THEORY OF POWER
(Him Ui Wolli)

The beginning student may ask; "Where does one obtain the power to create the devastating results attributed to Taekwon-Do?" This power is attributed to the utilization of a person's full potential through the mathematical application of Taekwon-Do techniques. The average person uses only 10 to 20 percent of his potential. Anyone, regardless of size, age, or sex who can condition himself to use 100 percent of his potential can also perform the same destructive techniques.

Though training will certainly result in a superb level of physical fitness, it will not necessarily result in the acquisition of extraordinary stamina or superhuman strength. More important, Taekwon-Do training will result in obtaining a high level of reaction force, concentration, equilibrium, breath control and speed; these are the factors that will result in a high degree of physical power.

"Powerful enough to uproot mountains"

REACTION FORCE *(Bandong Ryok)*

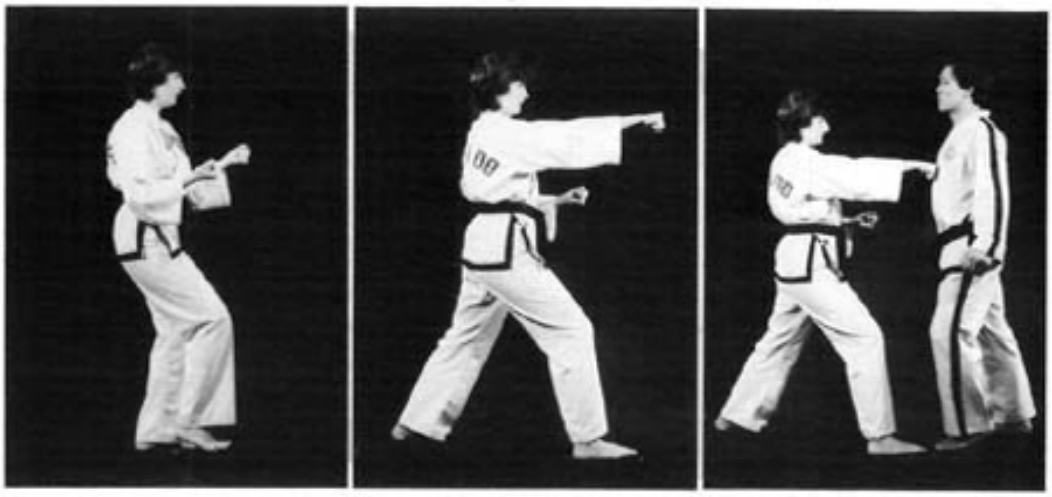
According to Newton's Law, every force has an equal and opposite force When an automobile crashes into a wall with the force of 2,000 pounds, the wall will return a force of 2,000 pounds; or forcing the end of seasaw down with a ton of weight will provide an upward force of the same weight; if your opponent is rushing towards you at a high speed, by the slightest blow at his head, the force with which you strike his head would be that of his own onslaught plus that of your blow.

The two forces combined; his, which is large, and yours, which is small are quite impressive. This, then, is the reaction force from the opponent. Another reaction force is your own. A punch with the right fist is aided by pulling back the left fist to the hip.

CORRECT

The maximum power is produced because the principle of reaction force is well observed, that is, the opposite fist is pulled to the hip at the moment of impact.

INCORRECT
Less power is produced because the principle of reaction force is ignored, that is, the left fist is not pulled to the hip.

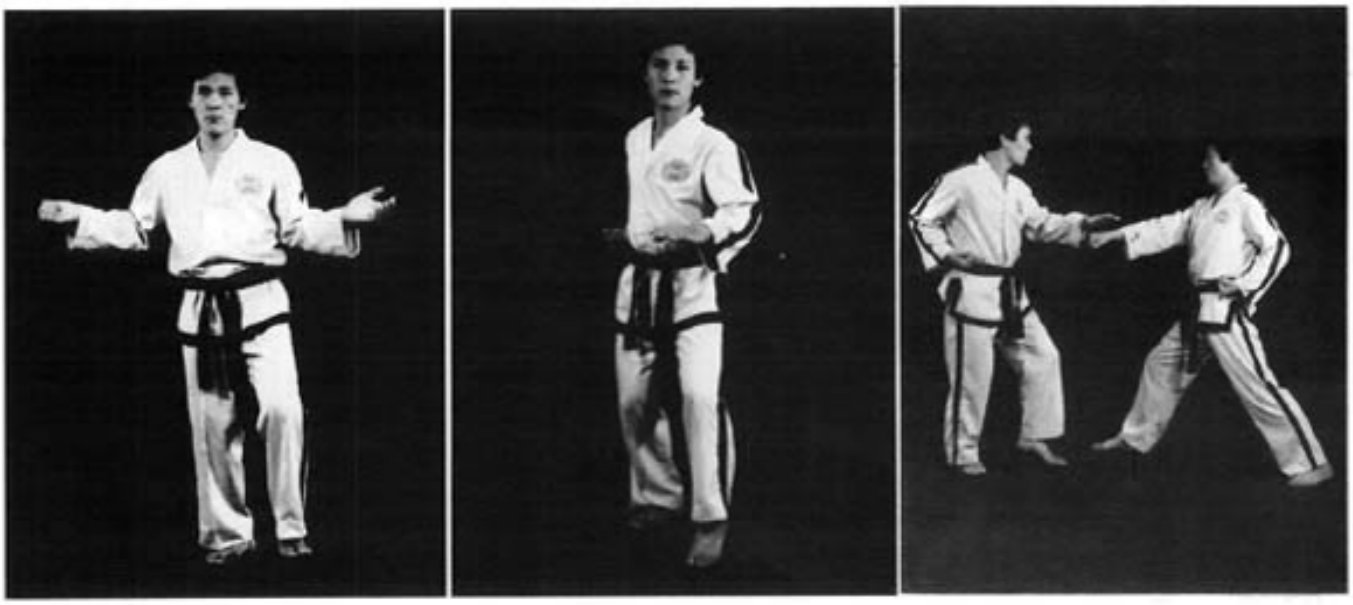


CORRECT

INCORRECT
The right fist fails to be pulled to the hip.

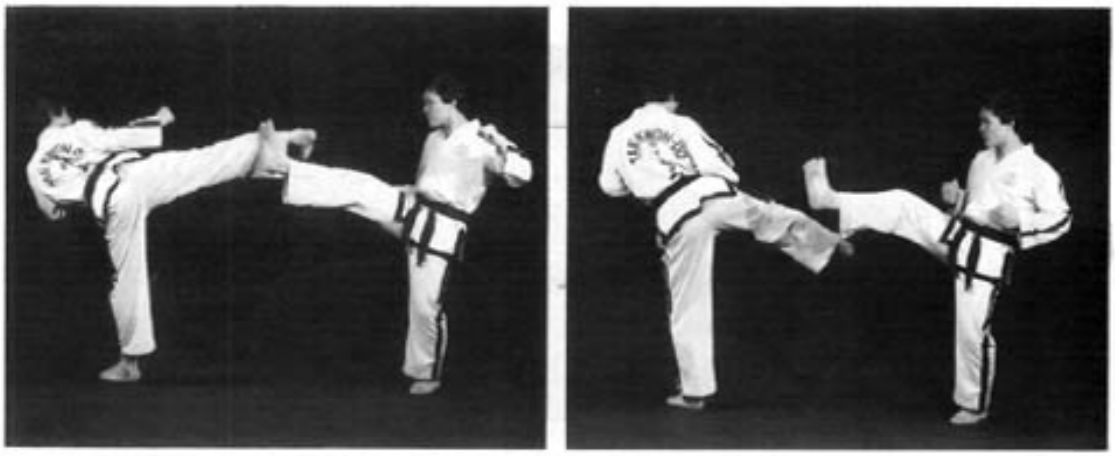
CORRECT

The right fist is pulled to the hip at the moment of the block.



INCORRECT

The right fist is not pulled to the hip at the moment of the block.



CORRECT
The defender applies the principle of reaction force correctly by using the attacker's momentum and a minimum of his own power to throw his opponent off balance.

CORRECT
The punch is well executed for the same reason mentioned above.

CONCENTRATION *(Jip Joong)*

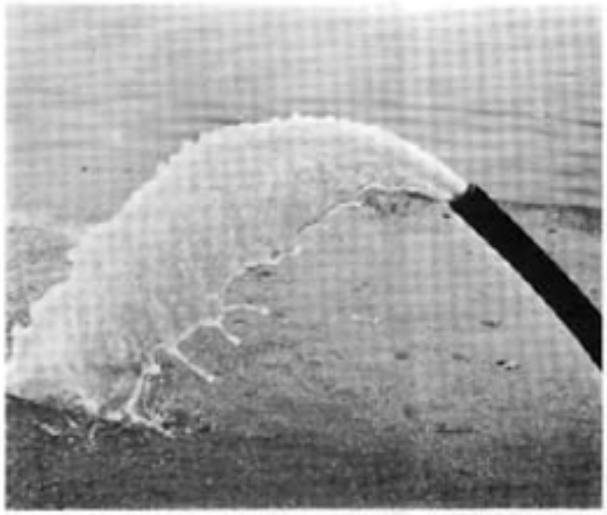
By applying the impact force onto the smallest target area, it will concentrate the force and therefore, increase its effect. For example, the force of water coming out of a water hose is greater if the orifice is smaller. Conversely, the weight of a man spread out on snow shoes makes hardly any impression on the snow. The blows in Taekwon-Do are often concentrated onto the edge of the open palm or to the crook of the fingers.

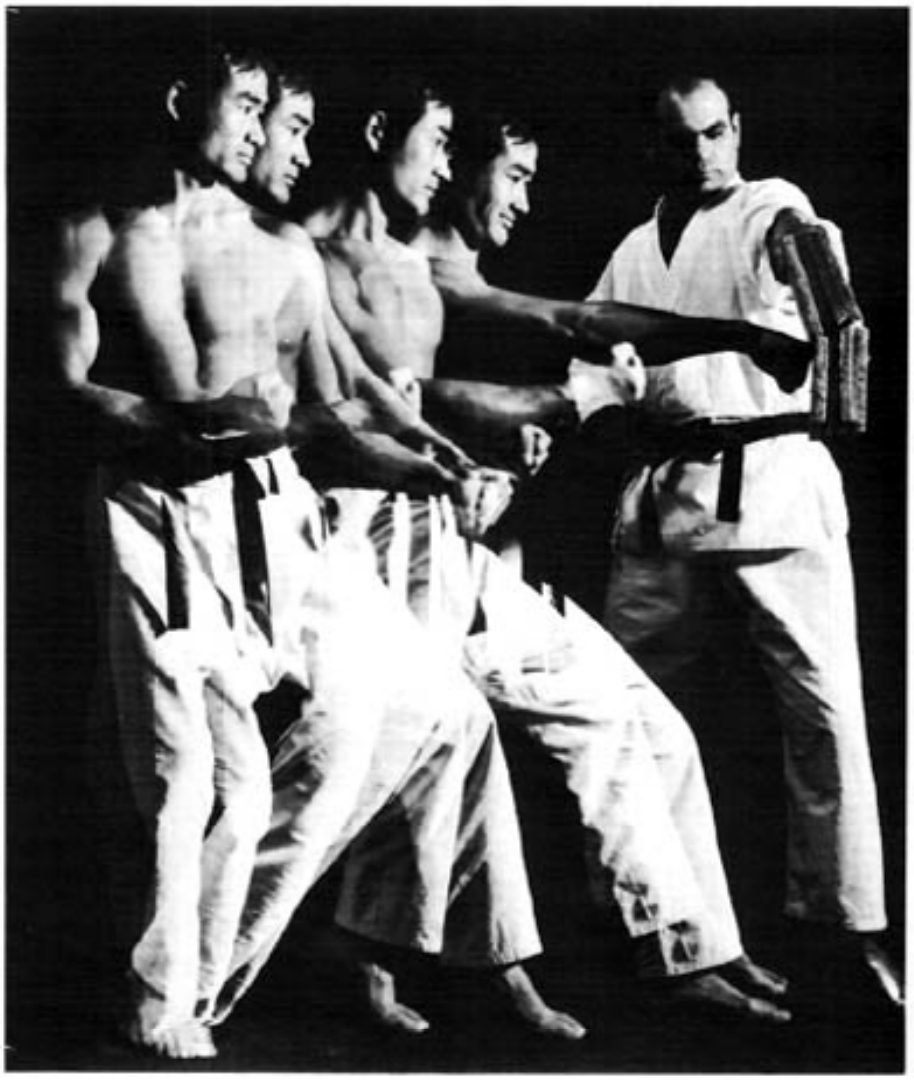
It is very important that you should not unleash all your strength at the beginning but gradually, and particularly at the point of contact with your opponent's body, the force must be so concentrated as to give a knock-out blow. That is to say, the shorter the time for the concentration, the greater will be the power of the blow. The utmost concentration is required in order to mobilize every muscle of the body onto the smallest target area simultaneously.

In conclusion, concentration is done in two ways: One is to concentrate every muscle of the body, particularly the bigger muscles around the hip and abdomen (which theoretically are slower than the smaller muscles of other parts of the body) towards the appropriate tool to be used at the proper time; the second way is to concentrate such mobilized muscles onto the opponent's vital spot. This is the reason why the hip and abdomen are jerked slightly before the hands and feet in any action, whether it be attack or defence.

Small outlet

Large outlet





CORRECT
Muscles are fully mobilized and well concentrated to the appropriate part of the forefist.

INCORRECT
The muscles of the hip and the abdomen are neither fully mobilized nor properly concentrated.

CORRECT

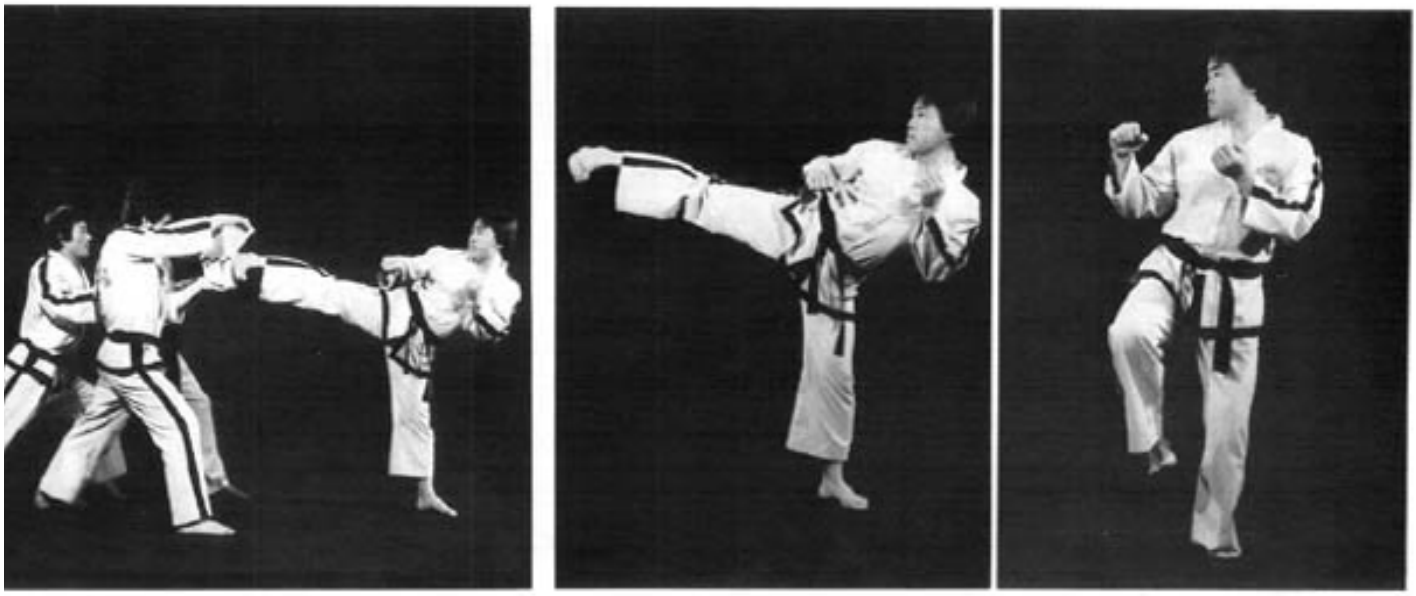
Muscles are fully mobilized because the hip rotates in the same direction as the hands.

INCORRECT

Muscles are not fully mobilized due to the failure to rotate the hip in the same direction as the hands.

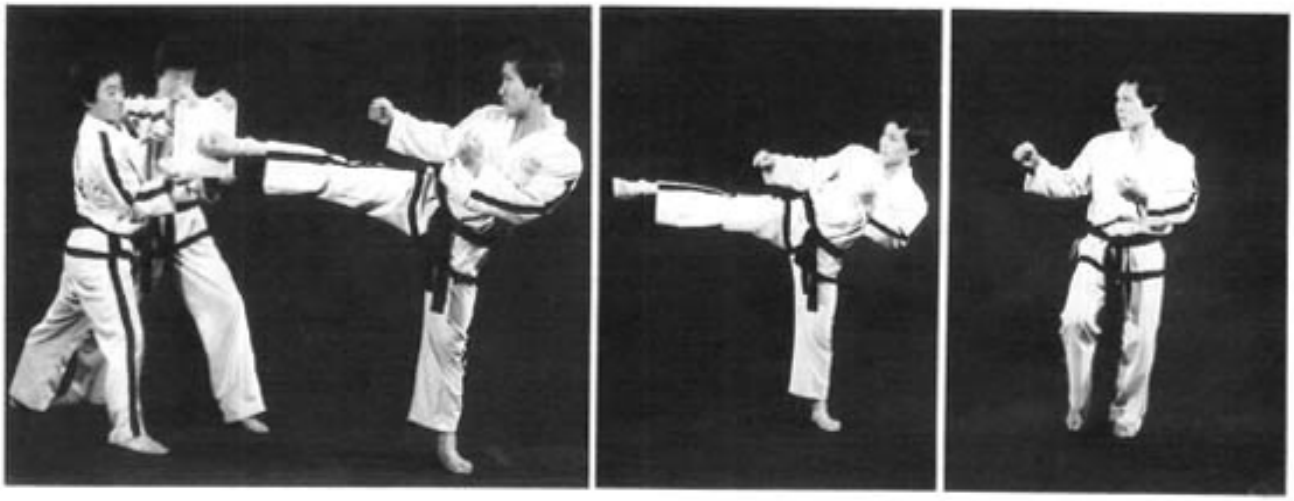
CORRECT

Muscles are concentrated to the appropriate part of the foot - in this case to the footsword.



INCORRECT

Muscles are not dully concentrated to the appropriate part of the foot - in this case to the toe edge rather than the footsword.



EQUILIBRIUM *(Kyun Hyung)*

Balance is of utmost importance in any type of athletics. In Taekwon-Do, it deserves special consideration. By keeping the body always in equilibrium, that is, well balanced, a blow is more effective and deadly. Conversely, the unbalanced one is easily toppled. The stance should always be stable yet flexible, for both offensive and defensive movements.

Equilibrium is classified into both dynamic and static stability. They are so closely inter-related that the maximum force can only be produced when the static stability is maintained through dynamic stability.

To maintain good equilibrium, the center of gravity of the stance must fall on a straight line midway between both legs when the body weight is distributed equally on both legs, or in the center of the foot if it is necessary to concentrate the bulk of body weight on one foot. The center of gravity can be adjusted according to body weight. Flexibility and knee spring are also important in maintaining balance for both a quick attack and instant recovery. One additional point; the heel of the rear foot should never be off the ground at the point of impact. This is not only necessary for good balance but also to produce maximum power at the point of impact.

Centre of gravity

CORRECT

Center of gravity

INCORRECT

Dynamic Stability *(Dongtchuk Anjong)*

Moving Forward

Center of gravity

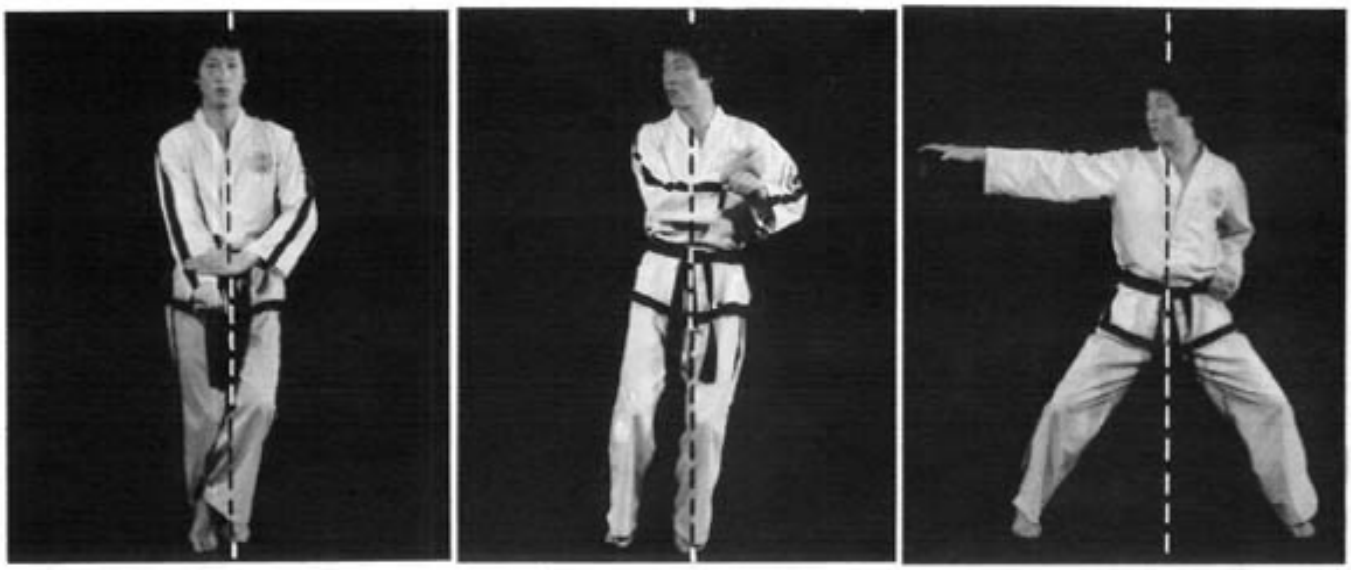
Centre of gravity

INCORRECT

Balance is not maintained because the bulk of the body weight still remains at the centre of gravity instead of the left foot.

The same principle is applicable for moving backward.

Moving Sideways



CORRECT

Center of gravity

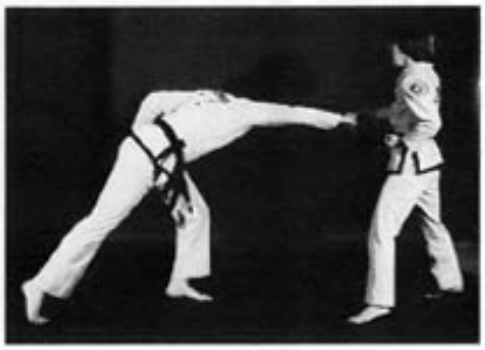
Stance is too narrow.

INCORRECT
The bulk of the body weight fails to be concentrated on the left foot.

Stance is too wide.

Static Stability *(Jungtchuk Anjong)*

CORRECT



INCORRECT
Right heel is off the ground.

INCORRECT
Right knee is bent too much.

CORRECT

INCORRECT
Right knee is pointed outward instead of inward.

CORRECT

INCORRECT
Heel of the stationary foot is off the ground.

CORRECT

INCORRECT
The body is leaned forward.

INCORRECT
The body is leaned too far backward.

CORRECT

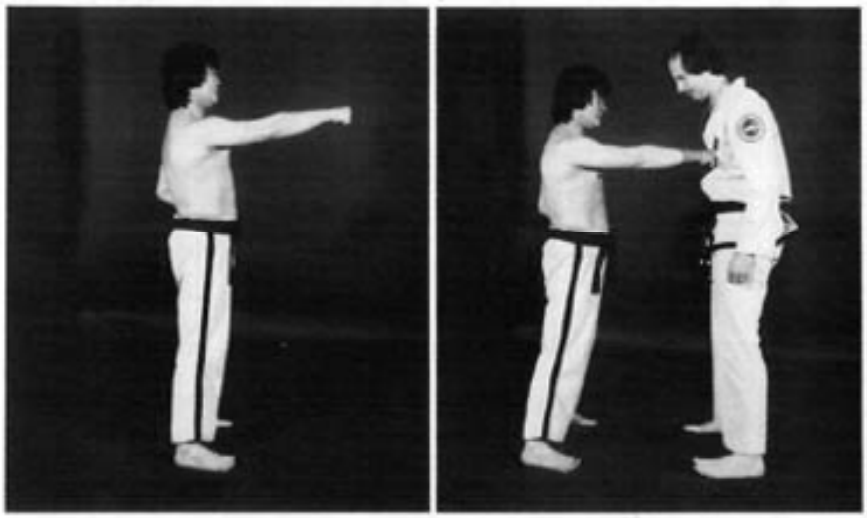
BREATH CONTROL *(Hohup Jojul)*

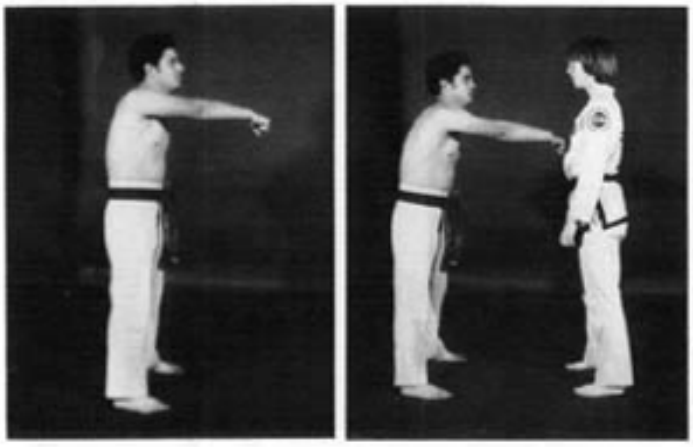
Controlled breathing not only affects one's stamina and speed but can also condition a body to receive a blow and augment the power of a blow directed against an opponent. Through practice, breath stopped in the state of exhaling at the critical moment when a blow is landed against a pressure point on the body can prevent a loss of consciousness and stifle pain. A sharp exhaling of breath at the moment of impact and stopping the breath during the execution of a movement tense the abdomen to concentrate maximum effort on the delivery of the motion, while a slow inhaling helps the preparation of the next movement. An important rule to remember: Never inhale while focusing a block or blow against an opponent. Not only will this impede movement but it will also result in a loss of power.

Students should also practice disguised breathing to conceal any outward signs of fatigue. An experienced fighter will certainly press an attack when he realizes his opponent is on the point of exhaustion.

One breath is required for one movement with the exception of a continuous motion.

CORRECT





INCORRECT
Fist has been stopped before reaching the target because of inhaling at the moment of impact.

CORRECT

INCORRECT
Block is performed while inhaling rather than exhaling.

CORRECT

INCORRECT
For the same reason mentioned above.

MASS *(Zilyang)*

Mathematically, the maximum kinetic energy or force is obtained from maximum body weight and speed and it is all important that the body weight be increased during the execution of a blow. No doubt the maximum body weight is applied with the motion by turning the hip. The large abdominal muscles are twisted to provide additional body momentum. Thus the hip rotates in the same direction as that of the attacking or blocking tool as in figure F. Another way of increasing body weight is the utilization of a springing action of the knee joint. This is achieved by slightly raising the hip at the beginning of the motion and lowering the hip at the moment of impact to drop the body weight into the motion as in figure G.

In summarizing, it is necessary to point out that the principles of force outlined here hold just as true today in our modern scientific and nuclear age as they did centuries ago.

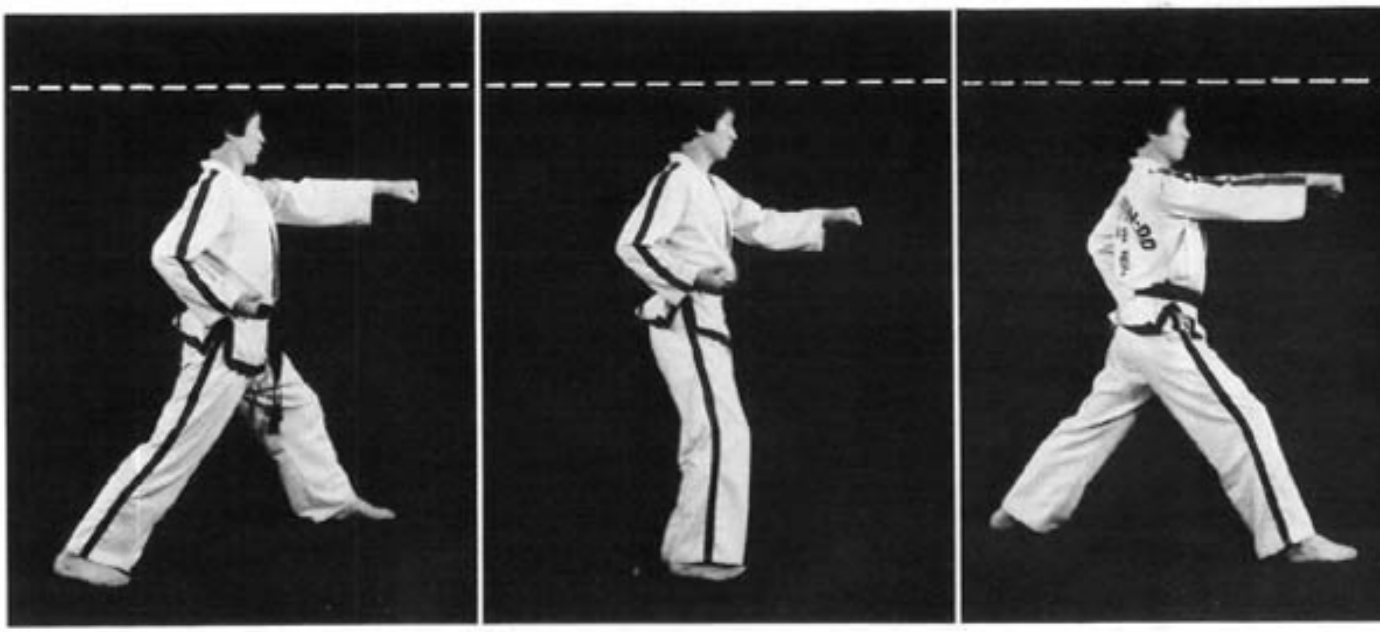
I am sure that when you go through this art, both in theory and in practice, you will find that the scientific basis of the motions and the real power which comes out a small human body cannot fail to impress you.

Fig. F

Fig. G

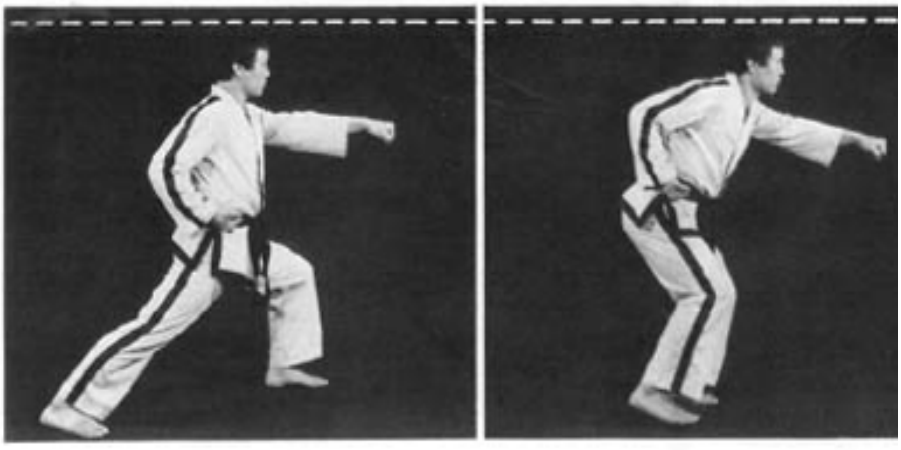
CORRECT

The hip raised.



The hip is lowered.

INCORRECT
The hip was kept at the same level throughout the movement, thus failing to increase the body weight.



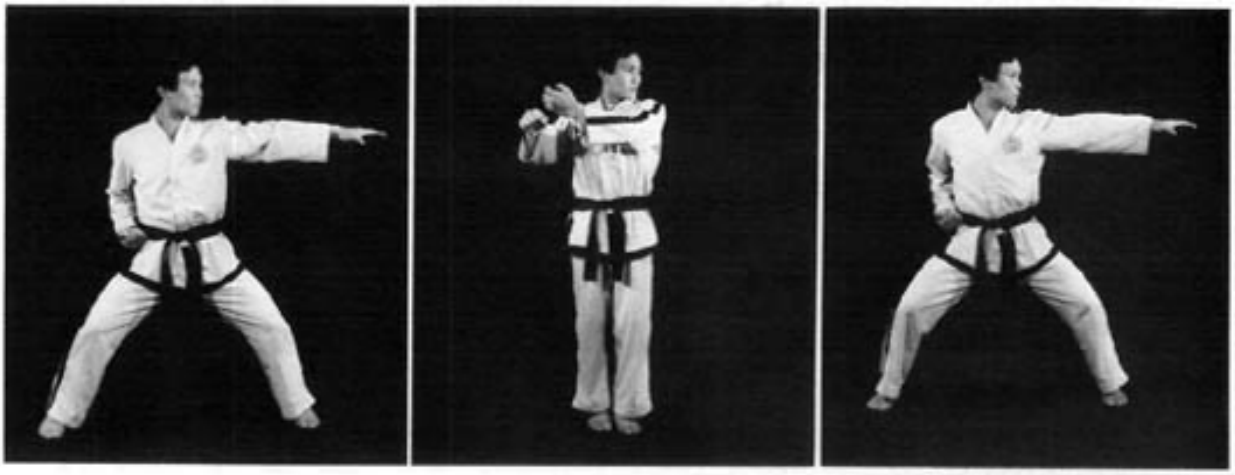
As a result maximum power is produced.

The result is less power.

CORRECT
The hip rotates in the same direction as that of the attacking tool — in this case the left hand.

INCORRET

The body weight is not increased properly because the foot is moved in a saw tooth wave instead of a sine wave.



SPEED *(Sokdo)*

Speed is the most essential factor of force or power. Scientifically, force equals mass X acceleration ($F = MA$) or ($P = MV^2$).

In figure A, a large stone has been gently dropped on a double pane of glass from a height of three inches. On the other hand, in figure B, a small stone has been thrown against the glass with great speed. In figure C, the flat of the hand passed in a slow motion through the flame of the candle with no result to the flame. The candle, however, was put out with a controlled punch or kick stopping within an inch of the flame as shown in figures D and E.

According to the theory of kinetic energy, every object increases its weight as well as speed in a downward movement. This very principle is applied to this particular art of self-defence, as proved in pages 29 and 30. For this reason, at the moment of impact, the position of the hand normally becomes lower than the shoulder and the foot lower than the hip while the body is in the air.

Reaction force, breath control, equilibrium, concentration and relaxation of the muscles cannot be ignored. However, these are the factors that contribute to the speed and all these factors, together with flexible and rhythmic movements, must be well coordinated to produce the maximum power in Taekwon-Do.

Fig. A

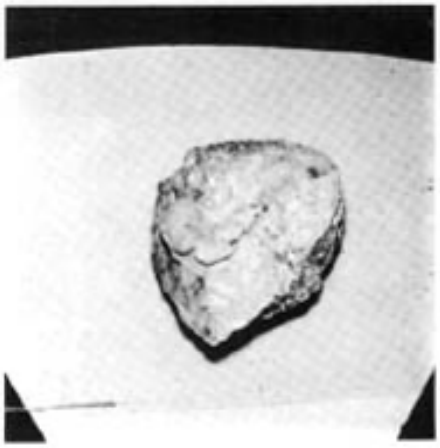


Fig.B

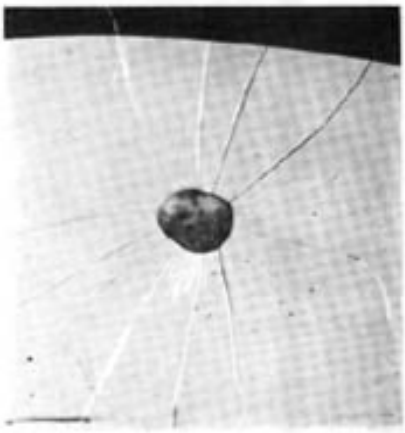
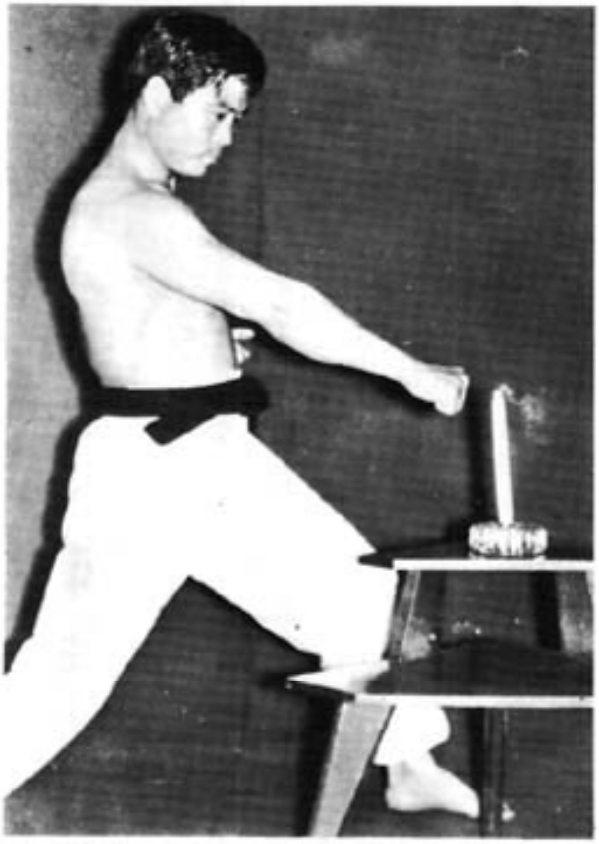


Fig. C



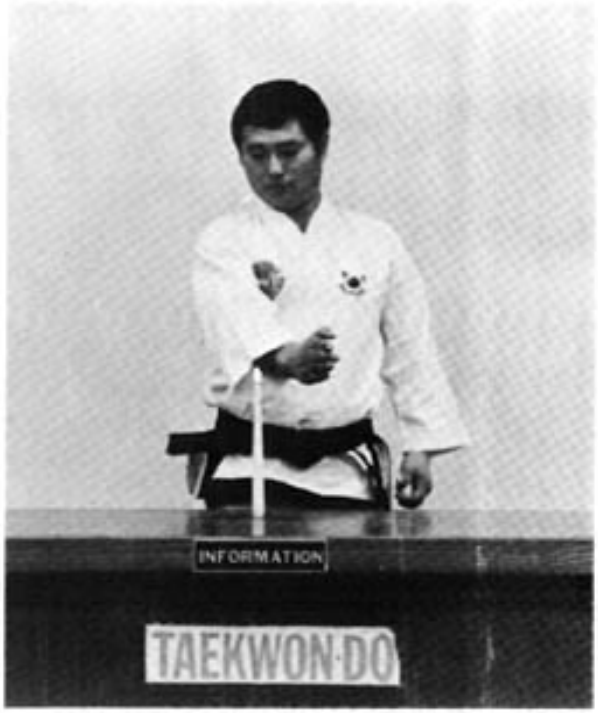


Fig. D

Fig. E

CORRECT

INCORRECT
Less power is produced because the point of focus is higher than the shoulder.

INCORRECT
Less power is produced as the hip is lower than the point of focus.

CORRECT

CORRECT

INCORRECT
Block is not as forceful as it should be.

SPEED AND REFLEX *(Sokdo wa Banung)*

It is essential for the students of Taekwon-Do to understand the relation of the speed and the execution time of techniques in order to apply them effectively.

Achieving precise measurements of these factors has been very difficult due to the great speed at which Taekwon-Do techniques are performed. However, in April of 1973, I conducted an experiment to measure the precise speed and execution time of various techniques.

The approach used was multi-flash Strobo photography. Two EG&G control units—model 553-11 (serial No. 248 and No. 256), and two flashes in reflectors were used to record movements on film. This experiment was conducted at the M.I.T. Strobo lab with special permission from Professors Edgerton and Miller.

Results of the experiment are presented below:

Side Piercing Kick

In this photograph, we can see three images of the right foot once it is lifted off the floor. Three images produce two intervals. The Strobe was set at 20 flashes per second, which means one interval is equal to 1/20 (0,05) of a second.

We can see from the photograph that it taks two intervals to complete this kick, which means that it takes 1/10 (0,1) of a second to execute.

Hooking Kick

In this photograph the right foot passes by my face after 3 1/2 intervals. The flash frequency was 30 per second, so it takes 0,117 seconds or just a little more than 1/10 of a second to execute this kick.

One remarkable fact is that the execution times of the above kicks are shorter than the normal reflex time, which means that it is impossible for anyone to block these kicks unless he can detect them before the leg is lifted off the floor; i.e., know what kick is coming before it is executed.

Normal reflex time is the elapsed time of reflex action. Reflex action consists of behavior in which the reactions usually occur as direct and immediate responses to particular stimuli. Here we are dealing with conditioned reflexes, which can be defined as built-up adjustments to particular external stimuli; i.e., seeing a punch or kick coming and responding by blocking or moving out of the path. Normal reflex time has been experimentally determined to be around 2/10 of a second, at the quickest.

Flying Front Kick

In this photograph, one interval is equal to 1/10 (0,1) of a second. Execution of a flying front kick takes one interval which means that this kick takes 1/10 (0,1) of a second to be completed.

This picture illustrates a defence against a sword attack.

Front Punch

The speed of a punch was also tested. Here we see one interval of 30 flashes per second. Therefore, it takes 0,03 or 3/100 of a second for the punch to be completed.

All these techniques cannot be blocked if we wait until an opponent begins to execute them, since the execution times of these techniques are shorter than the time it takes for our reflexes to respond. Therefore, we must be able to detect the on-coming of these techniques before-hand. This is the reason why one must gaze at the opponent's eyes at all times and not at the legs or arms.

At this point, it would be advantageous to introduce a formula which will enable the student to further understand the significance of speed in the execution of Taekwon-Do techniques.

The formula we can use to calculate the power of any technique is:

$$P = 1/2\ MV^2$$

P stands for power.

1/2 is a constant.

M stands for mass.

V stands for velocity or speed.

This equation clearly reveals why developing speed is the most important factor in developing power.

For example, if the mass is increased by a factor of three (with the speed kept constant) then the power is also increased by a factor of three. But if the speed is increased by a factor of three (with mass kept constant) then the power is increased by a factor of nine.

Hence, with this formula we can measure the power of each technique:

$$\text{Power} = (1/2) \times (\text{mass}) \times (\text{velocity})^2$$
$$= (1/2) \times (\text{mass}) \times (\text{velocity}) \times (\text{velocity})$$

And speed (velocity) can be expressed as

$$V = (\text{distance of last interval}) \times (1/\text{execution time of last interval})$$

This experiment has been a simple demonstration of how fast and powerful Taekwon-Do techniques can be practiced properly as taught.

This experiment is contributed by Jae Hun Kim, 3rd degree black belt holder.