. As a result, the researcher observed significant improvement in the second reaction time for the **Battement attacks**, which positively affected the players' ability to detect reactions from their coach, ultimately reducing the time taken for the second reaction.

The use of modern training tools, such as Fit Light training, contributed to this improvement, which was clearly evident in the results study "Garecin Mille Hamard"(2003)(17)

The use of modern and unconventional methods increases the effectiveness of utilizing the functional capabilities of players, such as using various activities and sports to develop and enhance the level of physical abilities, which has led to an

improvement in the level of physical and skill performance of players, as the nature of “Fit Light” training is characterized by quick and short movements, which makes the player able to respond quickly with enthusiasm and high concentration to reach the goal in the shortest possible time ،This is also consistent with the study **" Bulent Turna**"(2020)(16) And Study **"Giorgio Varesco and other**"(2024)(18)

Discussion of the Results of Hypothesis 6

There are statistically significant differences between the pre-test and post-test measurements of the four positions (Sixte, Qurte, Septime, Octave) in the FaNDy skill for the Pression attack, in favor of the post-test.

It is clear from Tables (15) and (16) that there are statistically significant differences at the significance level of (0.05) between the pre-test and post-test measurements for the sample being studied across the four positions (Qurte, Septime, Octave, Sixte) in the FaNDy skill for the Pression attack, in favor of the post-test. The results showed a clear difference in favor of the post-test for the Sixte position, with an average measurement of 23.25. The Sixte position ranked first in relative importance among the four fencing positions for the FaNDy movement, as it is positioned in the "high lines," representing the original engagement position for the athlete. The Octave position followed in importance with an average measurement of 30.625, followed by the Septime position with an average measurement of 31.75, and lastly, the Qurte position with an average measurement of 36.875.

These results support the hypothesis, indicating a clear improvement in the second reaction time for the **Pression attack**, which can be attributed to the effectiveness of **FitLight visual stimuli training**, with its structured and varied approach. The training involved different foot movements and drills for the **FaNDy movement** from various

positions, both individually based on the coach's instructions or with fast foot movements, wall drills, or training with the coach or a partner, all using visual stimuli. All of these training methods contributed to the positive improvement observed in the sample.

Furthermore, the results show the significant impact of the regularity of the players' training, their focus on speed, the variety of drills, and maintaining the correct technique for skill execution. This improvement aligns with findings from studies like **Giulia Di Martino and Stefano Giommoni (2024)**, which reported significant improvements in reaction time (both simple and complex) for the group that used **FitLight** technology compared to the group that used traditional training systems. Similarly, **TĂTĂRAN AMALIA and Teodorescu Silvia (2023)** emphasized the importance of modern tools like **FitLight** in enhancing reaction time in elite fencing.

The researcher also observed that, in the context of the different movements and positions, the **Pression** attack from the **FaNDy movement** had an average second reaction time ranging between **23.5 and 36.875**. In contrast, the **Marche Alonge** position had an average second reaction time between **13.25 and 26.625**, and the **Alonge** position had an average second reaction time between **9.75 and 17**. The shortest reaction time was observed for the **Alonge** position, as it only involves arm movements without much body movement, thus taking less than a second. However, in the **FaNDy** movement, the legs and feet contribute more, requiring additional force and distance, which results in a longer reaction time.

The results indicate that while the **FaNDy** movement takes longer to react due to the involvement of more body parts (arms, legs, and feet), the **Alonge** position is quicker as it is focused on arm movement with minimal body displacement.

Discussion of the Results for the Battement Skill (FaNDy) and Reaction Time

The performance of the **Battement** in the **FaNDy movement** showed an average second reaction time ranging between **27.875** and **35.25**. Meanwhile, from the **Marche Alonge** position, the average second reaction time ranged between **13.125** and **22.875**, and from the **Alonge** position, the average second reaction time ranged between **3.75** and **18**. We observe that the shortest reaction time was consistently recorded for the **Alonge** position, while the longest reaction time was recorded for the **FaNDy** movement. This can be attributed to the fact that **Alonge** primarily involves arm movement with minimal body displacement, which allows for a quicker reaction time, taking less than a second. In contrast, the **FaNDy** movement engages both the legs and feet, requiring additional effort and distance, thus taking a longer time for reaction. The shorter the second reaction time, the better it is for the fencer, as it enables quicker responses to the opponent's actions. As emphasized by El-Sayed Sami (2008), Mohamed Ghoneim (2013), and Ayman Ghoneim (2013), their studies showed that training programs and drills significantly improved and developed the second reaction time for athletes. This underlines the importance of the second reaction time for a fencer, as it allows the athlete to predict and respond to the opponent's moves more effectively. The second reaction time is crucial in fencing, as the fencer needs to be able to anticipate and react to the opponent's moves quickly. This ability allows the fencer to implement deceptive strategies, misleading the opponent into committing to a particular move that can then be countered strategically. Such skills are vital for gaining an advantage over the competitor. In modern fencing, reaction speed can be astonishing to spectators. In high-level competitions, many touches are made so quickly that they are virtually invisible to the naked eye. Fencing is thus classified

among sports that require high-level technical skills, a unique combination of finely-tuned abilities, and precise execution of various motor skills. All of this must be done with great accuracy and speed, demanding both physical and mental preparation. These findings highlight how reaction time is an integral component of fencing, as it not only impacts the physical execution of moves but also plays a psychological role in outwitting and responding to the opponent's strategies.

Conclusions:

In light of the research objectives, the sample used, and the statistical treatments and results obtained, the following conclusions were drawn:

1. The use of light stimuli (Fit Light) has a positive impact on the second reaction time for fencing attacks in the sample under study.
2. The light stimuli (Fit Light) led to a significant improvement between the pre- and post-measurements of the second reaction time for attacks with the blade (Battement, Pression) from the four positions.
3. The differences in the reaction time for the variables under study showed that:
    - For the Pression attack from the FaNDy position, the second reaction time ranged between 23.5 to 36.875.
    - For the Marche Alonge position, the second reaction time ranged between 13.25 to 26.625.
    - For the Alonge position, the second reaction time ranged between 9.75 to 17.

We observed that the shortest reaction time was recorded for the **Alonge position**, and the longest for the **FaNDy** position. This is due to the fact that **Alonge** involves arm

movement only without additional body movement, thus requiring less time (less than a second), while **FaNDy** requires movement from both the legs and feet, demanding more distance and time.

Recommendations:

Based on the research findings and conclusions, the researcher recommends the following:

1. Increase focus on specific training to improve the second reaction time when developing training programs for young fencers.
2. Apply other modern light stimuli techniques to other fencing weapons (e.g., Epee, Sabre).
3. Conduct more research and studies using modern technological tools in measurement and training in the sport of fencing.
4. Apply Fit Light training techniques to other fencing skills for a broader impact on performance.
5. Provide specialized training programs for coaches on using modern light stimuli technologies effectively in their coaching practices.
6. Conduct studies using Fit Light technology with other age groups in fencing to test its effects across different stages of development.

These recommendations aim to enhance fencing training by utilizing modern technology to improve reaction times and overall performance.

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